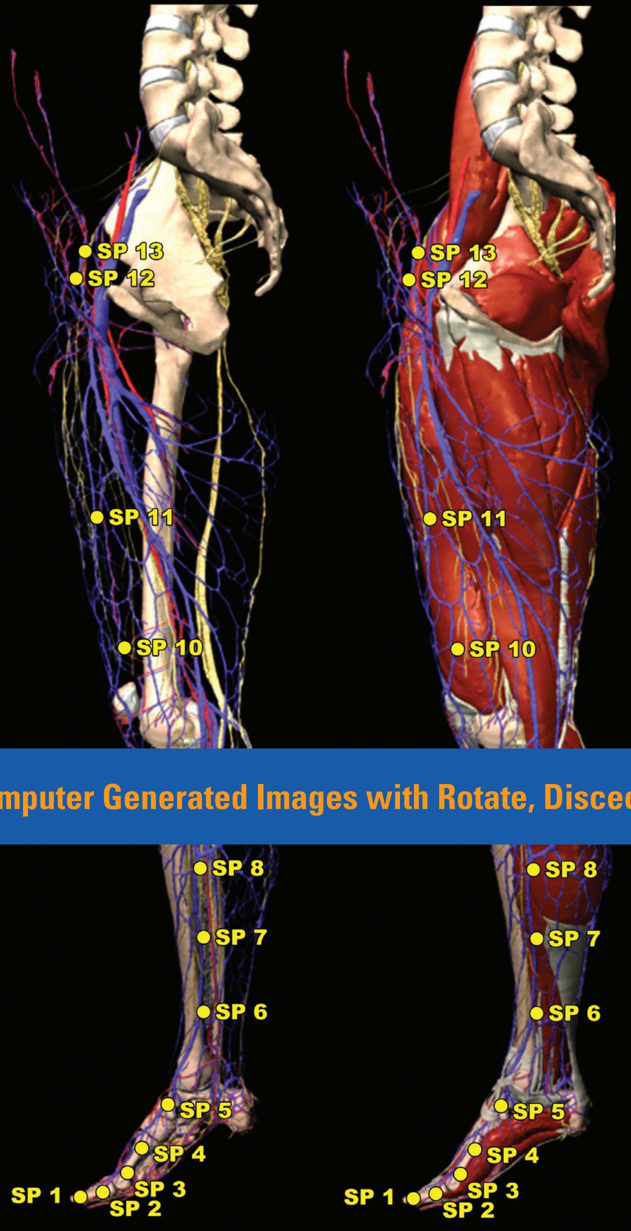
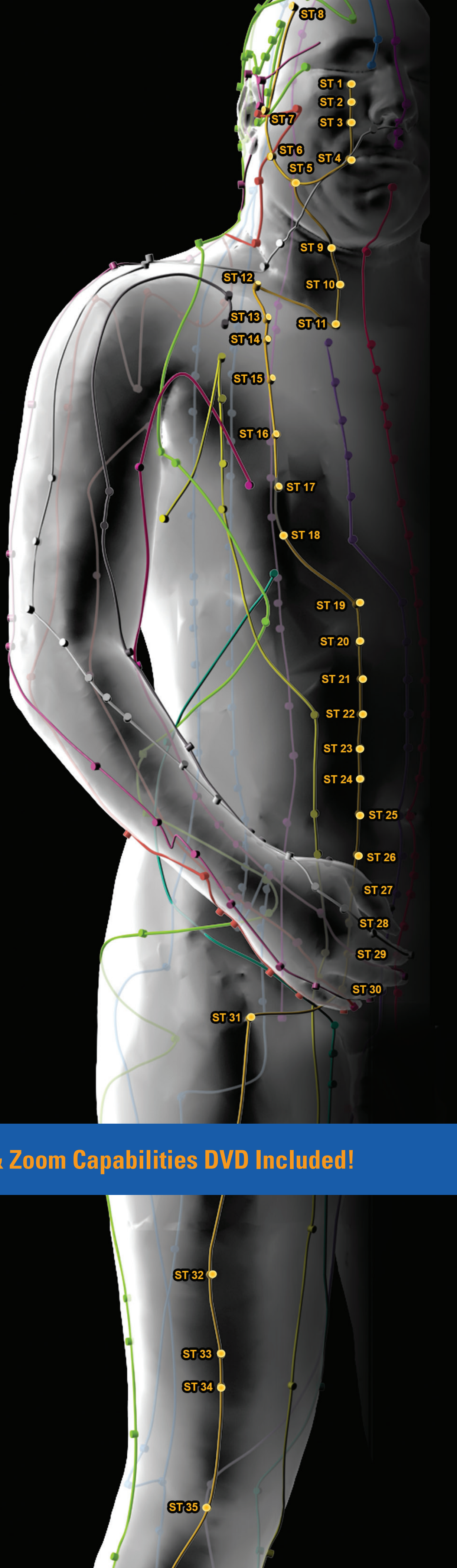
Interactive Medical Acupuncture Anatomy

Narda G. Robinson, DO, DVM, MS, FAAMA


SP 13
SP 12
SP 11
SP 10
SP 8
SP 7
SP 6
SP 5
SP 4
SP 3
SP 2
SP 1
SP 13
SP 12
SP 11
SP 10
SP 8
SP 7
SP 6
SP 5
SP 4
SP 3
SP 2
SP 1


ST 8
ST 1
ST 2
ST 3
ST 7
ST 6
ST 4
ST 5
ST 9
ST 12
ST 10
ST 13
ST 11
ST 14
ST 15
ST 16
ST 17
ST 18
ST 19
ST 20
ST 21
ST 22
ST 23
ST 24
ST 25
ST 26
ST 27
ST 28
ST 29
ST 30
ST 31
ST 32
ST 33
ST 34
ST 35

3D Interactive Computer Generated Images with Rotate, Discect & Zoom Capabilities DVD Included!

Interactive Medical Acupuncture Anatomy

Narda G. Robinson, DO, DVM, MS, FAAMA

Teton NewMedia
Innovative Publishing of Veterinary & Human Medicine

Teton NewMedia
Teton NewMedia
90 East Simpson, Suite 110
Jackson, WY 83001

© 2016 by Tenton NewMedia
Exclusive worldwide distribution by CRC Press an imprint of Taylor & Francis Group, an Informa business
Version Date: 20160105

International Standard Book Number-13: 978-1-4987-7485-7 (eBook - PDF)

This book contains information obtained from authentic and highly regarded sources. While all reasonable efforts have been made to publish reliable data and information, neither the author[s] nor the publisher can accept any legal responsibility or liability for any errors or omissions that may be made. The publishers wish to make clear that any views or opinions expressed in this book by individual editors, authors or contributors are personal to them and do not necessarily reflect the views/opinions of the publishers. The information or guidance contained in this book is intended for use by medical, scientific or health-care professionals and is provided strictly as a supplement to the medical or other professional's own judgement, their knowledge of the patient's medical history, relevant manufacturer's instructions and the appropriate best practice guidelines. Because of the rapid advances in medical science, any information or advice on dosages, procedures or diagnoses should be independently verified. The reader is strongly urged to consult the relevant national drug formulary and the drug companies' and device or material manufacturers' printed instructions, and their websites, before administering or utilizing any of the drugs, devices or materials mentioned in this book. This book does not indicate whether a particular treatment is appropriate or suitable for a particular individual. Ultimately it is the sole responsibility of the medical professional to make his or her own professional judgements, so as to advise and treat patients appropriately. The authors and publishers have also attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (http://www.copyright.com/) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the CRC Press Web site at
http://www.crcpress.com

and the Teton NewMedia Web site at
www.tetonnewmedia.com

Preface

Awakening to acupuncture as neuromodulation permanently transformed my teaching and practice. In contrast to the early days of my acupuncture education, when I hungrily consumed and dutifully assimilated the belief systems required to adopt an energy-based viewpoint, I am no longer willing, nor ready, nor able to accept that acupuncture works through mystical, spiritual processes.

That is, I, like so many others, was taught that needling stirred an unseen electrical force (“Qi”) along invisible lines called “meridians”. When I learned, through mentors such as Deke Kendall, OMD, PhD, that the notion of acupuncture as “energy medicine” possessed neither a scientific nor historically accurate basis, I was shocked. How could this entire domain of acupuncture energetics result from a mistranslation of the Chinese word “Qi” in the early 20th century into “energy”, “for lack of a better word”?

After reviewing the evidence for and against an energy-based mindset in acupuncture, I found no other rational explanation for its effects other than through, primarily, the nervous system. Intellectual honesty forced me to let go of belief systems entirely and instead teach only truth based on science and evidence. Intellectual curiosity led me to find far more beauty and wonder in the anatomy of acupuncture than even the most elaborate fairy tales ever could.

What I discovered inspires me endlessly. The modern science of acupuncture replaces the myths and metaphors of yesteryear with detectable mechanisms and measurable outcomes. The neurovascular channels beneath the skin allow us to both literally and figuratively “connect the dots”, i.e., acupuncture points. The anatomical structures assembled at each site tell of their function and thus their effects.

Acupuncture then becomes more accessible, predictable, and sensible. Knowing which nerve pathways to target and why constitutes the cornerstone of noninvasive neuromodulation with acupuncture. Starting at the acupuncture point, one can follow a nerve’s centripetal course to the spinal cord, autonomic centers, and the brain. The nervous system’s responses to scientific medical acupuncture and related techniques thereby become clear, as fact replaces fiction.

Dedication

To my parents, Evelyn and Leonard, who brought me from formless to form, whose love and support gave me the strength and courage to find my own path.

To my brother, Larry, who inspired me to become not only a physician, but an osteopathic physician.

To the ancient Chinese, whose system of point and channels provides me endless amazement.

To Joseph M. Helms, MD, FAAMA, who flung the door to a life filled with discovery and meaning open wide.

To Deke Kendall, OMD, PhD, who caused me to question and rethink what I'd learned, allowing me to find deep fulfillment in a system of knowledge based on indisputable facts and realism.

To Joseph Wong, MD, whose clear message concerning the simple truths of neuroanatomical acupuncture stay with me to this day.

To Dave Mishlove, my life partner, who further cultivated in me a taste for authenticity, a penchant for integrity, and the strength to stand for truth amid staunch opposition.

Acknowledgments

This book and CD resulted from the extraordinary talents and commitment of several individuals, including:

The Visible Productions team, with special thanks to Stew Crawford who provided the computer programming for the CD and Amanda S. Almon, the medical illustrator and computer animator, who patiently worked with me to place the points and lines on the Visible Human anatomy images.

The folks at Teton NewMedia and Fiftysix Forty Design, including Sue Haun, creative director, whose expertise provided a book that is functionally and aesthetically pleasing, as well as Mike Albiniak, production manager, who worked with the project from start to finish to produce the internal layout. Special thanks as well to John Spahr, principal owner of Teton NewMedia, and Carroll Cann, the editor in chief, who saw value in the project and brought it to fruition.

Table of Contents

Section 1:: The Science of Acupuncture Neuromodulation

Chapter 1:: From Metaphors to Modern Medicine 3
Chapter 2:: Function Follows Form 13

Section 2:: Acupuncture Points and Channels

Chapter 3:: Introducing the Points and Channels 35
Chapter 4:: Locating Points on the Body 37
Chapter 5:: Acupuncture Safety 45

Section 3:: Twelve Paired Channels

Channel 1:: The Lung (LU) 51
Channel 2:: The Large Intestine (LI) 73
Channel 3:: The Stomach (ST) 119
Channel 4:: The Spleen (SP) 225
Channel 5:: The Heart (HT) 281
Channel 6:: The Small Intestine (SI) 309
Channel 7:: The Bladder (BL) 359
Channel 8:: The Kidney (KI) 537
Channel 9:: The Pericardium (PC) 627
Channel 10:: The Triple Heater (TH) 665
Channel 11:: The Gallbladder (GB) 747
Channel 12:: The Liver (LR) 899

Section 4:: The Eight “Singular Vessels,” “Extraordinary Vessels,” or “Curious Meridians”

Channel 13:: The Conception Vessel (CV) 951
Channel 14:: The Governor Vessel (GV) 1039

Section 1::

The Science of Acupuncture Neuromodulation

Chapter 1:: From Metaphors to Modern Medicine

Chapter Highlights

To know acupuncture, know anatomy.
To know neuromodulation, know neuroanatomy.
Neuromodulation explains acupuncture.

Neither mysterious nor nebulous, the wisdom of acupuncture unfolds clearly and readily through the study of anatomy – specifically, neuroanatomy. Acupuncture anatomy eliminates the need to substitute science with myths and metaphors. Scientific investigations have identified and verified many of the mechanisms by which acupuncture and related techniques benefit the central, peripheral, and autonomic nervous systems. Needling results in neuromodulation. Neuromodulation interlocks the events that take place from neuron to brain and back again – no belief systems required.

What Is "Neuromodulation"?

Neuromodulation is a process of engagement with neural structures that helps to normalize nerve function. It reduces excessive firing of nociceptive pathways and improves the ability of endogenous analgesic mechanisms to counteract spinal cord windup and dampen the perception of pain. Effective neuromodulation begins with proper point selection. Neuroanatomically specific acupuncture protocols pinpoint a patient's presenting problem according to where and how it is altering function along the neuraxis and its peripheral as well as autonomic extensions.

By considering the myriad manners in which neural discord mediates and perpetuates aberrant signals, a scientifically based medical acupuncturist outlines neural avenues (i.e., acupuncture points and channels) as well as stimulation methods (e.g., needling alone or the introduction of electrical or laser stimulation) by means of which to restore harmony and homeostasis.[113,114,115,116,117,118,119] That is, neuromodulation impacts sensory, motor, and autonomic activity based on the nerves targeted. The modality and settings selected (e.g., intensity, frequency, and mode of stimulation) further color the patient's physiologic response. The input flows throughout the matrix of the nervous system, from peripheral to spinal nerves, and spinal cord to brain. Brain sites affected include, but are not limited to, the reticular activating system, central autonomic network, the limbic system, brainstem, and the diffuse noradrenergic projection system.[135,142,143]

Neuromodulation began long ago with acupuncture and electrotherapy;[120,121] modern medicine has created more direct interventions through implanted units. Whether they prove more effective, cost-saving, and safer than manual acupuncture (MA), electroacupuncture (EA), or laser acupuncture (LA) requires research comparing techniques head to head.

As with acupuncture, the aforementioned implanted stimulators have benefited patients with pain,[122] epilepsy, neurogenic bladder secondary to spinal cord injury, fecal incontinence, constipation, erectile dysfunction, interstitial cystitis, and lower urinary tract dysfunction (incontinence, overactive bladder, urinary retention).[123] Additional conditions include chronic, refractory angina pectoris,[136] migraine,[137,138] spinal cord injury,[139] and complex pain problems.[140]

Curiously, those who utilize implanted stimulators often insert them along similar nerve pathways as acupuncturists address. For example, implant-driven nerve stimulation for refractory overactive bladder focuses on the posterior tibial nerve.[124,144,145] Acupuncture treatments for urinary voiding dysfunction also focus on the tibial nerve with points such as KI 3, KI 4, KI 5, and SP 6.[125]

Vagal nerve stimulation (VNS) for seizure control offers another example.[126,127,128,129] Electrodes implanted in the cervical portion of the vagus nerve interrupt or abolish experimentally induced motor seizures.[130] Acupuncturists may also choose points on the face or head that speak to the vagus nerve through crosstalk with the trigeminal nerve. Auricular acupuncture opens another door to neuromodulating vagal function. Veterinarian acupuncturists treating epilepsy in dogs may select ear points such as Shen Men, a point shown to have value for seizures in rats as well.[131,132,133] Auricular Shen Men falls into the zone supplied by the auricular branch of the vagus nerve (cranial nerve X, or CN X).[134] Thus, whether through implanted electrodes or inserted acupuncture needles, VNS modifies brain activity and can reduce seizure activity in some cases.[146]

"What If I Prefer to Think of Acupuncture as Moving Energy Instead of Stimulating Nerves? Does It Matter?"

Yes, it matters. Shifting the dialogue from metaphors and metaphysics to meaningful mechanistic concepts requires a thoroughly different premise. That is, a science-based medical acupuncturist needs a modern medical education along with instruction in myofascial palpation and non-invasive neuromodulation skills. Traditional Chinese Medical (TCM) schools and energy-based physician acupuncture courses continue to teach that acupuncture moves energy they call "Qi". The latter approach demands little verification but much belief. Even today, after having sufficient opportunity to "get it right", Traditional Chinese Medicine (TCM), metaphor-based practitioners are still struggling to validate their TCM diagnostic approach. In other words, even experienced TCM acupuncturists cannot come to agreement in their metaphoric analyses of patients in studies after studies.[147,148,149]

Lacking tenable processes, a metaphor-based acupuncturist has limited rational rationales to rely on when deciding on which points to choose. Treating a headache of the "Liver Yang Rising" or "Qi Disturbance" variety affords mostly abstract analysis of the cause and effect. Although the liver often receives much of the blame in causing TCM headaches, the physical liver usually has little to do with producing head pain in most people. Other assessments involving disturbances in Qi, Yang, Yin, and Phlegm also miss the mark by resorting to stand-ins, i.e., metaphors, in place of the actual anatomic, physiologic, and pathologic problems. As such, TCM point selection usually resorts to metaphorical solutions rather than novel protocols based on the patient's actual pathology.[150] Point selection relies more heavily on rote memorization of empirical protocols that give the practitioner minimal insight into why those protocols work from a biological perspective. To illustrate the difference between a metaphoric and scientific view of point effects, review the comparison in Table 1-1.

In contrast, a science-based medical acupuncturist treating head pain would, in practice, ordinarily strive to define the true cause, location, and myofascial relationships to the headache. Even if s/he defaults to a standard protocol for research or training purposes, the mechanisms by which acupuncture affects patients remain clear. To illustrate this, a group of Taiwanese researchers assembled a group of migraine sufferers in order to compare the value of acupuncture and a drug (topiramate) for prophylaxis of headache in chronic migraineurs.[151] Points selected for all sixty-six participants were the same: BL 2, GB 20, Taiyang, and Yintang. The rationale? "All of the selected acupoints were in the distribution of trigeminal and cervical dermatomes related to the trigeminal sensory pathway." Simple. Again, according to the authors, "It is assumed that a variable combination of peripheral effects, spinal and supraspinal mechanisms, and cortical, psychological or "placebo" mechanisms contribute to the clinical effects of acupuncture. Current theories suggest that migraine is a neurovascular disorder involving cortical spreading depression, neurogenic inflammation, and vasodilation. Sensitization and facilitation of pain transmission in central trigeminal sensory pathways may have a particularly important role in the development of CM (chronic migraine). A recent study suggests that acupuncture may have anti-inflammatory action via release of neuropeptides from nerve endings, including calcitonin gene-related peptide (CGRP), an important mediator of neurogenic inflammation and a potent dilator during migraine attack. We selected acupoints in the distribution of the trigeminal and cervical dermatomes because we postulated that an interaction between trigeminal and cervical nociceptive inputs to the trigeminocervical complex via acupuncture may inhibit trigeminal-vascular activation and thus may inhibit migraine attack….It is…important to understand what roles the peripheral as well as the central mechanisms have in CM patients after acupuncture treatment in future studies."

"Isn't Medical Acupuncture "Reinventing" Acupuncture Into Something It Never Was?"

Absolutely not. Admittedly, those already wedded to the metaphorical conceptualization brought to us by TCM may resist the need to learn the biological basis of disease, the anatomical basis of acupuncture, and the physiology of neuromodulation because they believe that a scientific approach to acupuncture is somehow new or foreign to China.[152] This is false. In fact, acupuncturists in China have been striving to practice scientifically for decades, with Zhu Lian making many important strides back in the 1950s.

That is, while the French were reworking acupuncture into an abstract system of "French Energetics" (see the section on George Soulié de Morant, below), Communist China created "The New Acupuncture" with the help of Zhu Lian, a physician trained in Western medicine who held several influential medical posts in China.[68] In keeping with the goal of the Communist Party leader Mao Tse Tung to integrate Chinese medicine with modern science, Zhu Lian, "strongly advocated the application of anatomy and western medicine in acupuncture". Zhu Lian pioneered the neuroanatomic basis of acupuncture well before Mao Tse Tung created Traditional Chinese Medicine (TCM) in the mid-twentieth century. In so doing, she unraveled many former mysteries through her extensive anatomical knowledge.[153] She saw acupuncture's influences as working to "stimulate and modulate the regulatory and control functions of nerve cells."[154]

Scientific research has only bolstered Zhu Lian's visions from the 1950s, as she hoped would happen. Even back then, however, she noted:

"The locations of the fourteen meridians roughly correspond to the anatomical distribution of excitors. Responses of the human body to acupuncture stimulation can basically be explained by neuroscience. Knowledge of higher nerves, however, was not available to ancient therapists, and hence discrepancies inevitably arose, because traditional acupuncturists, without a full understanding of neurology, simply formed associations between acupoints and internal organs."[155] That is, as aforementioned, non-scientific acupuncturists are frequently unaware of how their needling treatments actually work even today. Moreover, although Zhu Lian wanted acupuncture to survive and felt that exposing its factual, rational basis would allow it to do so, politics prevailed and TCM became increasingly engulfed by its murky metaphors.

When it moved west, TCM fell victim to even more myths; the American and European appetite for metaphysics unfortunately prevailed. The term "TCM" only adds to the confusion. That is, although the "T" stands for "Traditional", connoting a long-standing medical system, the Chinese Communist Party invented TCM only fifty years ago, during the years 1953-1956.[70,71] TCM is "a medical construct distinct to Communist China" and symbolizes "the standardized, government- created, institution-bound medicine that has existed in the PRC since 1956."[72] The first Outline of TCM became available in Communist China in 1958, published by the Beijing People's Health Publishers. It was designed to help fulfill the government's goal of having "doctors of Western medicine study Chinese medicine."[73]

In her book, *Chinese Medicine in Early Communist China 1945-1963,* Kim Taylor described the events surrounding the creation of TCM. "The formulation of a basic theory of Chinese medicine was an extraordinary feat, the ultimate in the manipulation of knowledge and its subsequent validation at the hand of politics."[74] She continued: "In general, the main aim of these "Basic Theories of TCM" was to simplify Chinese medicine and to reduce two thousand years of controversy and debate into one easy-access nutshell. This compromises every level of the physician's encounter with the patient, from examination to diagnosis through to prescription. Therefore this newly established theory of TCM simplifies the process of the identification of illness and the appropriate dispensation of drugs to a few basic steps. Such is the structured and measured packaging of a ready-to-use TCM designed for institutional consumption in twentieth- and twenty-first century Communist China."[75]

On the other hand, both in- and outside of China, science-based acupuncturists continued to pursue acupuncture demystification. As one practitioner in the mid-1960s stated:

> “If we wish to be taken seriously, and not to be confused with bone-setters or faith-healers, we must abandon the whole more or less Chinese mass of philosophy, cosmogony and mythology in which we have been entangled these forty years past. Let us clear the decks, and look at our problems without preconceived ideas. The study of the anatomy and physiology of the skin, and of the central and sympathetic nervous systems, the investigation of the physico-chemical and enzymic reactions in the body, all these should provide us with the means of solving the problem of what acupuncture really is and does.”[1]

Scientific acupuncturists agree that acupuncture depends on nerve function. In 1972, the Peking Acupuncture Anesthesia Coordinating Group reported, “About half of the known acupuncture points are located right over various nerves and the rest are within half a centimeter of one or another nerve. From this, the conclusion was drawn that acupuncture acts in fact on the nervous system, and it is through a nerve that the stimulus produced by needling or applying a mild electric current is transmitted to a certain part of organ of the body where it effects a cure or brings about a state of analgesia.”[21] The number of reports showing that acupuncture works via the nervous system began its rapid expansion in the mid-1970’s and has continued ever since.[5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]

Indeed, if acupuncture worked by moving energy, not nerves, then severing nerves should not abolish the body’s reaction to needling. However, complete transection abolishes its effects and partial injuries minimize them.[2] This is not to say that acupuncture treatment should be avoided in cases of peripheral nerve, brain, or spinal cord injury, because needling therapy plays an important role (when given the opportunity) in helping patients recover from or contend with these conditions. Rather, it is intended to emphasize the central significance of the nervous system in medical acupuncture and related techniques.

In fact, by now, the neural basis of acupuncture has become so clear that certain authors are replacing the conventional alphanumeric naming system of acupuncture points and channels with nerve names – not remote and possibly imaginary organs as is now the case with commonly accepted nomenclature.[3] This idea,of revising and updating the acupuncture lexicon has a precedent; i.e., over thirty years ago, Dr. Patrick Wall, the co-developer of the gate control theory, felt that a new classification system based on acupuncture points and nerves was overdue.[4]

“You Say “To-May-To” and I Say “To-Mah-To”: Don’t Scientists and Energy-Based Acupuncturists Arrive at the Same Points?”

No, not always. Acupuncturists from either perspective may or may not select similar points. As indicated earlier, a TCM trained practitioner may view headache as Liver Yang dysfunction and select LR 3, LI 4, and GV 20. While the TCM rationale may involve statements about balancing Yin and Yang, expelling evil influences from the liver, or eliminating wind,[156] a neuroanatomic acupuncturists sees the process much differently. Both LR 3 and LI 4 relate to double arterial arch systems in the foot and hand, respectively. These vascular circuits receive heavy investment of sympathetic fibers. Thus, needle stimulation in their vicinity modulates autonomic function throughout the body. GV 20 impacts vagal function through crosstalk along trigeminovagal and cervicovagal routes. It also lies along the sagittal cranial suture overlying the sagittal venous sinus, thereby further impacting autonomic function and cerebral venous drainage. GV 20 overlies the galea aponeurotica as well; needle stimulation at this site aids in reducing occipitofrontalis muscle restriction that produces a “tension headache” type of pain. For migraine headaches per se, a scientifically based medical acupuncturist might add points to address trigeminal nerve dysfunction, as illustrated above. The weight of evidence supporting a neuroanatomic approach emphasizes the importance of selecting points according to actual patient pathophysiology. To wit, chronic migraine sufferers who received acupuncture at points supplied by the trigeminal nerve experienced a significantly larger reduction in moderate/severe headache days than did those in the topiramate group with far fewer side effects.[157]

Even if a metaphoric practitioner chose the same points as the science-based practitioners did in the migraine study just described, an accurate understanding of the ways in which acupuncture improves acupuncture’s legitimacy. Quoting Kendall: “Why does anyone care whether Chinese anatomy and physiology are explained as energy flowing through meridians, or by the circulation of blood, nutrients, other vital substances, and vital air (qi) through the vascular system? The answer to that lies in the moral obligation of every practitioner to provide each patient with the latest medical understanding available. The need to continually search for the truth is the most fundamental principle of science and medicine. If the functioning of the human body cannot be understood under normal physiological conditions, then there is little hope of knowing how to treat it when disease conditions exist. Research so far show that the true concepts of Chinese medicine operate under known physiological principles, involving the complex organization of the neural, vascular, endocrine, visceral, and somatic systems, sustained by the circulation of nutrients, vital substances, and oxygen from vital air.”[22]

Why Researchers Need to Recognize the Scientific Basis of Acupuncture

Ongoing research in Asia and on other continents focuses on measurable, physiologic changes due to acupuncture, not the vague nuance and mysticism so commonly found in Western acupuncture literature. According to Kendall, the abstract, unscientific idea that acupuncture has an immaterial basis “has kept Chinese medicine on the fringes of conventional care since the 1930s and 1940s”.[23] Countless research dollars and hours disappear in the misguided mission of searching for invisible, energy-conducting pathways, yielding little to benefit patients and further the understanding of acupuncture.[24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44] Moffet appears to concur, criticizing methodologic approaches that cling to “unsubstantiated traditional acupuncture theories”.[158] He continues: “When comparing acupuncture interventions [e.g., verum and sham approaches], investigators should offer a biologic rationale to support a hypothesis that the exposures are truly different. A clinical trial with indistinguishable exposures is a poor use of resources…If the acupuncture exposures are indistinguishable, then the investigators have failed to control for the placebo effect." Many examples of inadequate sham selection exist in the medical literature. Most commonly, researchers fail to consider the neuromodulatory overlap that happens when verum (real acupuncture) and sham (placebo acupuncture) excite similar nerve pathways.

Why Today's Clinicians Need to Espouse a Rational Premise for Acupuncture

The demystification of acupuncture in no way diminishes its brilliance. Rather, identifying the structure-function relationships between acupuncture point anatomy and clinical indications brings acupuncture closer to its ancient roots than do musings about energetic evolutions. Clinging to outdated jargon may, in fact, prevent patients from seeking appropriate medical attention.[45,46,47,48,49,50,51,52,53] For example, informing a patient complaining of chest pain and shortness of breath that they have "Qi and Yin Deficiency"[54] may have been adequate during the Han dynasty, but not today. Rather, prompt medical attention is in order. Similarly, "Liver Fire blazing with Phlegm-Heat" could indicate Graves' disease or even papillary thyroid cancer, and require treatments other than, or in addition to, acupuncture.[55] Patients with "Kidney Yang Deficiency"[56] may actually be experiencing adrenal insufficiency or crisis. One should neither delay nor preempt further diagnostic workup and appropriate medical intervention by seeking to balance an abstract Yin and Yang.[57,58,59,60]

Why, then, do schools and postgraduate courses promote acupuncture metaphysics? Perhaps too few instructors and students have learned about the actual origin of the energy-meridian misconception. Not thousands of years old, not even hundreds, the Qi-as-energy myth was born less than a century ago, a brainchild of a French citizen residing in China by the name of George Soulié de Morant.

George Soulié de Morant's Hope of Acupuncture Metaphysics

No convincing evidence exists that acupuncture works by pushing energy through invisible transmission lines.[61] As the inventor of the energy-meridian concept, George Soulié de Morant, stated, "Having observed the existence of "something" that passes through a meridian when a point is stimulated, the ancients gave this fluidity, this flux, the name qi, which we translate, for lack of a better word, "energy".[62] Because Soulié de Morant lacked medical training and in that he wanted to present Chinese medicine in ways he thought his French audience would understand, he introduced his own bias about how acupuncture worked, i.e., through unseen energies moving through intangible pathways.[63]

Living within the European cultural and philosophical context when he wrote his landmark text, *l'Acuponcture Chinoise (Chinese Acupuncture)*, Soulié de Morant relied on his readers believing his claim of a metaphysical basis for acupuncture. After all, the concept of "élan vital", or immaterial life force, had spread and grown popular throughout Europe. Élan vital was to have produced and shaped all life; notions about this vivifying impulse permeated the philosophy of that era.[64] Yet, not all were convinced; the British biologist Julian Huxley once commented that élan vital offers no better an explanation of life than élan locomotif accounts for the motion of a train.[65]

Nor was Soulié de Morant's book translator, Paul Zmiewski, convinced of the author's claims. Zmiewski noted in his introduction, "While ideas found in modern English texts are often expressed in English words derived from *l'Acuponcture Chinoise,* these words do not always mean what was meant in the classic works upon which *l'Acuponcture Chinoise* is based."[66] About Soulié de Morant's selecting the term "energy" for "Qi", Zmiewski wrote, "At the beginning of the twentieth century concepts like "human energy" were referenced in dictionaries and were considered valid matters for scientific inquiry. Many nineteenth century ideas of nature were still broadly regarded as truths. Today, however, the scientific era that had just begun when Soulié de Morant chose to use the term "energy," has left that word with new and different associations in both popular and scientific writing." As such, even Soulié de Morant's own idea behind the Qi translation has undergone an evolution, independent of its original meaning in ancient China.

Reinventing acupuncture into an "energy medicine" required that Soulié de Morant downplay the importance of anatomy and physiology in Chinese medicine.[76,77] He did not include *The Yellow Emperor's Classic of Internal Medicine* among his translations. Had he done so, as Kendall indicated, he would have found that the early Chinese physicians living between 600 and 300 BCE had compiled "surprisingly accurate and detailed information on the human body, with some of the ideas clearly equivalent to those of modern Western physiology."[78] Unfortunately, this disregard of acupuncture anatomy and physiology promulgated by Soulié de Morant led to an ensuing disinterest by future acupuncturists in the material foundation of acupuncture.

Some even assert, although incorrectly, that ancient Chinese investigators never performed anatomical investigations.[79] Kendall offers two possible reasons for this misconception.[80] First, historians may have assumed that since Confucian teachings proscribed postmortem dissections, they were not performed. Alternatively, some believe that since ancestor worship pervaded the culture especially strongly many centuries ago, those dissecting the body after death would have likely incurred a great degree of ancestral displeasure. Nevertheless, postmortem autopsy likely occurred long before Confucius existed (551-479 BCE), and still took place during his lifetime. Furthermore, the prohibition on autopsies that occurred in some dynasties happened several hundreds of years after the studies mentioned in the Nei Jing were already documented. Information encountered in the Nei Jing attests to the fact that anatomical dissections took place, producing insights into the size, weight, and capacity of all internal organs.[81]

Even the acupuncture channels (jingluo), which many now

Table 1-1

Metaphorical "Actions" of LI4 stimulation, according to Chinese Medicine[85]	**Effects of LI4 stimulation, according to Scientific Studies***
Autonomic Influences	
"Regulates the defensive qi and adjusts sweating"	Both high and low frequency electroacupuncture (EA) stimulation of LI 4 (with SI 3) produced short-term cooling.[86] Manual and EA stimulation of LI 4 produced long-lasting warming (indicating a sympatholytic effect) after the transient, segmental increase in sympathetic activity that caused a localized, short-term cooling.[87] Acupuncture at LI 4 caused an increase in palm temperature, probably due to cutaneous vessel dilation.[88] EA at LI 4 selectively activated the sympathetic, but not parasympathetic, nervous system. In so doing, the rhythmic micturition contraction cycle lengthened and urine excretion increased, as did renal sympathetic nerve activity and blood pressure. These results indicated that EA at LI 4 may benefit patients with hyperactive bladder problems.[110] EA at LI 4 and LI 11 increased both pain thresholds and muscle sympathetic nerve activity.[111]
Analgesia	
"Expels wind and releases the exterior"; "Regulates the face, eyes, nose, mouth and ears"; "Activates the channel and alleviates pain"	EA diminished dental pain perception; high intensity EA was most effective.[89] Naloxone failed to reverse elevated pain thresholds induced by EA, indicating that non-opioid transmitters are involved in dental analgesia.[90] Nitrous oxide blocked the effects of electrical stimulation at LI 4.[91] Needle manipulation at LI 4 significantly increased pain pressure thresholds.[92] Unilateral EA at LI 4 (and LI 11) transiently inhibited the motoneuron pool in the extensor digitorum communis muscle of the contralateral arm, suggesting that EA operates by central effects, instead of or in addition to peripheral influences.[93] Transcutaneous electrical nerve stimulation (TENS) at LI 4 reduced the sensation of pain but not vibration.[94]
Effects on the Central Nervous System	
"Restores the yang" (i.e., "for the treatment of collapse of yang characterised by loss of consciousness, aversion to cold, cold counterflow of the limbs, purple lips etc.")	Manual and EA stimulation of LI 4 produce differential brain activation. Manual needle manipulation caused prominent functional magnetic resonance imaging (fMRI) signal decreases in the posterior cingulate and superior temporal gyrus as well as the putamen/insula. EA caused signal increases in the precentral gyrus, the postcentral gyrus/inferior parietal lobule, and the putamen/insula.[100] Somatosensory evoked potentials obtained after EA at LI 4 (which activates radial nerve fibers) differ markedly from those obtained after EA at the median nerve.[101] Needle manipulation at LI 4 modulated activity in limbic and subcortical gray structures of the brain, as shown by fMRI.[102] Brain magnetic fields measured by SQUID (Superconductive Quantum Interference Device) after acupuncture at LI 4 revealed changes in the biomagnetic fields relating to the projection areas of the face and jaw.[103] LI 4 stimulation caused a significant increase in the latency and decrease in the amplitude of peaks reflecting primary cortical afferent activities.[104] Needle manipulation of LI 4 activated the hypothalamus, supporting the notion that this classical analgesic point works at least in part to reduce pain through hypothalamic activation.[105,106] Manual acupuncture to LI 4 activated both somatosensory cortical areas and the periaqueductal gray.[107] High-frequency EA at LI 4 induced specific electroencephalographic (EEG) modulation of Theta activity in the midline frontal region. This may reflect reduced activity in the anterior cingulate cortex, resulting in antinociception.[108] Needle manipulation at LI 4 activated structures in the descending antinociceptive pathway (i.e., the hypothalamus and nucleus accumbens) and

Effects on the Central Nervous System, Continued

	deactivated multiple areas in the limbic system associated with pain (rostral part of the anterior cingulate cortex, amygdala formation, and hippocampal complex), indicating ways in which endogenous pain modulation circuits in the brain may function.[109] EA at LI 4 and LI 11 caused a positive spread of activation across the spinal cord segments C5 to T1, with peak activity taking place at C7. Activation occurred at both the dorsal and ventral parts of the cord, indicating that LI 4 and LI 11 can indeed modulate specific spinal cord regions. This study suggests that individuals with sensorimotor deficits arising from these spinal segments may benefit from acupuncture at these points.[112] Magnetic stimulation of LI 4 affected specific brain areas, such as the anterior cingulate cortex, that differed from those influenced by a "mock" point, also on the hand.[159]
Obstetrical Influences	
"Induces labour"	Acupuncture at LI 4 suppressed uterine contractions induced by oxytocin in pregnant rats.[95] Acupuncture at LI 4 inhibited the expression of the cyclooxygenase-2 (COX-2) enzyme and reduced uterine motility significantly.[96] Acupuncture at LI 4 (and SP 6) helped ripen the cervix at term and shortened the time interval between estimated date of confinement (EDC) and delivery.[97] Ice massage on LI 4 reduced labor pain during contractions.[98] Acupressure at LI 4 and BL 67 reduced labor pain during the active phase of the first stage of labor, but did not significantly affect uterine contractions.[99]

call "meridians", originally pertained to actual blood vessels and their accompanying nerves. This makes sense given that acupuncture started as bloodletting. In his essay, "Bloodletting in early Chinese medicine and its relation to the origin of acupuncture", Epler wrote, "The vessels are organic structures, not functional pathways as they were later to become, blood is a fluid, and pneuma is, certainly in part, a material substance, not the "energy" it was later to become."[82] In his *Dao of Chinese Medicine,* Kendall noted, "Replacing the blood vascular system with nonexistent meridians is the single greatest translation error to befall Chinese medicine."[83]

In the context of his nonmedical background and the times in which he lived, Soulié de Morant's mistranslation of "Qi" as "energy" seems forgivable. What is less "okay" is the perpetuation of this mistranslation by educators today, instead of acknowledging the truth, i.e., that in the acupuncture matrix originally referred to the vascular network with its circulating gases, cells, and nutrients. Forcing acupuncture to stay stuck inside a mystique and superstition it long outgrew binds its natural development like foot-binding did to maturing anatomy, unable to reach its full expression.[67] In both the metaphor-based acupuncture model and the torturous practice of foot-binding, the ideal represented a culturally repressed esthetic as opposed to reality, a system of sustained immaturity weakened by those who curtail proper expansion and innate capacity.

How do acupuncture researchers, educators, and clinicians undo the damage done by this prodigious misstep in acupuncture's history? Like most recovery programs would insist, those addicted to the energy-meridian paradigm need to begin by telling the truth. The time is now to set the record straight and acknowledge the rational, anatomic, and scientific basis of acupuncture.

Summary

The specificity and multiplicity of verifiable and reliable outcomes obtained by scientifically studying a point such as LI 4, as outlined in Table 1-1, illustrate the advantages of allowing acupuncture to mature into a modern medical treatment based on neuromodulatory actions. The steps toward manifesting this transformation first require a comprehensive grasp of neuroanatomy as it relates to acupuncture points, thus the purpose of the book.

References

1. Khoubesserian H. Libres Propos. *RAC.* 1965;3-4, 7. In Gwei-Djen L and Needham J. *Celestial Lancets. A History and Rationale of Acupuncture and Moxa.* New York: RoutledgeCurzon, 2002. P. 185.
2. Li S, Jiang C, and Chen G. The relationship between needling sensation and acupuncture ffects, with special reference to their ascending pathway in the spinal cord. *Acupuncture & Electro-Therapeutics Res., Int J.* 1983;8:105-110.
3. Dung HC, Clogston CP, and Dunn JW. *Acupuncture. An Anatomical Approach.* Boca Raton: CRC Press LLC, 2004.
4. Gunn CC, Ditchburn FG, King MH, and Renwick GJ. Acupuncture loci: a proposal for their classification according to their relationship to known neural structures. *Am J Chin Med.* 1976;4(2):183-195.
5. Dung HC. Acupuncture points of the cranial nerves. *Am J Chin Med.* 1984;12(1-4):80-92.
6. Dung HC. Acupuncture points of the cervical plexus. *Am J Chin Med.* 1984;12(1-4):94-105.
7. Dung HC. Acupuncture points of the brachial plexus. *Am J Chin Med.* 1985;13(1-4):49-64.
8. Dung HC. Acupuncture points of the lumbar plexus. *Am J Chin Med.* 1985;13(1-4):133-143.
9. Dung HC. Acupuncture points of the sacral plexus. *Am J Chin Med.* 1985;13(1-4):145-156.
10. Dung HC. Acupuncture points of the typical spinal nerves. *Am J Chin Med.* 1985;13(1-4):39-47.
11. Bossy J. Morphological data concerning the acupuncture points and channel network. *Acupuncture & Electrother Res, Int J.* 1984;9:79-106.
12. Mann F. Acupuncture – The Ancient Chinese Art of Healing and How It Works Scientifically. New York: Random House, Inc., 1962.
13. Matsumoto T and Lyu B. Anatomical comparison between acupuncture and nerve block. *The American Surgeon.* 1975;41:11-16.
14. Dung HC. Anatomical features contributing to the formation of acupuncture points. *American Journal of Acupuncture.* 1984; 12:139-143.
15. Gunn CC, Ditchburn FG, King MH, and Renwick GJ. Acupuncture loci: a proposal for their classification according to their relationship to known neural structures. *American Journal of Chinese Medicine.* 1976;4:183-195.

16. Filshie J and White A. *Medical Acupuncture, A Western Scientific Approach*. London: Churchill Livingstone, 1998.

17. Wong JY. A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculoskeletal Disorders. Toronto: The Toronto Pain and Stress Clinic, Inc., 1999.

18. Wong JY. A Manual of Neuro-Anatomical Acupuncture. Volume II: Neurological Disorders. Toronto: The Toronto Pain and Stress Clinic, Inc., 2001.

19. Fu H. What is the material base of acupuncture? The nerves! *Medical Hypotheses*. 2000;54:358-359.

20. Cho ZH, Wong EK, and Fallon J. *Neuro-Acupuncture. Scientific Evidence of Acupuncture Revealed!*. Los Angeles: Q-Puncture, Inc., 2001.

21. Peking Acupuncture Anesthesia Coordinating Group. Acupuncture Anesthesia. Peking: Foreign Languages Press, 1972. Cited in: King Liu Y, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *American Journal of Chinese Medicine*. 1975;3(4):347-358.

22. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. P. 11.

23. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. P. 2.

24. Schlebusch K-P, Maric-Oehler W, and Popp F-A. Biophotonics in the infrared spectral range reveal acupuncture meridian structure of the body. *The Journal of Alternative and Complementary Medicine*. 2005;11(1):171-173.

25. Litscher G. Infrared thermography fails to visualize stimulation-induced meridian-like structures. *BioMedical Engineering OnLine*. 2005;4:38.

26. Yung K-T. A birdcage model for the Chinese meridian system: Part I. A channel as a transmission line. *American Journal of Chinese Medicine*. 2004;32(5):815-828.

27. Yung K-T. A birdcage model for the Chinese meridian system: Part II. The meridian system as a birdcage resonator. *American Journal of Chinese Medicine*. 2004;32(6):985-997.

28. Yung K-T. A birdcage model for the Chinese meridian system: Part III. Possible mechanism of magnetic therapy. *American Journal of Chinese Medicine*. 2004;32(5):589-597.

29. Yung K-T. A birdcage model for the Chinese meridian system: Part IV. Meridians as the primary regulatory system. *American Journal of Chinese Medicine*. 2005;33(5):759-766.

30. Zhang D, Gao H, Wen B, and Wei Z. Research on the acupuncture principles and meridian phenomena by means of infrared thermography. *Zhen ci yan jiu* (Acupuncture Research). 1990;15(4):319-323.

31. Yan Z, Chi Y, Wang P, Cheng J, Wang Y, Shu Q, and Huang G. Studies on the luminescence of channels in rats and its law of changes with “syndromes” and treatment of acupuncture and moxibustion. *Journal of Traditional Chinese Medicine*. 1992;12(4):283-287.

32. Gao H, Jingbi M, Wen S, Chang B, Li R, Tian J, Xu F, and Zhang S. Approach to the characteristics of the movement of Qixue in meridians by means of radionuclide imaging. *Zhen ci yan jiu* (Acupuncture Research). 1990;15(4):315-318.

33. Omura Y. Meridian-like networks of internal organs, corresponding to traditional Chinese 12 main meridians and their acupuncture points as detected by the “Bi-Digital O-Ring Test imaging method”: search for the correspondinginternal organ of Western medicine for each meridian – Part I. *Acupunct Electrother Res*. 1987;12(1):53-70.

34. Hu X, Wu B, and Wang P. Displaying of meridian courses traveling over human body surface under natural conditions. *Zhen ci yan jiu* (Acupuncture Research). 1993;18(2):83-89.

35. Zhang D, Gao H, Wei Z, and Wen B. Preliminary observation of imaging of facial temperature along meridians. *Zhen ci yan jiu* (Acupuncture Research). 1992;17(1):71-74.

36. Wang P, Hu X, and Wu B. Displaying of the infrared radiant track along meridians on the back of human body. *Zhen ci yan jiu* (Acupuncture Research). 1993;18(2):90-93, 89.

37. Zhang D, Fu W, Wang S, Wei Z, and Wang F. Displaying of infrared thermogram of temperature character on meridians. *Zhen ci yan jiu* (Acupuncture Research). 1996;21(3):63-67.

38. Li Z. The experimental demonstration of “the isothermal meridian courses”. *Zhen ci yan jiu* (Acupuncture Research). 1996;21(1):76-78.

39. Lee MS, Jeong S-Y, Lee Y-H, Jeong D-M, Eo Y-G. Differences in electrical conduction properties between meridians and non-meridians. *American Journal of Chinese Medicine*. 2005;33(5):723-728.

40. Ma W, Tong H, Xu W, Hu J, Liu N, Li H, and Cao L. Perivascular space: Possible anatomical substrate for the meridian. *The Journal of Alternative and Complementary Medicine*. 2003;9(6):851-859.

41. Lo S-Y. Meridians in acupuncture and infrared imaging. *Medical Hypotheses*. 2002;58(1):72-76.

42. Jeong D-M, Lee Y-H, and Lee MS. Development of the meridian-visualizing system that superimposes a bio-signal upon a body image. *American Journal of Chinese Medicine*. 2004;32(4):631-640.

43. Lee Y-H, Jeong D-M, Jeong S-Y, and Lee MS. Development of a system and improvement of the stimulus pattern to discriminate the acupuncture point and meridians. *Intern J Neuroscience*. 2005;115:969-1002.

44. Wu C-C, Chen M-F, and Lin C-C. Absorption of subcutaneous injection of Tc-99m pertechnetate via acupuncture points and non-acupuncture points. *Americal Journal of Chinese Medicine*. 1994;22(2):111-118.

45. Bossy J. Morphological data concerning the acupuncture point and channel network. *Acupuncture & Electrother Res., Int J*. 1984;9:79-106.

46. Kendall DE. *Dao of Cinese Medicine*. Hong Kong: Oxford University Press. 2002; pp. 6-7.

47. Wei LY. Theoretical foundation of Chinese Medicine: a modern interpretation. *Am J Chin Med*. 1976;4(4):355-372.

48. Lim TC. Article: Understanding Traditional Chinese Medicine – a doctor’s viewpoint (NK Ho). *Singapore Med J*. 2002;43(1):45.

49. Hogeboom CJ, Sherman KJ and Cherkin DC. Variation in diagnosis and treatment of chronic low back pain by traditional Chinese medical acupuncturists. *Complementary Therapies in Medicine*. 2001;9:154-166.

50. Zhang GG, Lee W, Bausell B, Lao A, Handwerger B, and Berman B. Variability in the Traditional Chinese Medicine (TCM) diagnoses and herbal prescriptions provided by three TCM practitioners for 40 patients with rheumatoid arthritis. *J Alt Comp Med*. 2005;11(3):415-421.

51. Kalauokalani D, Cherkin DC, and Sherman KJ. A comparison of physician and nonphysician acupuncture treatment for chronic low back pain. *Clin J Pain*. 2005;21:406-411.

52. Tan S, Tillisch K, Bolus R, Olivas TI, Spiegel BMR, Naliboff B, Chang L, and Mayer EA. Traditional Chinese Medicine based subgrouping of irritable bowel syndrome patients. *Am J Chin Med*. 2005;33(3):365-379.

53. Fox RI and Lau CS. Conference Report. Highlights of the International Conference and Exhibition of the Modernization of Traditional Chinese Medicine and Health Products. *Medscape Rheumatology*. 2005;6(2). Obtained at http://www.medscape.com/viewarticle/511877 on 09-28-05.

54. Maciocia G. *The Practice of Chinese Medicine. The Treatment of Diseases with Acupuncture and Chinese Herbs*. Edinburgh:Churchill Livingstone, 1994. P. 376.

55. Al-Omari AA, Haddad FH, Khushman HM, and Malkawi OM. Graves disease and papillary thyroid cancer. An association that can be missed. *Saudi Med J*. 2005;26(8):1280-1282.

56. Maciocia G. *Diagnosis in Chinese Medicine. A Comprehensive Guide*. Edinburgh: Churchill Livingstone, 2004, p. 905.

57. Ho NK. Understanding Traditional Chinese Medicine – a doctor’s viewpoint. *Singapore Med J*. 2001;42(10):487-492.

58. Parker M. Chinese dragon or toothless tiger? Regulating the professional competence of traditional Chinese medicine practitioners. *J Law Med*. 2003;10(3):285-295.

59. Shiang E. The Yin-Yang (cold-hot) theory of disease. *JAMA*. 1971;217(8):1108.

60. Klauer K. Adrenal insufficiency and adrenal crisis. *eMedicine*. Obtained at http://www.emedicine.com/emerg/topic16.htm on 09-23-05.

61. Engelhardt U. Translating and interpreting the *Fu-Ch’I I Ching-I Lun:* Experiences gained from editing a T’ang Dynasty Taoist medical treatise. In: Unschuld PU (ed.). *Approaches to Traditional Chinese Medical Literature. Proceedings of an International Symposium on Translation Methodologies and Terminologies*. Dordrecht/Boston/London: Kluwer Academic Publishers, 1989. pp. 129-138.

62. Soulié de Morant G. *Chinese Acupuncture*. [Grinnell L, Jeanmougin C, and Leveque M, translators; Zmiewski P, editor]. Brookline: Paradigm Publications, 1994. P. viii.

63. Unschuld PU. *Chinese Medicine*. Brookline: Paradigm Publications, 1998. Pp. 104-105.

64. Zalta EN (ed.) Henri Bergson. *Stanford Encyclopedia of Philosophy*. Obtained at http://plato.stanford.edu/entries/bergson/ on 01-01-06.

65. Lovejoy CO. Evolution of man and its implications for general principles of the evolution of intelligent life. CP-2156 Life in the Universe. *Nasa History Division*. Obtained at http://history.nasa.gov/CP-2156/ch4.8.htm on 01-01-06.

66. Soulié de Morant G. *Chinese Acupuncture*. (Grinnell L, Jeanmougin C, and Leveque M, translators; Zmiewski P, editor). Brookline: Paradigm Publications, 1994. P. ix.

67. Unschuld PU (ed.). *Approaches to Traditional Chinese Medical Literature. Proceedings of an International Symposium on Translation Methodologies and Terminologies*. Dordrecht/Boston/London: Kluwer Academic Publishers, 1989. P. x.

68. Taylor K. *Chinese Medicine in Early Communist China,* 1945-1963. *A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 18.

69. Zhu Lian, *The New Acupuncture*. Beijing: Renmin weisheng chubanshe, 1954. P. xvii. Cited in: Taylor K. *Chinese Medicine in Early Communist China,* 1945-1963. A Medicine of Revolution. Trowbridge, Wiltshire: The Cromwell Press, 2005. Pp. 25-26.

70. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 63.

71. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 83.

72. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. Pp. 85-86.

73. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 144.

74. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 147.

75. Taylor K. *Chinese Medicine in Early Communist China, 1945-1963. A Medicine of Revolution*. Trowbridge, Wiltshire: The Cromwell Press, 2005. P. 150.

76. Kendall DE. Problems with the energy-meridian theory. Pacific College of Oriental Medicine website. Obtained at http://pacificcollege.edu/alumni/newsletters/summer2001/energy_meridian.html on October 17, 2005.

77. Unschuld PU. *Chinese Medicine*. Brookline: Paradigm Publications, 1998. P. 106.

78. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. P. 25.

79. Kendall DE. Op cit., p. 32.

80. Ibid.

81. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong:

Oxford University Press, 2002. Pp. 44-47.

82. Epler D. Bloodletting in early Chinese medicine and its relation to the origin of acupuncture. *Bulletin of the History of Medicine.* 1980;54(3): 337-367.

83. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art.* Hong Kong: Oxford University Press, 2002. P. 2.

84. Napadow V, Liu J, and Kaptchuk TJ. A systematic study of acupuncture practice: acupoint usage in an outpatient setting in Beijing, China. *Complementary Therapies in Medicine.* 2004;12:209-216.

85. Deadman P, Al-Khafaji M, and Baker K. *A Manual of Acupuncture.* East Sussex (ENGLAND): Journal of Chinese Medicine Publications, 1998. Pp. 103-106.

86. Landry MD and Scudds RA. The cooling effects of electroacupuncture on the skin temperature of the hand. *J Hand Ther.* 1996;9:359-366.

87. Ernst M and Lee MHM. Sympathetic vasomotor changes induced by manual and electrical acupuncture of the Hoku point visualized by thermography. *Pain.* 1985;21:25-33.

88. Kuo T-C, Lin C-W, and Ho F-M. The soreness and numbness effect of acupuncture on skin blood flow. *Am J Chin Med.* 2004;32(1):117-129.

89. Schimek F, Chapman CR, Gerlach R, and Colpitts YH. Varying electrical acupuncture stimulation intensity: effects on dental pain-evoked potentials. *Anesth Analg.* 1982;61(6):499-503.

90. Chapman CR, Benedetti C, Colpitts YH, and Gerlach R. Naloxone fails to reverse pain thresholds elevated by acupuncture: acupuncture analgesia reconsidered. *Pain.* 1983;16(1):13-31.

91. Chapman CR, Schimek F, Gehrig JD, Gerlach R, and Colpitts YH. Effects of nitrous oxide, transcutaneous electrical stimulation, and their combination on brain potentials elicited by painful stimulation. *Anesthesiology.* 1983;58(3):250-256.

92. Zaslawski CJ, Cobbin D, Lidums E, and Petocz P. The impact of site specificity and needle manipulation on changes to pain pressure threshold following manual acupuncture: a controlled study. *Complementary Therapies in Medicine.* 2003;11:11-21.

93. Milne RJ, Dawson NJ, Butler MJ, and Lippold OCJ. Intramuscular acupuncture-like electrical stimulation inhibits stretch reflexes in contralateral finger extensor muscles. *Experimental Neurology.* 1985;90:96-107.

94. Wang N and Hui-Chan C. Effects of acupoints TENS on heat pain threshold in normal subjects. *Chin Med J (Engl).* 2003;116(12):1864-1868.

95. Pak SC, Na CS, Kim JS, Chae WS, Kamiya S, Wakatsuki D, Morinaka Y, and Wilson L Jr. The effects of acupuncture on uterine contraction induced by oxytocin. *Am J Chin Med.* 2000;28(1):35-40.

96. Kim J, Shin KH, and Na CS. Effect of acupuncture treatment on uterine motility and cyclooxygenase-2 expression in pregnant rats. *Gynecol Obstet Invest.* 2000;50(4):225-230.

97. Rabl M, Ahner R, Bitschnau M, Zeisler H, and Husslein P. Acupuncture for cervical ripening and induction of labor at term – a randomized controlled trial. *Wien Klin Wochenschr.* 2001;113(23-24):942-946.

98. Waters BL and Raisler J. Ice massage for the reduction of labor pain. *J Midwifery Womens Health.* 2003;48(5):317-321.

99. Chung UL, Hung LC, Kuo SC, and Huang CL. Effects of LI4 and BL67 acupressure on labor pain and uterine contractionsin the first stage of labor. *J Nurs Res.* 2003;11(4):251-260.

100. Kong J, Ma L, Gollub RL, Wei J, Yang X, Li D, Weng X, Jia F, Wang C, Li F, Li R, and Zhuang D. A pilot study of functional magnetic resonance imaging of the brain during manual and electroacupuncture stimulation of acupuncture point (LI-4 Hegu) in normal subjects reveals differential brain activation between methods. *Journal of Alternative and Complementary Medicine.* 2002;8(4):411-419.

101. Wei H, Kong J, Zhuang D, Shang H, and Yang X. Early-latency somatosensory evoked potentials elicited by electrical acupuncture after needling acupoint LI-4. *Clin Electroencephalogr.* 2000;31(3):160-164.

102. Hui KK, Liu J, Makris N, Gollub RL, Chen AJ, Moore CI, Kennedy DN, Rosen BR, and Kwong KK. Acupuncture modulates the limbic system and subcortical gray structures of the human brain: evidence from fMRI studies in normal subjects. *Hum Brain Mapp.* 2000;9(1):13-25.

103. Yang ZL, Ouyang Z, Cheng YG, and Chen YX. A neuromagnetic study of acupuncturing LI-4 (Hegu). *Acupunct Electrother Res.* 1995;20(1);15-20.

104. Abad-Alegria F, Adelantado S, and Martinex T. The role of the cerebral cortex in acupuncture modulation of the somesthetic afferent. *Am J Chin Med.* 1995;23(1):11-14.

105. Hsieh J-C, Tu C-H, Chen F-P, Chen M-C, Yeh T-C, Cheng H-C, Wu Y-T, Liu R-S, and Ho L-T. Activation of the hypothalamus characterizes the acupuncture stimulation at the analgesic pointing human: a positron emission tomography study. *Neuroscience Letters.* 2001;307:105-108.

106. Chiu J-H, Chung M-S, Cheng H-C, Yeh T-C, Hsieh J-C, Chang C-Y, Kuo W-Y, Cheng H, and Ho L-T. Different central manifestations in response to electroacupuncture at analgesic and nonanalgesic acupoints in rats: a manganese-enhanced functional magnetic resonance imaging study. *Canadian Journal of Veterinary Research.* 2003;67:94-101.

107. Liu WC, Feldman SC, Cook DB, Hung DL, Xu T, Kalnin AJ, and Komisaruk BR. fMRI study of acupuncture-induced periaqueductal gray activity in humans. *Neuroreport.* 2004;15(12):1937-1940.

108. Chen CAN, Liu F-J, Wang L, and Arendt-Nielsen L. Mode and site of acupuncture modulation in the human brain: 3D 0124-ch) EEG power spectrum mapping and source imaging. *Neuroimage.* 2005; in press.

109. Wu MT, Hsieh JC, Xiong J, Yang CF, Pan HB, Chen YC, Tsai G, Rosen BR, and Kwong KK. *Radiology.* 1999;212(1):133-141.

110. Lin T-B, Fu T-C, Chen C-F, Lin Y-J, and Chien C-T. Low and high frequency electroacupuncture at Hoku electits a distinct mechanism to activate sympathetic nervous system in anesthetized rats. *Neuroscience Letters.* 1998;247:155-158.

111. Knardahl S, Elam M, Olausson B, and Wallin BG. Sympathetic nerve activity after acupuncture in humans. *Pain.* 1998;75(1):19-25.

112. Li G, Ng MC, Wong KK, Luk KD, and Yang ES. Spinal effects of acupuncture stimulation assessed by proton density-weighted functional magnetic resonance imaging at 0.2T. *Magnetic Resonance Imaging.* 2005;23:995-999.

113. Dung HC. Anatomical features contributing to the formation of acupuncture points. *American Journal of Acupuncture.* 1984; 12:139-143.

114. Matsumoto T and Lyu B. Anatomical comparison between acupuncture and nerve block. *The American Surgeon.* 1975;41:11-16.

115. Shaozong C. Modern acupuncture theory and its clinical application (Chapter 5 The Morphological Relationship between Points and Nerves). *International Journal of Clinical Acupuncture.* 2001;12:149-157.

116. Shaozong C. Modern acupuncture theory and its clinical application. (Chapter 5 The Morphologic Relationship between Points and Nerves). *International Journal of Clinical Acupuncture.* 2001;121(2):149-158.

117. Li A-H, Zhang J-M, and Xie Y-K. Human acupuncture points mapped in rats are associated with excitable muscle/skin-nerve complexes with enriched nerve endings. *Brain Research.* 2004;1012:154-159.

118. Lu G-W. Characteristics of afferent fiber innervation on acupuncture points zusanli. *Am J Physiol.* 245 (*Regulatory Integrative Comp Physiol.* 14): R606-R612, 1983.

119. Zaslawski CJ, Cobbin D, Lidums E, and Petocz P. The impact of site specificity and needle manipulation on changes to pain pressure threshold following manual acupuncture: a controlled study. *Complementary Therapies in Medicine.* 2003;11:11-21.

120. Gildenberg PL. Evolution of neuromodulation. *Sterotact Funct Neurosurg.* 2005;83:71-79.

121. Fandel T, Tanagho EA. Neuromodulation in voiding dysfunction: a historical overview of neurostimulation and its application. *Urol Clin N Am.* 2005;32:1-10.

122. Elkersh MA, Simopoulos TT, and Bajwa ZH. Fundamentals of interventional pain medicine. *The Neurologist.* 2005;11(5):285-293.

123. Bernstein AJ and Peters KM. Expanding indications for neuromodulation. *Urol Clin N Am.* 2005;32:59-63.

124. Daneshgari F, and Moy ML. Current indications for neuromodulation. *Urol Clin N Am.* 2005;32:37-40.

125. Ellis A, Wiseman N, and Boss K. *Fundamentals of Chinese Acupuncture,Revised Edition.* Brookline: Paradigm Publications, 1991. Pp. 248-251.

126. DeGiorgio CM, Schachter SC, Handforth A, Salinsky M, Thompson J, Uthman B, Reed R et al. Prospective long-term study of vagus nerve stimulation for the treatment of refractory seizures. *Epilepsia.* 2000;41:1195-2000.

127. Murphy JV and Patil AA. Stimulation of the nervous system for the management of seizures. Current and future developments. *CNS Drugs.* 17(2):101-115.

128. Zabara J, Chaffee RB Jr, Tansy MF. Neuroinhibition in the regulation of emesis. *Space Life Sci.* 1972;3(3):282-292.

129. Zabara J. Inhibition of experimental seizures in canines by repetitive vagal stimulation. Epilepsia. 1992;33(6):1105-1012.

130. Zabara J. Inhibition of experimental seizures in canines by repetitive vagal stimulation. *Epilepsia.* 1992;33(6):1001-1012.

131. Panzer RB and Chrisman CL. An auricular acupuncture treatment for idiopathic canine epilepsy: a preliminary report. *Am J Chin Med.* 1994;22(1):11-17.

132. Van Niekerk J, Eckersley N. The use of acupuncture in canine epilepsy. *J S Afr Vet Assoc.* 1988;59(1):5.

133. Shu J, Liu RY, and Huang XF. The effects of ear-point stimulation on the contents of somatostatin and amino acid neurotransmitters in brain of rat with experimental seizure. *Acupunct Electrother Res.* 2004;29(1-2):43-51.

134. Still J. Chapter 27, Ear Acupuncture. In Schoen AM (ed). *Veterinary Acupuncture – Ancient Art to Modern Medicine.* St. Louis: Mosby, Inc. 2001. p. 335.

135. Henry TR. Therapeutic mechanisms of vagus nerve stimulation. *Neurology.* 2002;59(Supp 4):S3-S14.

136. Ballegaard S, Jensen G, Pedersen F, and Nissen VH. Acupuncture in severe, stable angina pectoris: a randomized trial. *Acta Med Scand.* 1986;220(4):307-313.

137. Bernstein AJ and Peters KM. Expanding indications for neuromodulation. *Urol Clin N Am.* 2005;32:59-63.

138. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache.* 2002;42:855-861.

139. Li G, Ng MC, Wong KK, Luk KD, and Yang ES. Spinal effects of acupuncture stimulation assessed by proton density-weighted functional magnetic resonance imaging at 0.2T. *Magnetic Resonance Imaging.* 2005;23:995-999.

140. Costantini A. Spinal cord stimulation. *Minera Anestesiol.* 2005;71:471-474.

141. Keats J. Ode on a Grecian Urn. In Quiller-Couch A. (ed.) *The Oxford Book of English Verse: 1250–1900,* 1919.

142. Zhang JL, Zhang SP, and Zhang HQ. Antiepileptic effect of electroacupuncture vs. vagal nerve stimulation in the rat thalamus. *Neurosci Lett.* 2008;441(2):183-187.

143. Cakmak YO. Epilepsy, electroacupuncture and the nucleus of the solitary tract. *Acupunct Med.* 2006;24(4):164-168.

144. Van der Pal F, van Baiken MR, Heesakkers JP, et al. Implant-driven tibial nerve stimulation in the treatment of refractory overactive bladder syndrome: 12-month follow-up. *Neuromodulation.* 2006;9(2):163-171.

145. Peters KM, Macdiarmid SA, Wooldridge LS, et al. Randomized trial of percutaneous tibial nerve stimulation versus extended-release tolterodine: results from the overactive bladder innovative therapy trial. *J Urol*. 2009;182(3):1055-1061.

146. Manni L, Albanesi M, Guaragna M, et al. Neurotrophins and acupuncture. *Auton Neurosci.* 2010;157(1-2):9-17.

147. Manni L, Albanesi M, Guaragna M, et al. Neurotrophins and acupuncture. *Auton Neurosci.* 2010;157(1-2):9-17.

148. Hogeboom CJ, Sherman KJ, and Cherkin DC. Variation in diagnosis and treatment of chronic low back pain by traditional Chinese medicine acupuncturists. *Complement Ther Med.* 2001;9(3):154-166.

149. Mist SD, Wright CL, Jones KD, et al. Traditional Chinese medicine diagnoses in a sample of women with fibromyalgia. *Acupunct Med.* 2011;29(4):266-269.

150. Coeytaux RR, Chen W, Lindemuth CE, et al. Variability in the diagnosis and point selection for persons with frequent headache by Traditional Chinese Medicine acupuncturists. *J Alt Comp Med.* 2006;12(9):863-872.

151. Yang C-P, Chang M-H, Liu P-E, et al. Acupuncture versus topiramate in chronic migraine prophylaxis: a randomized clinical trial. *Cephalalgia.* 2011;31(15):1510-1521.

152. Morris W. Medical epistemology: a bias of culture? *Acupuncture Today*. 2011;12(3). Accessed at http://www.acupuncturetoday.com/print_friendly.php?pr_file_name=http%3A%2F%2Fwww.acupuncturetoday.com%2Fmpacms%2F%2Fat%2Farticle.php%3Fid%3D32371%26no_paginate%3Dtrue on 12-18-11.

153. Fan K-W. Discussion on scientification of acupuncture in Hong Kongin 1950s: with special reference to Zhu Lian's *The New Acupuncture. Asian Culture and History.* 2011;3(2):2-8.

154. Fan K-W. Op cit.

155. Zhu Lian. *Xin Zhenjiu Xue* (The New Acupuncture). Beijing: People's medical publishing house, 1951. Cited in Fan K-W. Discussion on scientification of acupuncture in Hong Kongin 1950s: with special reference to *Zhu Lian's The New Acupuncture. Asian Culture and History.* 2011;3(2):2-8.

156. Deadman P, Al-Khafaji M, and Baker K. Some acupuncture points which treat headache. *J Chin Med.* 1997; 55. Accessed on 1-1-12 at http://www.jcm.co.uk/media/sample_articles/56-5.pdf .

157. Manni L, Albanesi M, Guaragna M, et al. Neurotrophins and acupuncture. *Auton Neurosci.* 2010;157(1-2):9-17.

158. Moffet HH. Acupuncture study hypotheses should rely on scientific, not imaginary, models. [Letter to the editor]. *Arch Phys Med Rehabil.* 2008;89:194.

159. Yu H, Xu G, Yang R, et al. Somatosensory-evoked potentials and cortical activities evoked by magnetic stimulation on acupoint in human. 31st Annual International Conference of the IEEE EMBS Minneapolis, Minnesota, USA, September 2-6, 2009:3445-8.

Chapter 2:: Function Follows Form

Key Points

The science of neuromodulation endows acupuncture with a factual, rational basis and a neuroanatomic framework. Together, the science of neurophysiology and the instructional attributes of anatomy inspire cogent and sophisticated protocols for scientific, medical acupuncture and related techniques (SMARTs).

The outcome of a neuromodulation treatment depends on the regions, types, and number of nerves activated, as well as the method of stimulation selected.

Acupuncture stimulation most immediately affects one or more of the three types of peripheral nerves:

- **Motor**
- **Sensory**
- **Autonomic**

Stimulation methods involved in medical acupuncture include but are not limited to:

- **Dry needling, otherwise known as manual acupuncture (MA)**
- **Electroacupuncture (EA)**
- **Laser acupuncture (LA)**
- **Acupressure**

Comprehensive treatment entails three steps:

- **Determine the problem; understand its nature, location, and origin**
- **Identify neural avenues that produced and perpetuate the problem; consider how neuromodulation can affect these or other nerves to undo the damage and promote recovery**
- **Influence nerves from the peripheral, central, and autonomic nervous systems**

Understand the Function of Acupuncture Points through their Anatomy (Form)

For ages, philosophers and physicians have recognized the inseparable partnership of anatomy and physiology.[282,283] Investigating ways in which form meets functions in acupuncture illuminates the wealth of wisdom layered into each needling site. Systematic analysis of the local anatomy uncovers the effects of stimulating a point with delightful directness. Metaphorical medicine then dissipates and dissolves like fog in the morning after a night of rain; science, like the sun, burns away clouds of uncertainty with beams shining light on the ways in which acupuncture actually works.

Not merely an intellectual exercise, the anatomy of acupuncture impels clinicians to ask more precise questions about their patients and informs their thinking fingers during myofascial assessment of them.

In the examination process, one asks, “Is this where it hurts?” as the examiner’s hands seek to find tension and tenderness. Three-dimensional anatomy reveals underlying reasons for numbness and weakness by disclosing regions where muscles course over and around nerves. Structure and function show why tension and pain result and where they require intervention. In other words, myofascial impediments may impair nerve communication. Nerve entrapment due to myofascial restriction, fascial bands, or scar tissue may block a signal from reaching its destination or alter its message. Thorough, informed palpation frequently allows the medical acupuncturist to detect sites of nerve compression through findings of tissue tension and tenderness.

Nerves that have suffered from excessive or prolonged pressure, overstretching, or starvation from of insufficient oxygenation and nutrients through poor circulation can become neuropathic. Neuropathic nerves transmit erroneous information. Like trying to carry on a conversation along a poor cell phone connection, injured nerves relay distorted or interrupted messages. Depending on the nerve’s job in life and specialization, the patient may experience alterations in sensory, motor, and/or autonomic message delivery. As a result, instead of accurately reporting information about position sense, pain, touch, and so on, neuropathic nerves may cause the patient to feel pain instead of touch or pressure (allodynia) or find a mildly uncomfortable stimulus to cause unbearable pain (hyperalgesia).

Dysfunctional muscle tissue and related neural networks produce myofascial trigger points. Myofascial trigger points, a nearly ubiquitous phenomenon, can cause peripheral nerves to become neuropathic and inflamed due to their chronic nature and tendency to worsen and multiply if left untreated. Attending to trigger point dysfunction with neuromodulation through needling and related techniques is a major process by which acupuncturists benefit their patients.

Where do trigger points occur? One finds most myofascial trigger points in the middle of the muscle belly where the majority of muscle spindles and motor endplates lie as well as in the myotendinous junctions, occupied by Golgi tendon organs. Due to their profound roles in producing and perpetuating pain and dysfunction, these sites of highly specialized nerve endings in muscles and tendons become critical targets for acupuncturists. For example, an acupuncturist may select Gallbladder 20 and 21 (GB 20, GB 21) for myofascial pain the shoulder-neck region. GB 20 is located at the myotendinous attachment of the upper portion of the trapezius, and GB 21 lives in the middle of its muscle belly.

On a broader scale, truncal anatomy (as shown in the layered as well as cross-sectional anatomy in the upcoming chapters) bespeaks how form and function affect both soma and viscera. How do the nerves occupying BL 23 on the body wall affect the kidney? The answer becomes clear when considering the spinal segmental nerve supply that both sites share. Interneurons in the spinal cord yoke neural traffic from the small of the back with signals stemming from the depths of the abdomen and pelvis. Palpation of the paraspinal muscles along the entire back reveal results of aberrant neural traffic from facilitated spinal segments in the form of tissue tenderness, tension, and restriction. These findings of myofascial dysfunction along certain spinal segments serve to raise our awareness of potential somatic and/or visceral disturbances in the body realms subserved by this spinal cord “real estate”. This then informs both our diagnosis and treatment of the patient.

Layered and cross-sectional anatomy images also uncover structures beyond our fingers' reach. The bony calvarium keeps us from touching the brain and its vessels. Through the translucent skull in the Visible Human images in this book, connections between channels and vessels such as the Governor Vessel (GV) and the superior sagittal venous sinus remind us of the original, vascular basis of acupuncture as a whole and the eight singular vessels in particular. The Governor Vessel's counterpart, Conception Vessel (CV), represents the vena cava, whose relationship to the overlying central CV on the surface of the anterior (ventral) trunk now makes sense. Clinically, one may detect expansions of the often forgotten collateral venous drainage pathways when the vena cava obstructs, making the connection between deep, interior processes and the body surface, visually striking. In this way, channels' interconnections from deep to superficial and from one to another bring to life the meaning behind the metaphor in ancient writings on acupuncture. Today, scientific pursuits elaborate on these early insights and draw detailed descriptions of how acupuncture and related techniques influence form and function. Let us begin at the point-stimulus juncture.

The Needle-Tissue Interface

In acupuncture, the "rubber meets the road" at the needle-tissue interface. Like tires on pavement, the acupuncture needle must engage with its surroundings in order to gain traction and cause change. When rotated, the acupuncture needle attracts and pulls on collagen and possibly muscle fibers, causing them to grab its shaft. This bond between metal and fibers forces the tissue to respond and initiates a conversation with neighboring nerves, fascia, and fibroblasts.

The message spreads to nearby cells, culminating in a wave of tissue deformation and neural discourse that travels beyond the immediate vicinity. If the needle has reached muscle, the impact of treatment intensifies.[284] Nerves ferry information about the event in both an orthodromic (toward the spinal cord) and antidromic (toward the nerve's terminals) direction along a channel.

The Peripheral Nervous System's Subspecialists: Nerve Endings

In addition to proprioceptors such as muscle spindles that respond to changes in length and Golgi tendon organs that assess tension, a number of other receptors in tissue act as an interface between the external environment and the nervous system. This allows the acupuncturist to employ treatments that adjust or alter sensory input with the aim of supporting the healing process. Knowing the types of nerve endings typically found at acupuncture sites gives the medical acupuncturist a better understanding of the likely outcome of stimulating those points. For instance, if the acupuncture point overlies a blood vessel, a needle tugging on fascia nearby may stimulate its nervi vasorum (vascular nerves). These adrenergic fibers control vessel wall tone. As such, the effects of needling this site could involve neuromodulation of circulation and blood pressure regulation. An example of this type of point is Lung 9 (LU 9).

Acupuncture Points as 3-D Structures

Acupuncture points are three-dimensional events, not static dots on the skin surface. This fact converts the rather simple activity of inserting a needle into a multilayered excursion into a patient's bodily habitus. The dialogue between form and function deepens as the needle traverses skin, then fat, then fascia, muscle, and maybe periosteum. At each level, tissue resistance to the needle tip's travel tells of the tension and tone it encounters. Too much or too little of either tension or tone can signify dysfunction and/or disease.

When the treatment involves trigger point deactivation, attention to tissue texture and tension changes becomes paramount. Isolating a patient's source of pain precedes its elimination. When patients exclaim, "That's it! That's where the problem is!", it confirms palpatory findings. Re-examination through palpation and patient feedback after dry needling verifies or denies that the trigger point has responded. Trigger point deactivation serves as a profound example of the dynamism between form and function that takes place through the needle conduit.

Nerve Chat

Nerves serve as the body's social medium. Not shy, they publicize their messages broadly, speaking to everyone who will listen, whether organs, glands, vessels, muscles, fascia, and other nerves. The messages they send may be momentary, such the faint brush of a breeze going by, or lifelong, as in the case of childhood onset Crohn's disease. Similarly, their emotional and somatic sequelae may place a temporary or permanent imprint, depending on how many signals they send each time they complain, and how long their upset lasts. The "complaint department", i.e., the central nervous system (CNS), responds to neural reports of pain and distress with attempts to alleviate them. If unsuccessful, neural plasticity makes the CNS a codependent partner by prolonging the problem, leading to hyperalgesia, allodynia, inflammation, sympathetic hyperactivity, muscle tension, and long-term stress.[285]

By the time a patient presents for treatment, pain and dysfunction have usually existed long enough to cause a collection of problems. This behooves the medical acupuncturist to develop a neuromodulatory intervention that addresses several levels. It is therefore not enough to ask how the chief complaint started and where it hurts, but also why is it continuing and how does it express itself in the structure (myofascia, posture, joint mobility), viscera (organ, metabolic, and glandular activity), and emotions (anxiety, depression, withdrawal, confusion)? Has the problem not only influenced function, but is it also now altering form?

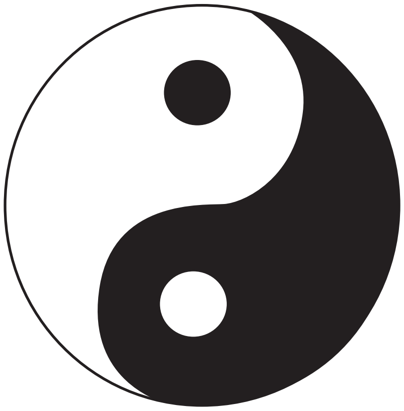
Acupuncture neuromodulation should, to the degree possible, address each aspect of a patient's discord; i.e., its central, peripheral, and autonomic components. This likely will require several treatments.

Acupuncture Neuromodulation

Neuromodulation is a naturally occurring phenomenon, allowing the body to respond and adapt to endogenous and exogenous stimuli. It provides for the protection, homeostasis, and repair of the organism.[2,3,4,5,6] Sometimes, though, autoregulatory processes either falter or fail. Acupuncture is simply a somatosensory input that assists the body in making the neuromodulatory changes necessary to regain health and homeostasis.[7]

Acupuncture neuromodulation signals initiated near needling sites propagate along nerves toward the CNS.[1] Connections at the spinal cord can course in several directions. The cord may 1) send efferent signals back out to the periphery (leading to antidromic activation of free nerve endings at the site of needling), 2) loop into related visceral neural networks and alter internal organ function in a spinal segmental manner, 3) foster endogenous opioid release in the dorsal horn of the spinal cord to reduce spinal facilitation, or "wind-up", and block pain, and/or 4) proceed to higher centers in the brain, altering neural and hormonal functions. When these impulses arrive at the brain, they influence activity there as well, usually in a beneficial manner.

Exactly how the body responds and which parts of the body react depend on the nerves stimulated.[8] However, the body's pre-needling state may also influence outcomes.[9,10] For example, the point ST 36 treats both diarrhea and constipation, depending on pre-treatment gastrointestinal motility status.[11,12] In this way, the same point can either "quiets things down" in cases of hyperfunction, or "fire them up" in hypofunction.



The Tai Ji symbol illustrates the balanced, intertwining, and evolving relationship between Yin (black) and Yang (white), with elements of the complementary partner held by each component (represented by the small circles).

Yin and Yang in the Modern Era

TCM terms such as "Yang Excess" and "Yin Deficiency" can now be viewed as sympathetic hyperfunction or parasympathetic hypofunction.[13,14] Disease states that illustrate Yang Excess include hyperthyroidism and acute fever. "Deficient Yin" describes parasympathetic hypofunction, most dramatically depicted by toxic exposure to anticholinergics, or parasympathetic antagonists. In this case, the victim turns "red as a beet, blind as a bat, dry as a bone, mad as a hatter, and hot as hell".[15]

Conversely, "Excess Yin" connotes just the opposite, i.e., parasympathetic hyperfunction and/or sympathetic hypofunction. One might even see a concatenation of autonomic disruption, as in cluster headaches. These patients exhibit both sympathetic hypofunction, manifesting as miosis and ptosis, along with parasympathetic hyperfunction, with rhinorrhea and lacrimation.

Table 2-1 Sympathetic and Parasympathetic Functions[18,19]

Organ	Effects of Sympathetic System (Yang)	Effects of Parasympathetic System (Yin)
Adipocyte metabolism	Causes lipolysis	---
Adipocyte, brown	Causes heat production	---
Adrenal medulla	Causes adrenaline/epinephrine (80%) and noradrenaline/norepinephrine (20%) secretion	---
Arteries in cranium	Vasoconstricts	May vasodilate
Arteries in erectile tissue (helical arteries and sinusoids in penis and clitoris)	Vasoconstricts	Vasodilates
Arteries in heart[20] (coronary arteries)	Transient vasoconstriction, followed by vasodilation	Some vasodilation
Arteries in skeletal muscle	Vasoconstricts (via adrenergic fibers) under resting tone and vasodilates large arteries (via cholinergic fibers) during exercise	---
Arteries in skin and mucosa of face	Vasoconstricts	Vasodilates
Arteries in skin of trunk and limbs	Vasoconstricts	----
Arteries in viscera	Vasoconstricts	----
Esophagus	Motility decreases Sphincters contract	Motility increases Sphincters relax
Eye	Pupillary dilator muscle dilates pupil Contracts tarsal muscle (lifts lid) Ciliary muscle relaxes for far vision	Pupillary sphincter muscle contracts pupil Contracts ciliary muscle
Gallbladder and biliary ducts	Relaxes	Contracts

Table 2-1 Sympathetic and Parasympathetic Functions, Continued

Heart	Increases heart rate Increases atrial and ventricular contractility	Decreases heart rate Decreases atrial contractility
Intestines	Motility decreases Sphincters relax Secretion decreases	Motility increases Sphincters contract Secretion increases
Kidneys	Arterioles constrict	Arterioles dilate
Lacrimal gland	---	Secretes
Liver metabolism	Causes glycogenolysis, gluconeogenesis	---
Lungs	Relaxes tracheobronchial muscles	Contracts tracheobronchial muscles Increases mucous secretions from bronchial glands
Lymphoid tissue	Reduces activity (e.g., of natural killer cells)	---
Nasopharyngeal glands	---	Secretes
Pancreas[21]	Increases circulating glucose Inhibits insulin secretion from the islet beta cells Constricts pancreatic blood vessels	Increases insulin secretion Dilates pancreatic blood vessels
Piloerector muscles	Contracts	----
Pilomotor muscles of the skin	Causes contraction	---
Pineal gland	Increases synthesis of melatonin	---
Prostate, seminal vesicle	Contracts	---
Salivary glands	Weak serous secretion (submandibular salivary gland) Sparse, thick secretion	Profuse serous secretion
Splenic capsule	Contracts	---
Stomach	Motility decreases Sphincters contract Secretion is inhibited	Motility increases Sphincters relax Secretion increases
Sweat glands of the skin	Induces profuse secretion	---
Thyroid gland	Becomes stimulated	
Ureter	Decreases ureteric tone and motility	Increases ureteric tone and motility
Urinary bladder	Relaxes detrusor muscle (small amount) Increases internal sphincter tone and trigone	Contracts detrusor muscle Relaxes internal sphincter tone and trigone
Uterus	Contracts pregnant uterus Relaxes or contracts the non-pregnant uterus	---
Vas deferens	Contracts	---
Veins	Vasoconstricts	---

Instead of relying on abstract concepts of Yin and Yang, studying the autonomic nerve supply to organs and glands yields insights into ways in which illness manifests neurophysiologically. This then opens the door to acupuncture neuromodulation by outlining neuroanatomic expressways that revise neural traffic. Table 2-1 compares the complementary actions of the two limbs of the autonomic nervous system (ANS), designated by tissue or organ. Most viscera receive dual innervation from both sympathetic and parasympathetic limbs of the ANS.[17]

How Acupuncture Points Affect Internal Organs

While needling neuromodulates nerve activity in local structures through direct effects on tissue, its broader, homeostatic value results from reflexes in the spinal cord and brain.

The Spinal Cord Connects the Soma with Viscera

One of the most salient depictions of how the ancient Chinese linked anatomy (structure) with physiology (function) comes from the Back Shu and Front Mu points. These twelve pairs of points (one Back Shu and one Front Mu for each organ) act upon certain sections of the spinal cord. Their associated spinal cord levels house interneuronal connections connecting pathways that produce reflexes between acupuncture points on the body surface (soma) and internal organs (viscera).

The paraspinal Back Shu points run along the inner Bladder channel from the thorax to the sacrum. The Front Mu points occur on the lateral or anterior aspects of the trunk and generally receive nerve supply from spinal cord segments that overlap with those of the Back Shu points.[122] Back Shu points receive innervation from the dorsal (posterior) ramus of a spinal nerve, while the Front Mu points occur along dermatomes of the same, or neighboring, spinal nerve, supplied by either the lateral or ventral (anterior) ramus.

Because each organ and its associated pair of Back Shu and Front Mu points often share innervation from similar or overlapping spinal cord levels. In the spinal cord, neurons in the deep layers of the dorsal horn receive convergent input from somatic structures and viscera.[124]

Unhappy nerves arise from unhappy organs and body wall structures such as tense or painful muscles and fascia. Nociceptive neurons, when activated, bombard the spinal cord with tales of woe.[123] They become more excitable and fire more readily in response to stimuli. This phenomenon of central nervous system excitation is known as "wind-up" or "facilitation".[125,126] Sensitized neurons will, in some cases, trigger impulses spontaneously, long after the initiating insult has ceased causing tissue damage or irritation. Cells receiving muscle input in the intermediolateral gray column of the spinal cord, where preganglionic autonomic cell bodies reside, become hyperactive as well, propelling a loop within the sympathetic system that participates in the process of referred hyperalgesia.[127]

Central sensitization amplifies output to both visceral and somatic structures. Sympathetic efferent neurons in the thoracic and lumbar spinal cord segments join in this dysfunctional dance. Muscles supplied by sensitized segments become tense due to increased output through somatic motor neurons, causing sustained muscle contraction. This engenders myofascial dysfunction and trigger points.[128] Heightened sympathetic tone drives vasoconstriction and edema; it also amplifies tissue tenderness and texture changes.[129,130,131,132,133]

Organs receiving neural input from "wound up" spinal segments experience decreased perfusion due to sympatho-excitation.[134,135] Conceivably, compromised blood flow in an organ could, over time, lead to insufficiency or, ultimately, failure in that structure. In the kidney, for example, activated renal sympathetic nerves reduce renal blood flow, increase renin secretion, and increase renal tubular sodium reabsorption.[136] Should counteracting autoregulatory controls falter or prove insufficient, hypertension may result.[137]

In practice, an acupuncturist palpates the entire group of Back

Table 2-2
Sympathetic Input to the Back Shu and Front Mu Points[157,158]

Organ	Sympathetic Preganglionic Levels[159,160,161,162]	Site of Synapse of Pre- and Post-Ganglionic Sympathetic Neurons[163]	Course of Nociceptive Afferent Pathways into the Central Nervous System*[164]	Associated Back Shu Point and Vertebral Level**	Associated Front Mu Point and Dermatome Level
Lungs (including the trachea and bronchi)	T2-T7, to upper thoracic sympathetic ganglia	T2-T6 sympathetic ganglia	Afferents travel with the sympathetics to the dorsal root ganglion neurons from T2-T7 and the vagus nerve to the nucleus tractus solitarius (NTS) in the medulla	**BL 13;** T3	**LU 1;** C4,T2
Pericardium	T1-T5, to upper thoracic and cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Afferents travel with the afferents in the middle and inferior cervical sympathetic cardiac nerves and the thoracic sympathetic cardiac nerves and enter the cord from T1-T5	**BL 14;** T4	**CV 17;** T4
Heart	T1-T5, to upper thoracic and cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Afferents travel with the afferents in the middle and inferior cervical sympathetic cardiac nerves and the thoracic sympathetic cardiac nerves and enter the cord from T1-T5	**BL 15;** T5	**CV 14;** T7
Liver	T5-T10, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T10	**BL 18;** T9	**LR 14;** T8, T9

Table 2-2 Sympathetic Input to the Back Shu and Front Mu Points, Continued

Gallbladder	T5-T10, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T10	**BL 19;** T10	**GB 24;** T9
Spleen (Pancreas)	T5-T11, to superior thoracic (greater) splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T11	**BL 20;** T11	**LR 13;** T10, T11
Stomach and Duodenum	T5-T11, to superior (greater) and middle (lesser) thoracic splanchnic nerves and celiac plexus	Celiac ganglion	Afferents travel with the sympathetics and enter the cord from T5-T11	**BL 21;** T12	**ST 25;** T10
Triple Heater (adrenal)	T7-L2, to superior (greater), middle (lesser), and inferior (least) thoracic splanchnic nerves and the first +/- second lumbar splanchnic nerves	Chromaffin cells of adrenal medulla	None reported	**BL 22;** L1	**CV 5;** T11, T12
Kidney	T10-L2, to middle (lesser) and inferior (least) thoracic splanchnic nerves and the first +/- second lumbar splanchnic nerves → celiac and renal plexuses	Celiac and aorticorenal ganglia	Afferents travel with the sympathetics and enter the cord from T10 to L2	**BL 23;** L2	**GB 25;** T12
Large Intestine	• **Cecum and appendix:** T10-T12 (cecum, appendix) to the superior (greater) and middle (lesser) thoracic splanchnic nerves → celiac and superior mesenteric plexuses • **Colon to the splenic flexure:** T10-L1 to the middle (lesser) and inferior (least) thoracic and first lumbar splanchnic nerves • **Splenic flexure to the rectum:** L1-2 through to the S2-S4 sacral chain ganglia, to the lumbar and sacral splanchnic nerves → inferior mesenteric and inferior hypogastric pelvic plexuses, to the	Superior and inferior mesenteric ganglia and ganglia in superior and inferior hypogastric plexuses	• **Cecum and appendix:** Afferents travel with the sympathetics and enter the cord from T10 to T12 • **Colon to the splenic flexure:** Afferents travel with the sympathetics, course through the superior and inferior mesenteric plexuses and splanchnic nerves, and into the cord from T10 to L1 • **Splenic flexure to the rectum:** Travel with the parasympathetic nerves and the pudendal nerves, into the cord at S2-S4	**BL 25;** L4 (receives sympathetic supply from T10-L2)	**ST 25;** T10
Small Intestine	T8-12 right, T8-T11 left, to the superior (greater) and middle (lesser) thoracic splanchnic nerves to the celiac plexus	Celiac and superior mesenteric ganglia	Travel with the sympathetics through the celiac and inferior mesenteric plexuses, into the cord from T8-T11	**BL 27;** (receives sympathetic supply from T10-L2)	**CV 4;** T12
Bladder	T11-L2 to the middle (lesser) and inferior (least) thoracic splanchnic nerves	Inferior mesenteric ganglion and sacral paravertebral ganglia	Travel with the parasympathetic nerves and some sympathetic afferents, to enter the cord at S2-S4 and L1-L2	**BL 28;** S2 (receives sympathetic supply from T10-L2)	**CV 3;** L1

*The afferent pathways listed in this table only pertain to the nociceptive avenues. Afferent fibers carrying other sensory information exist but have not been included here.

**Note: Sympathetic input to each spinal level is generally multi-segmental. That is, the tissues located in the vicinity of the Back Shu points along the inner line of the Bladder channel likely receive sympathetic supply from a spinal segment above and below that noted in the table.

Shu and Front Mu points in order to indirectly assess the function of the related organs. The point-organ relationships in the Shu-Mu system are arranged in a topographical fashion, with more cranial organs such as the lung and heart relating to more upper thoracic Shu-Mu point pairs, and more caudal organs such as the urinary bladder and large intestine showing up in the caudal point pairs. (See Table 2-2.)

Shu-Mu palpation should assess tension and tenderness in the muscles beneath the point, rather than merely the skin or subcutaneous tissue. Pain referred from an irritated viscus begins in deep somatic structures.[138] However, trophic changes in the skin follow visceral disturbances, as evidenced by thickened subcutaneous tissue and atrophic skeletal muscle.[139] When both members of the Shu-Mu pair demonstrate tenderness to palpation, assessment of that organ system would be prudent, since this may suggest visceral, rather than predominantly somatic dysfunction.[140,141,142,143,144]

Upon finding tender Shu-Mu points, an acupuncturist typically treats them, with the goal of reducing spinal cord windup and associated organ dysfunction. Mild, non-painful stimulation such as that provided by acupuncture may reduce pain and sympathetic hyperactivity in regions supplied by similar metameric/neuromeric/segmental fields.[145]

Table 2-2 also shows which spinal segments feed supply structures associated with the Back Shu and Front Mu points, the sites of synapse of pre- and post-ganglionic sympathetic neurons, and the course of nociceptive afferent pathways back to the CNS.

Table 2-3 provides the associated anatomy of organs outside of the Back Shu-Front Mu system. Relevant acupuncture points that could influence these organs can be determined on the basis of the neural structures linking the body surface (i.e., the soma) to these viscera.

Areas of referred tenderness precipitated by ongoing visceral nociceptive input land in metamerically connected cutaneous, subcutaneous, and muscular tissues. Metameric regions arise from similar segments of the developing embryo; referred pain and tenderness ordinarily occur ipsilateral to the disturbed structure.[146]

In the early stages of visceral disease, referred pain often has a deep, vague, and poorly localized quality. Pain at this phase (minutes to hours after the initial insult) feels like a dull discomfort, nearly always along the midline of the thorax or abdomen.[147] Autonomic concomitants such as sweating, nausea, vomiting, pallor, and a sense of impending death, may accompany true visceral pain in its early stages.[148]

If nociceptive signals continue from an irritated viscus, pain migrates to the body wall in the thorax or abdomen, usually located within similar or nearby spinal segments.[149] The referred pain begins to resemble somatic pain in that it becomes sharper, better defined, and well localized. Receptive fields expand in size in proportion to the number of painful episodes.[150] Over time, central sensitization as well as concurrent problems in other organs may cause pain to refer to adjacent myotomes, at which point neighboring Shu and Mu points could become tender.[151,152]

This is why, although the Back Shu and Front Mu pairs conventionally associate with only one organ, in reality, widespread multisegmental communication occurs. This limits the specificity of organs and acupuncture point relationships. Each paravertebral sympathetic ganglion may supply as many as six ipsilateral dermatomal levels.[153] Less predictable myotomal and scleromal innervation patterns further complicate interpretations of internal organ distress derived by myofascial palpation.[154]

While the nerve supply of the Back Shu-Front Mu points is elaborate and extensive, the general cranial to caudal layout of the Back Shu-Front Mu points exhibits a similar trend across species, even if specific vertebral levels differ. An alternative and probably more realistic arrangement would consist of over overlapping zones assigned to various organs instead of discrete points, as suggested for the horse.[155] Initially, this variance from the human norm arose to address difference in vertebral formulae between humans and other animals. As humans have twelve thoracic and five lumbar vertebrae and horses have eighteen thoracic and commonly six lumbar vertebrae, difficulties arise if one attempts to transpose the Back Shu points directly from the human to the horse.[156] Instead, Panzer proposes multi-level "association segments" rather than discrete association points.

Extrasegmental Acupuncture Points and Autonomic Function

Acupuncture points outside of the Back Shu-Front Mu system also modulate autonomic function, but do so through a variety of connections. Table 2-4 lists the associations between sympathetic structures and acupuncture points on the neck and trunk. Table 2-5 links points on the head and trunk with parasympathetic projections. Bear in mind that these are only partial lists, designed to denote the more common pathways utilized in a diverse and busy acupuncture practice.

The Brainstem's "Grand Central Stations" for Autonomic Reflexes in Neuromodulation: The Nucleus Tractus Solitarius and Rostral Ventral Lateral Medulla

Scientific research over the past decade has answered the question about how a point on the leg, ST 36, can treat both diarrhea and constipation. Instead of influencing autonomic activity in a unilateral direction, appropriately selected and stimulated acupuncture points modulate, or coax, bodily processes toward a homeostatic function.

Neuroscience has thus removed the need to rely on abstract "Yin-Yang balance" conceptualization by substituting metaphors with precise neurophysiologic descriptions that outline the trajectory from point to brain and spinal cord, and then on to the organ.

For example, two points on the limbs, ST 36 and PC 6, affect

Table 2-3
Anatomic Relationships of Organs Outside of the Shu Mu System[165]

Organ	Sympathetic Preganglionic Levels[166,167,168,169]	Site of Synapse of Pre- and Post-Ganglionic Sympathetic Neurons[170]	Course of Nociceptive Afferent Pathways into the Central Nervous System*[171]
Meninges and arteries of the brain	T1-T3 to and through the cervical sympathetic ganglia	T2-T6 sympathetic ganglia	Cranial nerves V, IX, and X enter the spinal trigeminal nucleus; afferents traveling through C1-C3 spinal nerves enter at the C1-C3 spinal cord segments
Eyes	T1-T4, to and through the cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Ophthalmic branch of CN V enters the spinal trigeminal nucleus
Lacrimal gland	T1, T2, to and through the cervical sympathetic ganglia	All cervical sympathetic ganglia and T1-T5 sympathetic ganglia	Lacrimal nerve to the ophthalmic branch of CN V, to the spinal trigeminal nucleus
Parotid	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Parotid nerve to the auriculotemporal nerve of CN V_3, to the spinal trigeminal nucleus
Submandibular, and sublingual glands	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Submandibular branch of the lingual nerve to CN V_3, to the spinal trigeminal nucleus
Thyroid gland	T1, T2, to and through the cervical sympathetic ganglia	Celiac ganglion	Travel with sympathetic nerves to T1-2 spinal cord segments
Blood vessels of the skin and somatic structures of the head and neck	T1-T4, to and through the cervical sympathetic ganglia	Celiac ganglion	Some travel with sympathetic nerves to the T1-T4 spinal cord segments; others accompany CN V, CN IX, and CN X to the spinal trigeminal nucleus
Larynx	T1, T2, to and through the cervical sympathetic ganglia	Chromaffin cells of adrenal medulla	Superior laryngeal nerve to the spinal trigeminal nucleus
Esophagus	• **Cervical:** T2-T4, to and through the upper thoracic sympathetic paravertebral ganglia • **Thoracic:** T3-T6, to and through the upper thoracic sympathetic paravertebral ganglia • **Abdominal:** T5-T8, to the thoracic sympathetic paravertebral ganglia and superior thoracic splanchnic nerve	Celiac and aorticorenal ganglia	• **Cervical:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T2-T4 • **Thoracic:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T3-T6 • **Abdominal:** Some travel with the vagus to the NTS, others travel with the sympathetics to spinal cord segments T5-T8
Thoracic Aorta	T1-T5, to the thoracic sympathetic paravertebral ganglia	Superior and inferior mesenteric ganglia and ganglia in superior and inferior hypogastric plexuses	Travel with the sympathetic afferent pathways to the spinal cord levels T1-T6
Abdominal Aorta	T5-L2, through splanchnic nerves and direct branches	Celiac and superior mesenteric ganglia	Travel with the sympathetic afferent pathways to the spinal cord levels T5-L2
Ureters	• **Upper 2/3:** T10-L2, to the middle and inferior splanchnic and upper two lumbar splanchnic nerves • **Lower 1/3:** T11-L2, to the S2-S4 sacral ganglia	Inferior mesenteric ganglion and sacral paravertebral ganglia	• **Upper 2/3:** Travel with sympathetics to the spinal cord levels T10-L2 • **Lower 1/3:** Travel with sympathetic and parasympathetic nerves to enter the cord between T10 and T12
Uterus	T6-L2, to the splanchnic nerves to aortic and ovarian plexuses and superior and inferior hypogastric plexuses		Travel with the sympathetic afferent pathways to the spinal cord levels T11-L2
Testes, ductus deferens, epididymis, seminal vesicles, and prostate	T10-L1 through thoracic and upper lumbar splanchnic nerves, the celiac, aortic (intermesenteric), and superior hypogastric plexus, and hypogastric nerves to the inferior hypogastric (i.e., pelvic) plexus	Prevertebral ganglia and inferior mesenteric ganglion	Afferents through the testes (or ovaries) travel to T10. Parasympathetic afferents from these structures enter the S2-S4 portion of the spinal cord

*The afferent pathways listed in this table only pertain to the nociceptive avenues. Afferent fibers carrying other sensory information exist but have not been included here.

Table 2-4
Linkage of Autonomic Structures and Acupuncture Points -- Sympathetics[175,176]

Associated Spinal cord segments (C8-L3)	Structures Near Acupuncture Points and their Function	Acupuncture Points
C8-T5	**Superior cervical ganglion:** Supplies the head, neck, and heart; postganglionic axons "hitchhike" on the carotid arteries and branches to reach their destinations, which include the blood vessels supplying the lacrimal, salivary, and nasopharyngeal glands, the eye and dilator pupillae muscle, and remaining tissues.	SI 17
T1-T6	**Middle cervical ganglion:** Supplies the neck and heart (via the cardiac pulmonary plexus)	ST 10 GV 14[177]
T1-T7	**Inferior cervical ganglion (may fuse with the T1 ganglion to form the stellate ganglion):** Supplies the heart, caudal neck, arm, and posterior region of the head	ST 11
T1-T12	**Thoracic sympathetic ganglia (paravertebral and prevertebral)** • T2-T5 supply the heart and lungs • T5-T9 form the supply the stomach and proximal gut (fibers synapse in the celiac ganglion) • T8 to L2 supply the adrenal gland • T7 to L1 supply the superior mesenteric ganglion • T9-T11 supply the superior mesenteric ganglion • T9-T10 supply the inferior mesenteric ganglion • T12 supplies the renal ganglion • T12 fibers may also synapse in the aorticorenal ganglion (the combined superior mesenteric, renal, and inferior mesenteric ganglia) which supplies the kidney	GV or BL points at related spinal levels[178]
L1-L5	**Lumbar Sympathetic Ganglia** Axons from all lumbar ganglia region spinal nerves supplying the abdominal wall and pelvic limbs. Axons from most lumbar ganglia also join the abdominal plexuses. Fibers from lower lumbar sympathetic nerves migrate along the iliac arteries and branches to innervate pelvic vessels.	
S1-S4	**Sacral Sympathetic Ganglia** The pelvic sympathetic chains fuse in the midline, anterior to the coccyx, to form the ganglion impar. Postganglionic branches supply the wall of the pelvis and the pelvic limbs. Branches destined for the distal colon or pelvic viscera form the superior and inferior hypogastric plexuses. The superior hypogastric plexus lies below the origin of the common iliac arteries. The inferior hypogastric plexus is also called the pelvic plexus, and is located deep within the pelvis, close to the pelvic nerves.	S1: BL 31; BL 27 S2: BL 32; BL 28 S3: BL 33; BL 29 S4: BL 34; BL 30

Table 2-5
Linkage of Autonomic Structures and Acupuncture Points -- Parasympathetics[179,180]

	Parasympathetic Structures Near Acupuncture Points and their Function	Points
Cranial Parasympathetic Nerves	**Ciliary ganglion, CN III** Pupillary constriction.	ST 1 for CN III
	Sphenopalatine/pterygopalatine ganglion, lacrimal gland, CN VII Sends secretomotor signals to the lacrimal gland to stimulate tear production. Innervates the mucosal glands of the nose and mouth.	TH 23; GB 1
	Submandibular ganglion, submandibular and sublingual glands, CN VII Causes the submandibular and sublingual salivary glands to secrete saliva.	ST 5 for submandibular ganglion
	Otic ganglion, parotid gland, CN IX Causes the parotid gland to secrete saliva.	ST 7 for otic ganglion
	Carotid sinus nerve, CN IX Supply the carotid sinus and body	CV 23 ST 9 for carotid sinus
	CN X Vagal input to the thoracic and abdominal viscera	TH 17; SI 16; ST 9 CV 22; ST 9 for recurrent laryngeal nerve
Sacral Parasympathetic Nerves	**Sacral Nerves (S2-S4)** Supply the lower gut and the pelvic viscera. Modulate smooth muscle activity and stimulate pelvic glands to secrete	S2: BL 28, BL 32 S3: BL 29, BL 33 S4: BL 30, BL 34

brainstem nuclei[172,173,174] that participate in long-loop reflexes between the acupuncture point and internal organs. These nuclei, most notably the nucleus tractus solitarius (NTS) and its partner, the dorsal motor nucleus of the vagus (DMNV) as well as the rostral ventral lateral medulla (rVLM), modulate autonomic tone based on somatoautonomic input converging on the NTS and rVLM.[24,25,26]

The Nucleus Tractus Solitarius

The NTS interconnects numerous central nervous system networks. It acts as an important relay center for sensory afferents from diverse sources. Afferent signals arising from peripheral chemoreceptors, baroreceptors, the gastrointestinal tract, cardiovascular system, lungs, and the airways terminate in the NTS.[27] Some of these afferents reach the NTS by hitchhiking on cranial nerves III, VII, IX, and X, i.e., the cranial nerves that carry parasympathetic fibers.[28]

The NTS also receives input from afferents innervating the skin, subcutaneous tissues, and muscle in an ongoing fashion. Adding somatic afferent stimulation through acupuncture augments or otherwise modifies this input.[286]

For example, acupuncture points on the face (supplied by the trigeminal nerve) and limbs (such as ST 36, supplied by the fibular (peroneal) nerve), influence gastrointestinal motility, blood pressure, cardiopulmonary function, and pain. In one study, researchers used the cellular marker of neural activity, c-fos, to identify activated neurons in the CNS after gastric distension and electroacupuncture. They stimulated points on the face (GB 14, ST 2, and ST 6). Their results showed that both noxious visceral information and non-noxious somatic afferent stimulation (i.e., acupuncture) converged in the NTS. This suggested that the NTS mediates EA analgesia through neuromodulation.[29,287]

Receptors from the cardiovascular and respiratory systems also send messages into the NTS. Baro- and chemoreceptors living in the bifurcation of the carotid artery help the body autoregulate blood pressure and blood chemistry.[30] Impulses from the carotid body and sinus artery travel to the NTS by way of the glossopharyngeal nerve (CN IX). There, they converge with input from the reticular formation and the hypothalamus as well. The NTS assembles this information and determines the appropriate reflex autonomic responses.[31]

Impaired sensing capability from dysfunctional baro- and chemoreceptors triggers sympathetic bias that could conceivably lead to myocardial infarction, heart failure, and stroke.[32] Carotid body and carotid sinus electromodulation may help prevent or treat cerebrovascular events by restoring autoregulation.[33] The idea of externally influencing the carotid sinus is not new; carotid sinus massage has been used to determine the cause of syncope and also to terminate supraventricular tachycardia through alterations in autonomic tone.[34,35] The acupuncture point ST 9 (located near the carotid body and sinus) has long received attention as a point that is valuable for treating “shortness of breath”, “asthma”, “sudden turmoil disorder”, “pulseless syndrome”, “hypertension”, and “hypotension”.[36] This indicates that the ancient Chinese recognized the role of structures stimulated by needling ST 9 in cardiopulmonary problems, even though they were unaware of the actual neurophysiological mechanisms involved.

Far and away, the largest body of research exploring the impact of acupuncture on NTS has focused on its role in restoring normal gastrointestinal motility.[288] This results from communication with its neighbor, the dorsal motor nucleus of the vagus (DMNV). Together, the NTS (a site that receives afferent information) and the DMNV (an efferent structure) form the dorsal vagal complex, or DVC. The DVC thus comprises sensory and motor aspects, creating a conduit for somatovagal and vagovagal reflexes.[49] In this manner, the DVC is a parasympathetic preganglionic center that modifies visceral output based on convergent, somatoautonomic input.

The Rostral Ventral Lateral Medulla

The rostral ventral lateral medulla (rVLM), like the NTS, receives convergent input from both visceral and somatic sources. The rVLM also assists the NTS in the baroreceptor reflex.[37] The rVLM affords the main source of tonic excitatory input to cardiovascular sympathetic preganglionic neurons in the spinal cord.[38] It modulates cardiovascular responses according to the signals it receives from the gut and soma. The neurotransmitters nitric oxide, opioids, and nociceptin are a few examples of the chemicals involved in its activity.[39,40,41,42]

EA influences cardiovascular function at least in part by affecting rVLM activity.[43,44,45] Physiologic investigations demonstrate point- (i.e., nerve-) specific cardiovascular responses in the rVLM.[46] EA at points associated with deep nerves (such as the median (PC 5, PC 6) or deep radial (LI 10, LI 11)) produce stronger and longer-lasting modulation of visceral reflex pressor responses than does EA over superficial cutaneous nerves, such as at the terminal branches of the tibial nerve (KI 1, BL 67).[47] Cardiovascular responses to EA also demonstrate frequency specificity. Research shows that both EA at 2 Hz and MA (dry needling) inhibit reflexive excitatory cardiovascular responses caused by visceral afferent stimulation, but EA at 40 Hz or 100 Hz does not.[48]

The rVLM influences gastrointestinal motor function, too. Compared to somatic afferent stimulation at ST 36, which, after reaching the NTS, increases gastric contractions (a parasympathetic effect), stimulation at ST 25 predominantly influences the rVLM, resulting in gastric relaxation (a sympathetic effect).[289]

Somato-somatic Reflexes

Each acupuncture point delivers a panoply of effects. Some influence both somatic and autonomic function simultaneously. ST 36, for instance, treats not only constipation and diarrhea through the mechanisms just described, but also helps alleviate back pain and pelvic limb dysfunction.

MA at ST 36 activates afferent fibers belonging to groups I, II, III, and IV.[196] Group II and III afferents elicit acupuncture analgesia; afferents belonging to groups II, III, and IV also impact various autonomic processes,[197,198] while activation of Group I afferents more clearly influence motor neuron activity.[199] All of these afferents connect to the fibular nerve, supplied by lumbosacral spinal cord segments. Patients with disk disease or back pain in the low back may derive relief from ST 36 stimulation at least in part because of the spinal segmental analgesia it provides. From a supraspinal perspective, EA at ST 36 regulates beta-endorphin and adrenocorticotropic hormone (ACTH) levels in the hypothalamus and pituitary, bestowing generalized analgesia and anti-inflammatory effects.[201,202,290]

EA at ST 36 also affects structures in the limbic system, i.e., brain structures involved in processing pain, memory of pain, and its emotional qualities.[291,292] Furthermore, ST 36 neuromodulation leads to changes in cerebral blood flow in the frontal lobes, brainstem, and thalami. These alterations occur as a consequence of acupuncture treatment and relate to pain-relief.[200] Thus, even considering this one point's effects, one sees how acupuncture alleviates pain through a multiplicity of mechanisms.[192,193,194]

While needling points such as ST 36 can help patients with conditions such as back pain through generalized analgesic mechanims, direct treatment of painful regions is usually also necessary for successful treatment. Palpation and postural evaluation of the back, neurologic testing, and mobility assessments all lend vital information about the specific problems plaguing the patient. The medical acupuncturist then considers ways in which to stimulate sites related to the myofascial and neuroanatomic matrix in order to optimize relief, especially when medication has failed to do so.[208,209]

This is where somato-somatic reflexes through acupuncture neuromodulation perform vital roles in prompting recovery. In the case of back pain, for example, stimulation of paravertebral somatic afferent fibers at acupuncture points along the spine suppresses activity in spinal nociceptive neurons.[195] This alleviates muscle tension, fascial restriction, and local nerve irritation and inflammation, ultimately reducing spinal cord facilitation. Reduction in facilitation (wind-up) helps dampen pain transmission, efferent motor activity and sympathetic tone, leading to analgesia, muscle relaxation, and improved circulation. Obtaining a twitch in the muscle through electrical stimulation, similar in ways to the needling of trigger points, provides significantly greater immediate and sustained relief of myofascial low back pain than stimulating only the muscle or overlying skin.[215]

As an illustration of how somato-somatic reflexes connect acupuncture points to painful sites, Table 2-6 lists groups of acupuncture points often used for spinal pain, their location, and the nerves they most intimately impact. Not included are peripheral points such as BL 40, BL 60, ST 36, SI 3, and others that provide additional analgesia, depending on the patient's pain problem(s). In general, it is standard practice to focus not only on the specific spinal segment or vertebral level involved in the pain problem, but also on points associated with spinal segments above and below. This takes into account the multisegmental somatic nerve supply to spinal structures as well as the discrepancy that appears between the vertebral level and dermatomal nerve supply in the caudal spine. One should not neglect the sympathetic contribution to the pain problem. Therefore, one should consider selecting points along paraspinal locations that provide autonomic input to the region.[244,245]

Table 2-6 Acupuncture Points Commonly used for Spinal Pain

Acupuncture Points (Medial to Lateral)	Location	Related Nerves[246]
Governor Vessel (GV) points and additional interspinous points along the midline	Between spinous processes of adjacent vertebrae, on the dorsal midline	Medial branch of the dorsal (posterior) primary ramus
Huatojiaji points[247,248,249,250]	0.5 cun lateral to the midline, from C1 to L5	Medial branch of the dorsal primary ramus
Facet joint points	1.0 cun lateral to the midline, from C1 to L5	Medial branch of the dorsal primary ramus
Inner Bladder line	1.5 cun lateral to the midline	Lateral branch of the dorsal primary ramus
Outer Bladder line	3.0 cun lateral to the midline	Ventral branch of the dorsal primary ramus
Myofascial Trigger points	Variable	Variable
Front Mu points (for organ relationship)	Variable	Variable

Table 2-7 associates structures often implicated in spinal pain such as intervertebral disks, facet joints, and spinal muscles.[251] Inflammation, compression, developmental anomalies, or degeneration of these tissues can all lead to spinal pain. The table includes mention of particular acupuncture point groupings that may most directly influence pain transmission in the affected nerves.

Controlled trials and systematic reviews in human research provide increasingly strong supportive evidence indicating that acupuncture effectively treats chronic spinal pain.[222,223,224,225,226,227,228,229,230,231] Several uncontrolled studies have reported that acupuncture also reduces spinal pain in dogs and horses.[232,233,234,235,236,237,238] According to Adrian R. White, MD, the author of several systematic reviews on acupuncture, “Acupuncture treatment should be considered for anyone who has nonspecific mechanical back pain that has persisted for 6 weeks or more despite standard treatment.”[239,240] In humans, ten sessions of acupuncture produced stable, long-term effects lasting at least six months according to a recently published prospective cohort study.[241] A 2005 paper systematically reviewing acupuncture for chronic low back pain echoed the findings of earlier work, concluding that adding acupuncture plus conventional treatment produced better analgesia and functional improvement than conventional treatments alone.[242,243] Acupuncture saves money; results from a 2011 study in Canada suggest that patients with low back pain were less likely to visit physicians if they had received acupuncture, thereby lowering costs spent on healthcare for these patients.[293]

Assembling Acupuncture Points to Impart a Meaningful Neuromodulatory Input

Whether treating back pain, irritable bowel syndrome, trigeminal neuralgia, or radiation-induced xerostomia, a medical acupuncturist can simplify the neural input protocol by asking three simple questions:

1. What is the problem and how is it expressing itself in the soma with myofascial dysfunction, pain, tenderness to palpation, etc.?
2. How did the problem affect neurophysiologic activities in the periphery, CNS, and ANS?
3. Which acupuncture points will influence these affected nerve pathways both specifically and comprehensively?

The physician acupuncturist will find the answers to question 1 when taking the patient’s history, performing the physical examination, and pursuing an appropriately detailed workup. The answers to questions 2 and 3 require a solid foundation in neuroanatomy, neurophysiology, and scientifically based medical acupuncture. Acupuncture point anatomy, such as that presented in the chapters that follow, informs the physician about the local, regional, and system-wide impact of stimulating each site.

Summary

Whether a clinical problem involves pain, visceral disturbance, or a psychological or somatic dysfunction, numerous neural networks participate in the problem. This is due to the widespread interactions between the nociceptive and autonomic systems not only in the periphery, but also in the spinal cord, brainstem, and several sites in the cerebrum and cerebellum.[280] Fortunately, acupuncture can influence many of these loci, including, most notably, the medulla, pons, periaqueductal gray, hypothalamus, amygdala, insular cortex, and anterior cingulate gyrus. These sites serve to regulate autonomic outflow, balance endocrine function, and blunt pain.[281] The key is knowing which nerves and regions to target. Hence, the fundamental premise of this book.

References

1. Bossy J. Morphological data concerning the acupuncture points and channel network. *Acupuncture & Electrother Res, Int J.* 1984;9:79-106.
2. Kettunen P, Kyriakatos A, Hallen K, and El Manira A. Neuromodulation via conditional release of endocannabinoids in the spinal locomotor network. *Neuron.* 2005;45:95-104.
3. Ribeiro JA. What can adenosine neuromodulation do for neuroprotection? *Current Drug Targets – CNS & Neurological Disorders.* 2005; 4:325-329.
4. Nurse CA. Review. Neurotransmission and neuromodulation in the chemosensory carotid body. *Autonomic Neuroscience: Basic and Clinical.* 2005;120:1-9.
5. Yu AJ and Dayan P. Uncertainty, neuromodulation, and attention. *Neuron.* 2005;46:681-692.
6. Frick A and Johnston D. Plasticity of dendritic excitability. *J Neurobiol.* 2005;64:100-115.
7. Kandel ER, Schwartz JH, Jessell TM. *Principles of Neural Science,* 4th edition. New York: McGraw-Hill, 2000. P. 965.

Table 2-7
Potential Sources of Back Pain, Their Innervations, and Related Acupuncture Points[252,253,254]

Structural Source of Back Pain	**Related Neural Elements**	**Acupuncture Points Influencing Nerves Related to the Pain Source – Select Points at One to Three Spinal Segments Above and Below the Lesion, as Well as Those Located at the Pertinent Level From Which Sympathetic Contributions Arise**
Intervertebral disc	The outer third of intervertebral disks contains nociceptors and mechanoreceptors. • The sinuvertebral nerve innervates the dorsal (posterior) aspect of lumbar intervertebral disks.[255] The sinuvertebral nerves consist of somatic and sympathetic fibers. When they return to the spine, they can ascend or descend for up to 5 segmental levels.[256,257] Sympathetic fibers supplying disc in the lumbar spine will arise from the thoracolumbar level. Low back pain caused by the sinuvertebral nerve is often diffuse because of its unique anatomic pathway and sympathetic components.[258] The dorsal portion of the lower lumbar disks receives innervation from sensory fibers arising from the T13 to L2 DRG's.[259] • Branches of the ventral rami and the gray rami communicantes supply the lateral aspects of the disks in the lumbar spine.[260,261] The lateral portion of the L5-L6 intervertebral disc (in rats) arise from both ipsilateral and contralateral dorsal root ganglion (DRG) neurons from the T13, L1, and L2 levels.[262] • The ventral (anterior) portion of the L5-L6 intervertebral disc (in rats) receives innervation from the L1 or L2 spinal nerves. This may explain why patients with lower lumbar disc problems may also experience pain in the inguinal region, which corresponds to the L1-L2 dermatome.[263,264,265] • "Paradiscal rami" from the rami communicantes cross intervertebral disks and course through the connective tissue of the disc deep to the origin of the psoas muscle. These rami also likely provide discal innervation.[266] • Severely degenerated lumbar intervertebral disks exhibit more extensive disc innervation than do normal disks.[267]	Huatojiaji points,[1] "facet joint points"[268]
Facet joint capsule	The joint capsule is richly innervated by proprioceptors and nociceptors. The synovial membrane of the lumbar facet joint (in rats) is supplied by sensory and sympathetic fibers.[269] The dorsal rami supply the lateral portions of the facet joints. The sinuvertebral nerves supply the medial portion of the facet joints. Facet joints in the low back receive both segmental and nonsegmental innervation, due to the innervation from sympathetic postganglionic neurons in the thoracolumbar region and the multisegmental nature of spinal innervation.[270] In rats, the L5/L6 facet joint receives multisegmental innervation from the L1 to L5 DRGs.[271]	Huatojiaji points, "facet joint points"[272]
Costovertebral joints (thoracic spine only)	Dorsal rami and sympathetic fibers supply the costovertebral joints.	Huatojiaji points, "facet joint points"
Dorsal root ganglion (DRG)	Mechanically sensitive nociceptors (i.e., mechanonociceptors) in the nervi nervorum of the epineuria surrounding the DRG may contribute to pain if compression or tension affects the DRG.	Points along the inner Bladder channel

Table 2-7 Potential Sources of Back Pain, Their Innervations, and Related Acupuncture Points, Continued

Spinal ligaments: **1) Longitudinal ligaments – dorsal/posterior and ventral/anterior** **2) Supraspinal ligaments** **3) Interspinous ligaments**	These ligaments contain free nerve endings that have been implicated as potential contributors to back pain. • The sinuvertebral nerve supplies the dorsal (or posterior) longitudinal ligament. • Recurrent branches of the rami communicantes innervate the ventral (or anterior) longitudinal ligament.[273] • The grey rami communicantes supply the anterior (ventral) longitudinal ligament. • Medial branches of the lumbar dorsal rami supply the interspinous ligaments	Points along the Governor Vessel channel
Vertebral periosteum	The periosteum contains an extensive plexus of nerve fibers that exhibits the lowest pain threshold of any of the deep tissues.	Huatojiaji points or points along the Governor Vessel channel
Meninges	The dura is sensitive to mechanical and noxious stimulation; meningeal irritation may contribute to back pain. The sinuvertebral nerve supplies the dura mater. The dura mater of the lower lumbar spine receives sensory fibers from the upper lumbar ganglia; these fibers may interact with sympathetic nerves and mediate pain in the low back.[274]	Points along the Bladder channel
Muscles attaching or referring to the back	Myofascial pain is characterized by palpable, taut bands occurring lengthwise along muscles that contain exquisitely tender regions. Lateral branches of the dorsal rami supply the iliocostalis lumborum muscle; intermediate branches of the lumbar dorsal rami supply the longissimus muscle. Medial branches of the lumbar dorsal rami supply the multifidus and the short intersegmental muscles (intertransversarii mediales and interspinales).	Local, direct needling into the taut band or trigger point[275]
Thoracolumbar fascia	Cutaneous branches from dorsal rami of lumbar spinal nerves innervate the thoracolumbar fascia. The thoracolumbar fascia may be involved in a neurosensory capacity in controlling the lumbar spine mechanism.[276] Nerves supplying the thoracolumbar fascia in humans with chronic mechanical back pain may undergo degeneration secondary to ischemia or inflammation.[277]	Points along the Governor Vessel, Bladder, or Gallbladder channels, depending on the area affected by pain, as determined by palpation
Sacroiliac joint	Sensory innervation to the sacroiliac joint arises from neurons in the DRGs ipsilateral to the joint from L1 to S2; sensory fibers from the L1 and L2 DRG's course through the paravertebral sympathetic trunk.[278]	
Dysfunctional viscera causing or resulting from central sensitization[279]	Address both the myofascial and visceral components.	Points along the Governor Vessel, Bladder, or Gallbladder channels, depending on the area affected by pain, as determined by palpation

---

8. Tjen-A-Looi SC, Li P, and Longhurst JC. Medullary substrate and differential cardiovascular responses during stimulation of specific acupoints. *Am J Physiol Regul Integr Comp Physiol.* 2004;287:R852-R862.

9. Li Z, Want C, Mak AFT, and Chow DHK. Effects of acupuncture on heart rate variability in normal subjects under fatigue and non-fatigue state. *Eur J Appl Physiol.* 2005;94:633-640.

10. Ballegaard S, Muteki T, Harada H, Ueda N, Tsuda H, Tayama F, and Ohishi K. Modulatory effect of acupuncture on the cardiovascular system: a crossover study. *Acupuncture & Electrotherapeutics Res., Int J.* 1993;18:103-115.

11. Tatewaki M, Harris M, Uemura K, Ueno T, Hoshino E, Shiotani A, Pappas T, and Takahashi T. Dual effects of acupuncture on gastric motility in conscious rats. *Am J Physiol Regul Integr Comp PHysiol.* 2003;285:R862-R872.

12. Tatewaki M, Harris M, Uemura K, Ueno T, Hoshino E, Shiotani A, Pappas T, and Takahashi T. Dual effects of acupuncture on gastric motility in conscious rats. *Am J Physiol Regul Integr Comp PHysiol.* 2003;285:R862-R872.

13. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. P. 215.

14. Johansson M, Elam M, Rundqvist B, Eisenhofer G, Herlitz H, Lambert G, and Friberg P. Increased sympathetic nerve activity in renovascular hypertension. *Circulation.* 1999;99:2537-2542.

15. Maciocia G. *Diagnosis in Chinese Medicine. A Comprehensive Guide.* Edinburgh: Churchill Livingstone, 2004. Pp. 986-987.

16. Corcoran C, Connor TJ, O'Keene V, and Garland MR. The effects of vagus nerve stimulation on pro- and anti-inflammatory cytokines in humans: a preliminary report. *Neuroimmunomodulation.* 2005;12:307-309.

17. Kiba T. Relationships between the autonomic nervous system and the pancreas including regulation of regeneration and apoptosis. *Pancreas.* 2004;29(2):e51-e58.

18. Mathias CJ and Bannister SR. *Autonomic Failure. A Textbook of Clinical Disorders of the Autonomic Nervous System, 4th Ed.* New York: Oxford University Press, 1999, p. 5 (unless otherwise referenced).

19. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. P. 220.

20. Klabunde, RE. Cardiovascular physiology concepts. Obtained at http://www.cvphysiology.com/Blood%20Flow/BF001.htm on 092305.

21. Kiba T. Relationships between the autonomic nervous system and the pancreas

including regulation of regeneration and apoptosis. Recent developments. *Pancreas.* 2004;29(2):e51-e58.

22. Sato A, Li P, and Campbell JL (eds). *Acupuncture – is there a physiologic basis?* Amsterdam: Elsevier. 2002.

23. Kong J, Ma L, Gollub RL, Wei J, Yang X, Li D, Weng X, Jia F, Wang C, Li F, Li R, and Zhuang D. A pilot study of functional magnetic resonance imaging of the brain during manual and electroacupuncture stimulation of acupuncture point (LI-4 Hegu) in normal subjects reveals differential brain activation between methods. *Journal of Alternative and Complementary Medicine.* 2002;8(4):411-419.

24. Longhurst JC. Central and peripheral neural mechanisms of acupuncture in myocardial ischemia. *International Congress Series.* 2002;1238:79-87.

25. Li P. Neural mechanisms of the effect of acupuncture on cardiovascular diseases. *International Congress Series.* 2002;1238:71-77.

26. Sequeira H, Viltart O, Ba-M'Hamed S, and Poulain P. Cortical control of Somato-cardiovascular integration: Neuroanatomical studies. *Brain Research Bulletin.* 2000;53(1):87-93.

27. Zec N and Kinney HC. Anatomic relationships of the human nucleus of the solitary tract in the medulla oblongata: a DiI labeling study. *Autonomic Neuroscience: Basic and Clinical.* 2003;105:131-144.

28. Liu J-H, Li J, Yan J, Chang X-R, Cui R-F, He J-F, and Hu J-M. Expression of c-fos in the nucleus of the solitary tract following electroacupuncture at facial acupoints and gastric distension in rats. Neuroscience Letters. 2004;366:215-219.

29. Liu J-H, Li J, Yan J, Chang X-R, Cui R-F, He J-F, and Hu J-M. Expression of c-fos in the nucleus of the solitary tract following electroacupuncture at facial acupoints and gastric distension in rats. *Neuroscience Letters.* 2004;366:215-219.

30. Nurse CA. Neurotransmission and neuromodulation in the chemosensory carotid body. *Auton Neurosci.* 2005;120(1-2):1-9.

31. Wilson-Pauwels L, Akesson EJ, and Stewart PA. *Cranial Nerves. Anatomy and Clinical Comments.* Hamilton: BC Decker, Inc. 1988. P. 120.

32. Doux JD and Yun AJ. The link between carotid artery disease and ischemic stroke may be partially attributable to autonomic dysfunction and failure of cerebrovascular autoregulation triggered by Darwinian maladaptation of the carotid baroreceptors and chemoreceptors. *Medical Hypotheses.* 2006;66:176-181.

33. Doux JD and Yun AJ. The link between carotid artery disease and ischemic stroke may be partially attributable to autonomic dysfunction and failure of cerebrovascular autoregulation triggered by Darwinian maladaptation of the carotid baroreceptors and chemoreceptors. *Medical Hypotheses.* 2006;66:176-181.

34. Deepak SM, Jenkins NP, Davidson NC, Bennett DH, and Mushahwar SS. Ventricular fibrillation induced by carotid sinus massage without preceding bradycardia. *Europace.* 2005;7:638-640.

35. Deepak SM, Jenkins NP, Davidson NC, Bennett DH, and Mushahwar SS. Ventricular fibrillation induced by carotid sinus massage without preceding bradycardia. *Europace.* 2005;7(6):638-640.

36. Deadman P, Al-Khafaji M, and Baker K. *A Manual of Acupuncture.* East Sussex (ENGLAND): Journal of Chinese Medicine Publications, 1998. Pp. 137-138.

37. Yu D and Gordon FJ. Anatomical evidence for a bi-neuronal pathway connecting the nucleus tractus solitarius to caudal ventrolateral medulla to rostral ventrolateral medulla in the rat. *Neuroscience Letters.* 1996;205:21-24.

38. Dampney RA. Functional organization of central pathways regulating the cardiovascular system. *Physiol Rev.* 1994;74:323-364.

39. Zhou W, Tjen-A-Looi SC and Longhurst JC. Brain stem mechanisms underlying acupuncture modality-related modulation of cardiovascular responses in rats. *J Appl Physiol.* 2005;99:851-860.

40. Lu JX, Zhou PH, Wang J, Li X, Cao YX, Zhou X, and Zhu DN. Medullary ventrolateral nitric oxide mediates the cardiac effect of electroacupuncture at "Neiguan" acupoint on acute myocardial ischemia in rats. *Sheng Li Xue Bao.* 2004;56(4):503-508.

41. Li P, Tjen-A-Looi S, and Longhurst JC. Rostral ventrolateral medullary opioid receptor subtypes in the inhibitory effects of electroacupuncture on reflex autonomic response in cats. *Auton Neurosci.* 2001;89(1-2):38-47.

42. Crisostomo MM, Li P, Tjen-A-Looi SC, and Longhurst JC. Nociceptin in rVLM mediates electroacupuncture inhibition of cardiovascular reflex excitatory response in rats. *J Appl Physiol.* 2005;98(6):2056-2063.

43. Zhou WY, Tjen-A-Looi SC, and Longhurst JC. Brain stem mechanisms underlying acupuncture modality-related modulation of cardiovascular responses in rats. *J Appl Physiol.* 2005;99(3):851-860.

44. Chao DM, Shen LL, Tjen-A-Looi S, Pitsillides KF, Li P, and Longhurst JC. Naloxone reverses inhibitory effect of electoacupuncture on sympathetic cardiovascular reflex responses. *Am J Physiol Heart Circ Physiol.* 1999;276:H2127-H2134.

45. Tjen-A-Looi SC, Li P, and Longhurst JC. Prolonged inhibition of rostral ventral lateral medullary premotor sympathetic neurons by electroacupuncture in cats. *Autonomic Neuroscience: Basic and Clinical.* 2003;106:19-131.

46. Tjen-A-Looi SC, Li P, and Longhurst JC. Medullary substrate and differential cardiovascular responses during stimulation of specific acupoints. *Am J Physiol Regul Integr Comp Physiol.* 2004;287:R852-R862.

47. Tjen-A-Looi SC, Li P, and Longhurst JC. Medullary substrate and differential cardiovascular responses during stimulation of specific acupoints. *Am J Physiol Regul Integr Comp Physiol.* 2004;287:R852-R862.

48. Zhou W, Fu LW, Tjen-A-Looi SC, Li P, and Longhurst JC. Afferent mechanisms underlying stimulation modality-related modulation of acupuncture-related cardiovascular responses. *J Appl Physiol.* 2005;98:872-880.

49. Liu J-H, Yan J, Yi S-X, Chang X-R, Lin Y-P, and Hu J-M. Effects of electroacupuncture on gastric myoelectric activity and substance P in the dorsal vagal complex of rats. *Neuroscience Letters.* 2004;356:99-102.

50. Liu J-H, Yan J, Yi S-X, Chang X-R, Lin Y-P, and Hu J-M. Effects of electroacupuncture on gastric myoelectric activity and substance P in the dorsal vagal complex of rats. *Neuroscience Letters.* 2004;356:99-102.

51. Lu, G-W. Characteristics of afferent fiber innervation on acupuncture points zusanli. A*merican Journal of Physiology – Regulatory, Integrative, Comparative Physiology.* 1983; 245:R606-R612.

52. Ezzo J, Berman B, Hadhazy VA, Jadad AR, Lao L and Singh BB. Is acupuncture effective for the treatment of chronic pain? A systematic review. *Pain.* 2000;86:217-225.

53. White AR and Ernst E. A trial method for assessing the adequacy of acupuncture treatments. *Alternative Therapies.* 1998;4:66-71.

54. Liao T-J et al. Transient decrease in skin resistance response and level at the Deh-Chi stage caused by manual acupuncture. *Tohoku J Exp Med.* 1998;186:19-25.

55. Tanaka TH. The physiological responses induced by superficial acupuncture: a comparative study of acupuncture stimulation during exhalation phase and continuous stimulation. *International Journal of Neuroscience.* 1997;90(1-2):45-58.

56. Ying M and Weihong L. Studies on reducing and reinforcing manipulation of acupuncture during the past 4 years (continued). *Journal of Traditional Chinese Medicine.* 1994;14(4):308-311.

57. Ying M and Weihong L. Studies on reducing and reinforcing manipulation of acupuncture during the past 4 years (continued). *Journal of Traditional Chinese Medicine.* 1994;14(4):308-311.

58. Uchida Y et al. Electroacupuncture induces the expression of Fos in rat dorsal horn via capsaicin-insensitive afferents. *Brain Research.* 2003;978:136-140.

59. Wang K and Liu J. Needling sensation receptor of an acupoint supplied by the median nerve – studies of their electro-physiological characteristics. *American Journal of Chinese Medicine.* 1989; 17(3-4): 145-155.

60. Zhu B et al. A C-fiber reflex inhibition induced by electroacupuncture with different intensities applied at homotopic and heterotopic acupoints in rats selectively destructive effects on myelinated and unmyelinated afferent fibers. *Brain Research.* 2004;1011:228-237.

61. Bowsher D. Mechanisms of acupuncture. Obtained at http://www.intl.elsevierhealth.com/e-books/pdf/131.pdf on 10-08-04.

62. Xie Y et al. Neurobiological mechanisms of the meridian and the propagation of needle feeling along the meridian pathway. *Science in China (Series C).* 1996;39(1):99-112.

63. Chan AKS et al. The effect of acupuncture on alpha-motoneuron excitability. *Acupuncture & Electro-Therapeutics Res., Int. J.* 2004;29:53-72.

64. Chen X-H and Han J-S. Analgesia induced by electroacupuncture of different frequencies is mediated by different types of opioid receptors: another cross-tolerance study. *Behavioural Brain Research.* 1992;47:143-149.

65. Hsieh C-L et al. Changes of pulse rate and skin temperature evoked by electroacupuncture stimulation with different frequency on both Zusanli acupoints in humans. *American Journal of Chinese Medicine.* 1999;27(1):11-18.

66. Shimoju-Kobayashi R, Maruyama H, Yoneda M, and Kurosawa M. Responses of hepatic glucose output to electro-acupuncture stimulation of the hindlimb in anaesthetized rats. *Autonomic Neuroscience: Basic and Clinical.* 2004;115:7-14.

67. Chao DM et al. Naloxone reverses inhibitory effect of electroacupuncture on sympathetic cardiovascular reflex responses. *Am J Physiolog 276 (Heart Circ Physiol 45)*: H2127-H2134, 1999.

68. Lin T-B et al. Low and high frequency electroacupuncture at Hoku elicits a distinct mechanism to activate sympathetic nervous system in anesthetized rats. *Neuroscience Letters.* 1998;247:155-158.

69. Haker E et al. Effect of sensory stimulation (acupuncture) on sympathetic and parasympathetic activities in healthy subjects. *Journal of the Autonomic Nervous System.* 2000;79:52-59.

70. Liu J-H et al. Expression of c-fos in the nucleus of the solitary tract following electroacupuncture at facial acupoints and gastric distension in rats. *Neuroscience Letters.* 2004;366:215-219.

71. Chiu J-H et al. Somatic electrical nerve stimulation regulates the motility of Sphincter or Oddi in rabbits and cats. Evidence for a somatovisceral reflex mediated by cholecystokinin. *Digestive Diseases and Sciences.* 1999;44(9):1759-1767.

72. Sato A et al. Neural mechanisms of the reflex inhibition and excitation of gastric motility elicited by acupuncture-like stimulation in anesthetized rats. *Neuroscience Research.* 1993;18:53-62.

73. Sato A et al. Neural mechanisms of the reflex inhibition and excitation of gastric motility elicited by acupuncture-like stimulation in anesthetized rats. *Neuroscience Research.* 1993;18:53-62.

74. Wang JD et al. An alternative method to enhance vagal activities and suppress sympathetic activities in humans. *Autonomic Neuroscience: Basic and Clinical.* 2002;100:90-95.

75. Richards D and Marley J. Stimulation of auricular acupuncture points in weight loss. *Aust*

Fam Physician. 1998;27 (suppl 2):S73-S77.

76. Choy DS and Eidenschenk E. Effect of tragus clips on gastric peristalsis: a pilot study. *J Altern Complement Med.* 1998;4:399-403.

77. Asamoto S and Takeshige C. Activation of the satiety center by auricular acupuncture point stimulation. *Brain Res Bull.* 1992;29:157-164.

78. Shiraishi T et al. Effects of auricular stimulation on feeding-related hypothalamic neuronal activity in normal and obese rats. *Brain Res Bull.* 1995;36:141-148.

79. Pert A et al. Alterations in rat central nervous system endorphins following transauricular electroacupuncture. *Brain Res.* 1981;224:83-93.

80. Kawakita K et al. Development of the low impedance points in the auricular skin of experimental peritonitis rats. *Am J Chin Med.* 1991;19:199-205.

81. Saku K et al. Characteristics of reactive electropermeable points on the auricles of coronary heart disease patients. *Clin Cardiol.* 1993;16:415-419.

82. Ogata A, Sugenoya J, Nishimura N, and Matsumoto T. Low and high frequency acupuncture stimulation inhibits mental stress-induced sweating in humans via different mechanisms. *Auton Neurosci.* 2005;118(1-2):93-101.

83. Hsieh C-L et al. Changes of pulse rate and skin temperature evoked by electroacupuncture stimulation with different frequency on both Zusanli acupoints in humans. *American Journal of Chinese Medicine.* 1999;27(1):11-18.

84. Sato A et al. Reflex modulation of catecholamine secretion and adrenal sympathetic nerve activity by acupuncture-like stimulation in anesthetized rat. *Japanese Journal of Physiology.* 1996;46:411-421.

85. Rong P-J, Zhu B, Huang Q-F, Gao X-Y, Ben H, Li Y-H. Acupuncture inhibition on neuronal activityof spinal dorsal horn induced by noxious colorectal distention in rat. *World J Gastroenterol.* 2005;1(7):1011-1017.

86. Zhou W, Tjen-A-Looi SC, and Longhurst JC. Brain stem mechanisms underlying acupuncture modality-related modulation of cardiovascular responses in rats. *J Appl Physiol.* 2005; Apr 7 (Epub ahead of print).

87. Takagi J and Yonehara N. Serotonin receptor subtypes involved in modulation of electrical acupuncture. *Japanese Journal of Pharmacology.* 1998;78:511-514.

88. Sugai GCM et al. Serotonin involvement in the electroacupuncture- and moxibustion-induced gastric emptying in rats. *Physiology & Behavior.* 2004;82:855-861.

89. Lee S-H et al. Effects of acupuncture on the 5-hydroxytryptamine synthesis and tryptophan hydroxylase expression in the dorsal raphe of exercised rats. *Neuroscience Letters.* 2002;332:17-20.

90. Lee S-H et al. Effects of acupuncture on the 5-hydroxytryptamine synthesis and tryptophan hydroxylase expression in the dorsal raphe of exercised rats. *Neuroscience Letters.* 2002;332:17-20.

91. Gan P, Cheng JS, Ng YK, and Ling EA. Role of GABA in electro-acupuncture therapy on cerebral ischemia induced by occlusion of the middle cerebral artery in rats. *Neurosci Lett.* 2005;383(3):317-321.

92. Uvnas-Moberg K, Bruzelius G, Alster P, and Lundeberg T. The antinociceptive effect of non-noxious sensory stimulation is mediated partly through oxytocinergic mechanisms. *Acta Physiol Scand.* 1993;149(2):199-204.

93. Lundeberg T. Peripheral effects of sensory nerve stimulation (acupuncture) in inflammation and ischemia. S*candinavian Journal of Rehabilitation Medicine, Supplement.* 1993;29:61-86.

94. Sato A et al. Calcitonin gene-related peptide produces skeletal muscle vasodilation following antidromic stimulation of unmyelinated afferents in the dorsal root in rats. *Neuroscience Letters.* 2000;283:137-140.

95. Dawidson I et al. Sensory stimulation (acupuncture) increases the release of calcitonin gene-related peptide in the saliva of xerostomia sufferers. *Neuropeptides.* 1999;33(3):244-250.

96. Hotta H et al. Stimulation of saphenous afferent nerve produces vasodilatation of the vasa nervorum via an axon reflex-like mechanism in the sciatic nerve of anesthetized rats. *Neuroscience Research.* 1996; 24:305-308.

97. Lundeberg T. Peripheral effects of sensory nerve stimulation (acupuncture) in inflammation and ischemia. S*candinavian Journal of Rehabilitation Medicine, Supplement.* 1993;29:61-86.

98. Kwon Y-B et al. Visceral antinociception produced by bee venom stimulation of the Zhongwan acupuncture point in mice: role of $\alpha 2$ adrenoceptors. *Neuroscience letters.* 2001;308:133-137.

99. Kim HW, Kwon YB, Han HJ, Yang IS, Beitz AJ, Lee JH. Antinociceptive mechanisms associated with diluted bee venom acupuncture (apipuncture) in the rat formalin test: involvement of descending adrenergic and serotonergic pathways. Pharmacological Research. 2005;51:183-188.

100. Zhang SP et al. Non-opioid-dependent anti-inflammatory effects of low frequency electroacupuncture. *Brain Research Bulletin.* 2004;62:327-334.

101. Tatewaki M, Strickland C, Fukuda H, Tsuchida D, Hoshino E, Pappas TN, Takahashi R. Effects of acupuncture on vasopressin-induced emesis in conscious dogs. *Am J Physiol Regul Integr Comp Physiol.* 2005;288:R401-R408.

102. Chang S-L, Tsai C-C, Lin J-G, Hsieh C-L, Lin R-T, and Cheng J-T. Involvement of serotonin in the hypoglycemic response to 2 Hz electroacupuncture of zusanli acupoint (ST36) in rats. *Neuroscience Letters.* 2005;379:69-73.

103. Huang C, Long H, Shi Y-S, Han J-S, and Wan Y. Ketamine enhances the efficacy to and delays the development of tolerance to electroacupuncture-induced antinociception in rats. *Neuroscience Letters.* 2005;375:138-142.

104. Jeong H-J et al. The effect of acupuncture on proinflammatory cytokine production in patients with chronic headache: a preliminary report. *The American Journal of Chinese Medicine.* 2003;31(6):945-954.

105. Zhang SP. Non-opioid-dependent anti-inflammatory effects of low frequency electroacupuncture. *Brain Research Bulletin.* 2004;62:327-334.

106. Lao L et al. Electro-acupuncture attenuates behavioral hyperalgesia and selectively reduces spinal fos protein expression in rats with persistent inflammation. *The Journal of Pain.* 2001;2(2):111-117.

107. Lao L et al. A parametric study of electroacupuncture on persistent hyperalgesia and Fos expression in rats. *Brain Research.* 2004;1020:18-29.

108. Zhang R-X, Lao L, Want X, Fan A, Wang L, Ren K, and Berman B. Electroacupuncture attenuates inflammation in a rat model. *J Alt Comp Med.* 2005;11(1):135-142.

109. Loaiza LA et al. Electro-acupuncture stimulation to muscle afferents in anesthetized rats modulates the blood flow to the knee joint through autonomic reflexes and nitric oxide. *Autonomic Neuroscience: Basic and Clinical.* 2002;97:103-109.

110. Ma S-X, Ma J, Moise G, Li X-Y. Responses of neuronal nitric oxide synthase expression in the brainstem to electroacupuncture Zusanli (ST 36) in rats. *Brain Research.* 2005;1037:70-77.

111. Hui KKS et al. Acupuncture modulates the limbic system and the subcortical gray structures of the human brain: evidence from fMRI studies in normal subjects. *Human Brain Mapping.* 2000;9:13-25.

112. Wu M-T et al. Central nervous pathway for acupuncture stimulation: localization and processing with functional MR imaging of the brain – preliminary experience. *Radiology.* 1999;212:133-141.

113. He L, Lu R, Zhuang S, Zhang X, and Pan X. Possible involvement of opioid peptides of caudate nucleus in acupuncture analgesia. *Pain.* 1985;23:83-93.

114. Zhang W-T et al. Evidence from brain imaging with fMRI supporting functional specificity of acupoints in humans. *Neuroscience Letters.* 2004;354:50-53.

115. Napadow V, Makris N, Liu J, Kettner NW, Kwong KK, and Hui KKS. Effects of electroacupuncture versus manual acupuncture on the human brain as measured by fMRI. *Human Brain Mapping.* 2005;24:193-205.

116. Newberg AB, LaRiccia PJ, Lee BY, Farrar JT, Lee L, and Alavi A. Cerebral blood flow effects of pain and acupuncture: a preliminary single-photon emission computed tomography imaging study. *J Neuroimaging.* 2005;15:43-49.

117. Yoo SS, Teh EK, Blinder RA, and Jolesz FA. Modulation of cerebellar activities by acupuncture stimulation: evidence from fMRI study. *Neuroimage.* 2004;22(2):932-940.

118. De Medeiros MA et al. Analgesia and c-Fos expression in the periaqueductal gray induced by electroacupuncture at the Zusanli point in rats. *Brain Research.* 2003;973:196-204.

119. Biella G et al. Acupuncture produces central activations in pain regions. *NeuroImage.* 2001;14:60-66.

120. Kim Y-K, Lim H-H, Song Y-K, Lee H-H, Lim S, Han S-M, and Kim C-J. Effect of acupuncture on 6-hydroxydopamine-induced nigrostriatal dopaminergic neuronal cell death in rats. *Neuroscience Letters.* 2005;384:133-138.

121. Parient J, White P, Frackowiak RSJ, and Lewith G. Expectancy and belief modulate the neuronal substrates of pain treated by acupuncture. *Neuroimage.* 2005;25:1161-1167.

122. Teitelbaum DE. Osteopathic vertebral manipulation and acupuncture treatment using Front Mu and Back Shu points. *Medical Acupuncture.* 2000;12(2): article 6. Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol12_2/article6.html on 121705.

123. Nicholas AS, DeBias D, Ehrenfeuchter W, England KM, England RW, Greene CH, Heilig D, and Kirschbaum M. A somatic component to myocardial infarction. *British Medical Journal.* 1985;291:13-17.

124. Giamberardino MA. Referred muscle pain/hyperalgesia and central sensitization. *J Rehabil Med.* 2003; Suppl 41:85-88.

125. Johansson M, Elam M, Rundqvist B, Eisenhofer G, Herlitz H, Lambert G, and Friberg P. Increased sympathetic nerve activity in renovascular hypertension. *Circulation.* 1999;99:2537-2542.

126. Schramm LP. Spinal sympathetic interneurons: Their identification and roles after spinal cord injury. In: Weaver LC and Polosa C (eds.): *Progress in Brain Research.* Volume 152, 2006. Pp. 27-37.

127. Giamberardino MA, Dalal A, Valente R, and Vecchiet L. Changes in activity of spinal cells with muscular input in rats with referred muscular hyperalgesia from ureteral calculosis. *Neuroscience Leters.* 1996;203:89-92.

128. Giamberardino MA, Affaitati G, Lerza R, Fano G, Fulle S, Belia S, Lapenna D, and Vechhiet L. Evaluation of indices of skeletal muscle contraction in areas of referred hyperalgesia from an artificial ureteric stone in rats. *Neuroscience Letters.* 2003;338:213-216.

129. Kuchera M and Kuchera W. *Osteopathic Considerations in Systemic Dysfunction.* Columbus, OH: Greyden Press, 1994.

130. Beal MC. Palpatory testing for somatic dysfunction in patients with cardiovascular disease. *JAOA.* 1983;82(11):822-831.

131. Nicholas NS. Correlation of somatic dysfunction with visceral disease. *Proceedings of the Nineteenth National Osteopathic Research Conference: Part IV. JAOA.* 1975; 75:425-429.

132. Budgell BS. Reflex effects of subluxation: the autonomic nervous system. *J Manipulative Physiol Ther.* 2000;23:104-106.

133. Johansson M, Elam M, Rundqvist B, Eisenhofer G, Herlitz H, Lambert G, and Friberg P. Increased sympathetic nerve activity in renovascular hypertension. *Circulation.* 1999;99:2537-2542.

134. Karlsson A-K. Autonomic dysfunction in spinal cord injury: clinical presentation of symptoms and signs. In: Weaver LC and Polosa C (eds.): *Progress in Brain Research.* Volume 152, 2006. Pp. 1-8.

135. Llewellyn-Smith IJ, Weaver LC, and Keast JR. Effects of spinal cord injury on synaptic inputs to sympathetic preganglionic neurons. In: Weaver LC and Polosa C (eds.): *Progress in Brain Research.* Volume 152, 2006. Pp. 11-26.

136. DiBona GF. Physiology in perspective: The Wisdom of the Body. Neural control of the kidney. *Am J Physiol Regul Integr Comp Physiol.* 2005;289:R633-R641.

137. DiBona GF. Neural control of the kidney. Past, present, and future. *Hypertension.* 2003;41(part 2):621-624.

138. Vecchiet L, Giamberardino MA, Dragani L, and Albe-Fessard D. Pain from renal/ureteral calculosis: evaluation of sensory thresholds in the lumbar area. *Pain.* 1989;36:289-295.

139. Giamerardino MA, Affaitati G, Lerza R, Lapenna D, Costantini R, and Vecchiet L. Relationship between pain symptoms and referred sensory and trophic changes in patients with gallbladder pathology. *Pain.* 2005;114:239-249.

140. Giamberardino MA, Valente R, Affaitati G, and Vecchiet L. Central neuronal changes in recurrent visceral pain. *Int J Clin Pharm Res.* 1997;17(2-3):63-66.

141. Nicholas AS, DeBias D, Ehrenfeuchter W, England KM, England RW, Greene CH, Heilig D, and Kirschbaum M. A somatic component to myocardial infarction. *British Medical Journal.* 1985;291:13-17.

142. Beal MC. Palpatory testing for somatic dysfunction in patients with cardiovascular disease. *JAOA.* 1983;82(11): 822-831.

143. Stawowy M, Funch-Jensen P, Arendt-Nielsen L, and Drewes AM. Somatosensory changes in the referred pain area in patients with cholecystolithiasis. *European Journal of Gastroenterology & Hepatology.* 2005;17:865-870.

144. Yelland MJ. Back, chest and abdominal pain. How good are spinal signs at identifying musculoskeletal causes of back, chest or abdominal pain? *Australian Family Physician.* 2001;30(9):908-912.

145. Giamberardino MA, Rampin O, Laplace JP, Vecchiet L, and Albe-Fessard D. Muscular hyperalgesia and hypoalgesia after stimulation of the ureter in rats. *Neuroscience Letters.* 1988;87:29-34.

146. Giamberardino MA, Rampin O, Laplace JP, Vecchiet L, and Albe-Fessard D. Muscular hyperalgesia and hypoalgesia after stimulation of the ureter in rats. *Neuroscience Letters.* 1988;87:29-34.

147. Giamberardino MA and Vechhiet L. Visceral pain, referred hyperalgesia and outcome: new concepts. *European Journal of Anaesthesiology.* 1995;12(suppl 10):61-66.

148. Vecchiet L, Vecchiet J, and Giamberardino MA. Referred muscle pain: clinical and pathophysiologic aspects. *Current Review of Pain.* 1999;3:489-498.

149. Giamberardino MA and Vechhiet L. Visceral pain, referred hyperalgesia and outcome: new concepts. *European Journal of Anaesthesiology.* 1995;12(suppl 10):61-66.

150. Giamberardino MA, Valente R, Affaitati G, and Vecchiet L. Central neuronal changes in recurrent visceral pain. *Int J Clin Pharm Res.* 1997;17(2-3):63-66.

151. Giamberardino MA. Referred muscle pain/hyperalgesia and central sensitization. *J Rehabil Med.* 2003;Suppl 41:85-88.

152. Giamberardino MA, Berkley KJ, Affaitati G, Lerza R, Centurione L, Lapenna D, and Vechhiet L. Influence of endometriosis on pain behaviors and muscle hyperalgesia by a ureteral calculosis in female rats. *Pain.* 2002;95(3):247-257.

153. Freeman R, Waldorf HA, Dover JS. Autonomic neurodermatology (Part II): Disorders of sweating and flushing. Semin Neurol 1992; 12(4):394-407.

154. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). Bonica's Management of Pain, 3rd Ed. Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 196-221.

155. Panzer RB. A comparison of the traditional Chinese versus transpositional zangfu organ association acupoint locations in the horse. Am J Chin Med. 1993;21(2):119-131.

156. Dyce KM, Sack WO, and Wensing CJG. Veterinary Anatomy, 3rd ed. Philadelphia: Saunders, 2002. P. 511.

157. Teitelbaum DE. Osteopathic vertebral manipulation and acupuncture treatment using Front Mu and Back Shu points. Medical Acupuncture. 2000;12(2): article 6. Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol12_2/article6.html on 121705.

158. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

159. Netter FH. *Atlas of Human Anatomy.* East Hanover: Novartis, 1997.

160. Wilson-Pauwels L, Steward PA, Akesson EJ. *Autonomic Nerves.* Hamilton, Ontario: BC Decker, Inc., 1997.

161. Netter FH. *The Ciba Collection of Medical Illustrations. Volume 1. Nervous System. Part 1. Anatomy and Physiology.* Summit, NJ, 1991.

162. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

163. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

164. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

165. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

166. Netter FH. *Atlas of Human Anatomy.* East Hanover: Novartis, 1997.

167. Wilson-Pauwels L, Steward PA, Akesson EJ. *Autonomic Nerves.* Hamilton, Ontario: BC Decker, Inc., 1997.

168. Netter FH. The Ciba Collection of Medical Illustrations. Volume 1. Nervous System. Part 1. *Anatomy and Physiology.* Summit, NJ, 1991.

169. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

170. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

171. Bonica JJ and Loeser JD. Chapter 8. Applied anatomy relevant to pain. In: Loeser JD (ed.). *Bonica's Management of Pain, 3rd Ed.* Philadelphia: Lippincott Williams & Wilkins, 2001. Pp. 216-219.

172. Li P. Modulatory effect of electroacupuncture on cardiovascular functions. *Journal of Traditional Chinese Medicine.* 1985;5(3):211-214.

173. Wong WH and Brayton D. The physiology of acupuncture: effects of acupuncture on peripheral circulation. *American Journal of Acupuncture.* 1982;10(1):59-63.

174. Nishijo K, Mori H, Yosikawa K, and Yazawa K. Decreased heart rate by acupuncture stimulation in humans via facilitation of cardiac vagal activity and suppression of cardiac sympathetic nerve. *Neuroscience Letters.* 1997;227:165-168.

175. Wilson-Pauwels L, Steward PA, Akesson EJ. *Autonomic Nerves.* Hamilton, Ontario: BC Decker, Inc., 1997, p. 67.

176. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume II1: East Meets West. A Review of TCM with Western Medicine Interpretation.* Toronto: The Toronto Pain and Stress Clinic Inc., 2003. Pp. 153-168.

177. Liu F-C, Chen C-A, Yang S-S, and Lin S-H. Acupuncture therapy rapidly terminates intractable hiccups complicating acute myocardial infarction. *Southern Medical Journal.* 2005;98(3):385-387.

178. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume 1: Musculo-Skeletal Diorders.* Toronto: The Toronto Pain and Stress Clinic Inc., 1999. Pp. 123-124.

179. Wilson-Pauwels L, Steward PA, Akesson EJ. *Autonomic Nerves.* Hamilton, Ontario: BC Decker, Inc., 1997, p. 67.

180. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume III: East Meets West. A Review of TCM with Western Medicine Interpretation.* Toronto: The Toronto Pain and Stress Clinic Inc., 2003. Pp. 153-168.

181. Andersson GBJ. Epidemiology of low back pain. *Acta Orthop Scand.* 1998; Suppl 281;69:28-31.

182. Andersson GBJ. Epidemiology of low back pain. *Acta Orthop Scand.* 1998; Suppl 281;69:28-31.

183. Andersson GBJ. The epidemiology of spinal disorders. In Frymoyer JW (ed): *The Adult Spine: Principles and Practice,* 2nd edition. Philadelphia: Lippincott-Raven Publishers. 1997. Pp. 93-141.

184. Andersson GBJ. Epidemiological features of chronic low-back pain. *Lancet.* 1999;354:581-585.

185. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.

186. Andersson GBJ. Epidemiology of low back pain. *Acta Orthop Scand.* 1998; Suppl 281;69:28-31.

187. Andersson GBJ. Epidemiological features of chronic low-back pain. *Lancet.* 1999;354:581-585.

188. Andersson GBJ. Epidemiology of low back pain. *Acta Orthop Scand.* 1998; Suppl 281;69:28-31.

189. Webb AA. Potential sources of neck and back pain in clinical conditions of dogs and cats: a review. *The Veterinary Journal.* 2003;165(3):193-213.

190. Ross MD and Bayer E. Cancer as a cause of low back pain in a patient seen in a direct access physical therapy setting. *Journal of Orthopaedic and Sports Physical Therapy.* 2005;35:651-658.

191. Macdonald AJR. Segmental acupuncture therapy. *Acupuncture & Electro-therapeutics Res., Int J.* 1983;8:267-282.

192. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculo-Skeletal Disorders.* Toronto: The Toronto Pain and Stress Clinic Inc., 1999.

193. Gunn CC, Milbrandt WE,Little AS, Mason KE. Dry needling of muscle motor points for chronic low-back pain: a randomized trial with long-term follow-up. *Spine.* 1980; 5(3):279-291.

194. Han J-S. Acupuncture and endorphins. *Neuroscience Letters.* 2004;361:258-261.

195. Gillette RG, Kramis RC, and Roberts WJ. Suppression of activity in spinal nociceptive "low back" neurons by paravertebral somatic stimuli in the cat. *Neuroscience Letters.* 1998;241:45-48.

196. Kagitani F, Uchida S, Hotta H, and Aikawa Y. Manual acupuncture needle stimulation

of the rat hindlimb activates Groups I, II, III, and IV single afferent nerve fibers in the dorsal spinal roots. *Japanese Journal of Physiology.* 2005;55:149-155.

197. Kagitani F, Uchida S, Hotta H, and Aikawa Y. Manual acupuncture needle stimulation of the rat hindlimb activates Groups I, II, III, and IV single afferent nerve fibers in the dorsal spinal roots. *Japanese Journal of Physiology*. 2005;55:149-155.

198. Noguchi E, Ohsawa H, Kobayashi S, Shimura M, Uchida S, and Sato Y. The effect of electro-acupuncture stimulation on the muscle blood flow of the hindlimb in anesthetized rats. *Journal of the Autonomic Nervous System.* 1999;75:78-86.

199. Kagitani F, Uchida S, Hotta H, and Aikawa Y. Manual acupuncture needle stimulation of the rat hindlimb activates Groups I, II, III, and IV single afferent nerve fibers in the dorsal spinal roots. *Japanese Journal of Physiology.* 2005;55:149-155.

200. Newberg AB, Lariccia PJ, Lee BY, Farrar JT, Lee L, and Alavi A. Cerebral blood flow effects of pain and acupuncture: a preliminary single-photon emission computed tomography imaging study. *J Neuroimaging.* 2005;15(1):43-49.

201. Zhang R-X, Lao L, Wang X, Fan A, Wang L, Ren K, and Berman B. Electroacupuncture attenuates inflammation in a rat model. *Journal of Alternative and Complementary Medicine.* 2005;11(1):135-142.

202. Hsieh J-C, Tu C-H, Chen F-P, Chen M-C, Yeh T-C, Cheng H-C, Wu Y-T, Liu R-S, and Ho L-T. Activation of the hypothalamus characterizes the acupuncture stimulation at the analgesic point in human: a positron emission tomography study. *Neuroscience Letters.* 2001;307:105-108.

203. Facco E and Ceccherelli F. Myofascial pain mimicking radicular syndromes. *Acta Neurochir.* 2005;92:147-150.

204. Gerwin RD. A review of myofascial pain and fibromyalgia – factors that promote their persistence. *Acupuncture in Medicine.* 2005;23(3):121-134.

205. Doggweiler-Wiygul R. Urologic myofascial pain syndromes. *Current Pain and Headache Reports.* 2004;8:445-451.

206. Kang YM, Kenney MJ, Spratt KF, and Pickar JG. Somatosympathetic reflexes from the low back in the anesthetized cat. *J Neurophysiol.* 2003;90:2548-2559.

207. Ehrlich GE. Back Pain. *J Rheumatol.* 2003;30 Uppl 67:26-31002E

208. Gerwin RD. A review of myofascial pain and fibromyalgia – factors that promote their persistence. *Acupuncture in Medicine.* 2005;23(3):121-134.

209. Lundeberg T, Hurtig T, Lundeberg S, and Thomas M. Long-term results of acupuncture in chronic head and neck pain. *The Pain Clinic.* 1988;2(1):15-31.

210. Chan AK, Vujnovich A, and Bradnam-Roberts L. The effect of acupuncture on alphamotoneuron excitability. *Acupunct Electrother Res.* 2004;29(1-2):53-72.

211. Yu YH, Wang HC, and Wang ZJ. The effect of acupuncture on spinal motor neuron excitability in stroke patients. *Zhongua Yi Xue Za Zhi.* 1995;56(4):258-263.

212. Lo YL, Cui SL, and Fook-Chong S. The effect of acupuncture on motor cortex excitability and plasticity. *Neuroscience Letters.* 2005;384:145-149.

213. Sato A, Sato Y, Shimura M, and Uchida S. Calcitonin gene-related peptide produces skeletal muscle vasodilation following antidromic stimulation of unmyelinated afferentsin the dorsal root in rats. *Neuroscience Letters.* 2000;283:137-140.

214. Sandberg M, Larsson B, Lindberg L-G, and Gerdle B. Different patterns of blood flow response in the trapezius muscle following needle stimulation (acupuncture) between healthy subjects and patients with fibromyalgia and work-related trapezius myalgia. *European Journal of Pain.* 2005;9:497-510.

215. Chu J, Yuen K, Wang B, Chan RC, Schwartz I, and Neuhauser D. Electrical twitch-obtaining intramuscular stimulation in lower back pain: a pilot study. *Am J Phys Med Rehabil.* 2004;83:104-111.

216. O'Sullivan P. Diagnosis and classification of chronic low back pain disorders: maladaptive movement and motor control impairments as underlying mechanism. *Manual Therapy.* 2005;10:2424-255.

217. Tanaka TH, Leisman G, and Nishijo K. Dynamic electromyographic response following acupuncture: possible influence on synergistic coordination. *Int J Neuroscience.* 1998;95(1/2):51-62.

218. Ceccherelli F, Rigoni MT, Gagliardi G, and Ruzzante L. Comparison of superficial and deep acupuncture in the treatment of lumbar myofascial pain: a double-blind randomized controlled study. *Clin J Pain.* 2002;18(3):149-153.

219. Itoh K, Katsumi Y, and Kitakoji H. Trigger point acupuncture treatment of chronic low back pain in elderly patients – a blinded RCT. *Acupuncture in Medicine.* 2004;22(4):170-177.

220. Baldry P. Superficial versus deep dry needling. *Acupuncture in Medicine.* 2002;20(2-3):78-81.

221. Sandberg M, Larsson B, Lindberg L-G, and Gerdle B. Different patterns of blood flow response in the trapezius muscle following needle stimulation (acupuncture) between healthy subjects and patients with fibromyalgia and work-related trapezius myalgia. *European Journal of Pain.* 2005;9:497-510.

222. Ernst E and White AR. Acupuncture for back pain. *Arch Int Med.* 1998;158:2235-2241.

223. Irnich D, Behrens J, Gleditsch JM, Stör W, Schreiber MA, Schöps P, Vickers AJ, and Beyer A. Immediate effects of dry needling and acupuncture at distant points in chronic neck pain: results of a randomized, double-blind, sham-controlled crossover trial. *Pain.* 2002;99:83-89.

224. Ghoname EA, Craig WF, White PF, Ahmed HE, Hamza MA, Henderson BN, Gajraj NM, Huber PJ, and Gatchel RJ. Percutaneous electrical nerve stimulation for low back pain. A randomized crossover study. *JAMA.* 1999;281(9):818-823.

225. Carlsson CPO and Sjölund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.

226. White P, Lewith G, Prescott P, and Conway J. Acupuncture versus placebo for the treatment of chronic mechanical neck pain. *Ann Intern Med.* 2004;141:911-919.

227. Irnich D, Behrens N, Molzen H, König A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schöps P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1574-1578.

228. Blossfeldt P. Acupuncture for chronic neck pain – a cohort study in an NHS pain clinic. *Acupuncture in Medicine.* 2004;22(3):146-151.

229. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.

230. Leibing E, Leonhardt U, Köster G, Goerlitz A, Rosenfeldt J-A, Hilgers R, and Ramadori G. Acupuncture treatment of chronic low-back pain – a randomized, blinded, placebo-controlled trial with 9-month follow-up. *Pain.* 202;96:189-196.

231. Davis KG and Kotowski SE. Preliminary evidence of the short-term effectiveness of alternative treatments for low back pain. *Technology and Health Care.* 2005;13:453-462.

232. Han HJ, Jeong SW, Kim JY, Jeong MB, and Kim JS. The effect of conservative therapy on thoracolumbar intervertebral disc disease on 15 dogs. *Journal of Veterinary Clinics.* 2003;20(1):52-58.

233. Graw U. Acupuncture as the standard therapy for discopathy with ataxia of the hind legs. *Ganzheitliche Tiermedizin.* 2003;17(1):9-13.

234. Kim MS, Kim SY, Seo KM, and Nam TC. Acupuncture treatment for acute torticollis (wry neck) in a dog. *Journal of Veterinary Clinics.* 2004;21(4):395-397.

235. Jeong SM and Park SW. Application of traditional acupuncture on canine intervertebral disc disease. *Journal of Veterinary Clinics.* 2004;21(1):49-51.

236. Janssens LAA. Trigger points in 48 dogs with myofascial pain syndromes. *Veterinary Surgery.* 1991;20(4):274-278.

237. Kim M-S, Xie H, Seo K-M, and Nam T-C. The effect of electro-acupuncture treatment for chronic back pain in horses. *Journal of Veterinary Clinics.* 2005;22(2):144-147.

238. Klide AM and Martin BB. Methods of stimulating acupuncture points for treatment of chronic back pain in horses. *JAVMA.* 1989;195(10):1375-1379.

239. White AR. Interview. *Modern Medicine.* 1999;67:46.

240. Manheimer E, White A, Berman B, Forys K, and Ernst E. Meta-analysis: acupuncture for low back pain. *Ann Intern Med.* 2005;142:651-663.

241. Kukuk P, Lungenhausen M, Molsberger A, and Endres HG. Long-term improvement in pain coping for cLBP and gonarthrosis patients following body needle acupuncture: a prospective cohort study. *European Journal of Medical Research.* 2005;10:263-272.

242. Furlan AD, Van Tulder M, Cherkin D, Tsukayama H, Lao L, Koes B, and Berman B. Acupuncture and dry-needling for low back pain: an updated systematic review within the framework of the Cochrane Collaboration. *Spine.* 2005;30:944-963.

243. Longworth W and McCarthy PW. A review of research on acupuncture for the treatment of lumbar disk protrusions and associated neurological symptomatology. *Journal of Alternative and Complementary Medicine.* 1997;3(1):55-76.

244. Suseki K, Takahashi Y, Takahashi K, Chiba T, Yamagata M, and Moriya H. Sensory nerve fibres from lumbar intervertebral disks pass through rami communicantes. *J Bone Joint Surg.* 1998;80-B:737-742.

245. Higuchi K and Sato T. Anatomical study of lumbar spine innervation. *Folia Morphol.* 2002;61(2):71-79.

246. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculo-Skeletal Disorders.* Toronto: The Toronto Pain and Stress Clinic Inc., 1999, p. 123.

247. Zhang Y. Observation of curative effects of Huatojiaji in the treatment of 300 cases of apoplexy. *Journal of Traditional Chinese Medicine.* 1996;16(2):117-120.

248. Wang S, Lai X, and Lao J. The third lumbar transverse process syndrome treated by electroacupuncture at Huatojiaji points. *Journal of Traditional Chinese Medicine.* 1999;19(3):190-194.

249. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.

250. Zhang Y and Yang Z. Ulcerative colitis treated by acupuncture at Jiaji points (EX-B2) and tapping with plum-blossom needle at Sanjiaoshu (BL22) and Dachangshu (BL 25). *Journal of Traditional Chinese Medicine.* 2005;25(2):83-84.

251. Bogduk N. The anatomical basis for spinal pain syndromes. *J Manipulative Physiol Ther.* 1995;18(9):603-605.

252. Bogduk N. The innervation of the lumbar spine. *Spine.* 1983;8(3):286-293.

253. Webb AA. Potential sources of neck and back pain in clinical conditions of dogs and cats: a review. *The Veterinary Journal.* 2003;165(3):193-213.

254. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculo-Skeletal Disorders.* Toronto: The Toronto Pain and Stress Clinic Inc., 1999.

255. Bogduk N, Tynan W, and Wilson AS. The nerve supply to the human lumbar intervertebral disks. *J Anat.* 1981;132(Part 1):39-56.

256. Sizer PS, Phelps V, and Azavedo E. Disc related and non-disc related disorders of the thoracic spine. *Pain Practice.* 2001;1(2):136-149.

257. Ohtori S, Takahashi Y, Takahashi K, Yamagata M, Chiba T, Tanaka K, Hirayama J, and Moriya H. Sensory innervation of the dorsal portion of the lumbar intervertebral disc in rats. *Spine.* 1999;24(22):2295-2299.

258. Raoul S, Faure A, Robert R, Rogez JM, Hamel O, Cuillere P, and Le Borgne J. Role of the sinu-vertebral nerve in low back pain and anatomical basis of therapeutic implications. *Surg Radiol Anat.* 2002;24:366-371.

259. Ohtori S, Takahashi K, Yamagata M, Sameda H, Moriya H, Chiba T, and Takahashi Y. Neurones in the dorsal root ganglia of T13, L1 and L2 innervate the dorsal portion of lower lumbar disks in rats. *J Bone Joint Surg.* 2001;83-B:1191-1194.

260. Sizer PS, Phelps V, and Azavedo E. Disc related and non-disc related disorders of the thoracic spine. *Pain Practice.* 2001;1(2):136-149.

261. Bogduk N. The innervation of the lumbar spine. *Spine.* 1983;8(3):286-293.

262. Aoki Y, Takahashi Y, Takahashi K, Chiba T, Kurokawa M, Ozawa T, and Moriya H. Sensory innervation of the lateral portion of the lumbar intervertebral disc in rats. *The Spine Journal.* 2004;4:275-280.

263. Morinaga T, Takahashi K, Yamagata M, Chiba T, Tanaka K, Takahashi Y, Nakamura S, Suseki K, and Moriya H. Sensory innervation to the anterior portion of lumbar intervertebral disc. *Spine.* 1996;21(16):1848-1851.

264. Takahashi Y, Hirayama J, Nakajima Y, Ohtori S, and Takahashi K. Electrical stimulation of the rat lumbar spine induces reflex action potentials in the nerves to the lower abdomen. *Spine.* 2000;25(4):411-417.

265. Sameda H, Takahashi Y, Takahashi K, Chiba T, Ohtori S, and Moriya H. Dorsal root ganglion neurons with dichotomizing afferent fibres to both the lumbar disc and the groin skin. *J Bone Joint Surg.* 2003;85_B:600-603.

266. Bogduk N, Tynan W, and Wilson AS. The nerve supply to the human lumbar intervertebral disks. *J Anat.* 1981;132(Part 1):39-56.

267. Coppes MH, Marani E, Thomeer RT, and Groen GJ. Innervation of "painful" lumbar disks. *Spine.* 1997;22(20):2342-2349.

268. Wong JY. *A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculo-Skeletal Disorders.* Toronto: The Toronto Pain and Stress Clinic Inc., 1999.

269. Ahmed M, Bjurholm A, Kreicbergs A, and Schultzberg M. Sensory and autonomic innervation of the facet joint in the rat lumbar spine. *Spine.* 1993;18(14):2121-2126.

270. Suseki K, Takahashi Y, Takahashi K, Chiba T, Tanaka K, Morinaga T, Nakamura S-I, and Moriya H. Innervation of the lumbar facet joints: origin and functions. *Spine.* 1997;22(5):477-485.

271. Ishikawa T, Miyagi M, Ohtori S, Aoki Y, Ozawa T, Doya H, Saito T, Moriya H, and Takahashi K. Characteristics of sensory DRG neurons innervating the lumbar facet joints in rats. *Eur Spine J.* 2005;14:559-564.

272. Wong JY. A Manual of Neuro-Anatomical Acupuncture. Volume I: Musculo-Skeletal Disorders. Toronto: The Toronto Pain and Stress Clinic Inc., 1999.

273. Bogduk N, Tynan W, and Wilson AS. The nerve supply to the human lumbar intervertebral disks. *J Anat.* 1981;132(Part 1):39-56.

274. Konnai Y, Honda T, Sekiguchi Y, Kikuchi S, Sugiura Y. Sensory innervation of the lumbar dura mater passing through the sympathetic trunk in rats. *Spine.* 2000;25(7):776-782.

275. Gunn CC, Milbrandt WE, Little AS, and Mason KE. Dry needling of muscle motor points for chronic low-back pain. A randomized clinical trial with long-term follow-up. *Spine.* 1980;5(3):279-291.

276. Yahia L, Rhalmi S, Newman N, and Isler M. Sensory innervation of human thoracolumbar fascia. An immunohistochemcial study. *Acta Orthop Scand.* 1992;63(2):195-197.

277. Bednar DA, Orr FW, and Simon GT. Observations on the pathomorphology of the thoracolumbar fascia in chronic mechanical back pain. *Spine.* 1995;20(10):1161-1164.

278. Murata Y, Takahashi K, Yamagata M, Takahashi Y, Shimada Y, and Moriya H. Sensory innervation of the sacroiliac joint in rats. *Spine.* 2000;25(16):2015-2019.

279. Jorgensen LS and Fossgreen J. Back pain and spinal pathology in patients with functional upper abdominal pain. *Scand J Gastroenterol.* 1990;25:1235-1241.

280. Benarroch EE. Pain-autonomic interactions: a selective review. *Clinical Autonomic Research.* 2001;11:343-349.

281. Benarroch EE. Pain-autonomic interactions: a selective review. *Clinical Autonomic Research.* 2001;11:343-349.

282. Thomson A. The relation of structure and function as illustrated by the form of the lower epiphyseal sutures of the femur. *Journal of Anatomy and Physiology.* 1902;36: 95-105.

283. Spencer H. Principles of Biology. 1898, Volume 1, p. 197. Cited in: Thomson A. The relation of structure and function as illustrated by the form of the lower epiphyseal sutures of the femur. *Journal of Anatomy and Physiology.* 1902;36: 95-105.

284. Bai Y, Wang J, Wu J-P, et al. Review of evidence suggesting that the fascia network could be the anatomical basis for acupoints and meridians in the human body. *Evidence-Based Complementary and Alternative Medicine.* 2011: 260510.

285. Herrero JF, Laird JMA, and Lopez-Garcia JA. Wind-up of spinal cord neurons and pain sensation: much ado about something? *Progress in Neurobiology.* 2000;61:169-203.

286. Iwa M, Tateiwa M, Sakita M, et al. Anatomical evidence of regional specific effects of acupuncture on gastric motor function in rats. *Autonomic Neuroscience: Basic and Clinical.* 2007;137:67-76.

287. Liu J, Fu W, Yi W, et al. Extrasegmental analgesia of heterotopic electroacupuncture stimulation on visceral pain rats. *Brain Research.* 2011;1373:160-171.

288. Iwa M, Tateiwa M, Sakita M, et al. Anatomical evidence of regional specific effects of acupuncture on gastric motor function in rats. *Autonomic Neuroscience: Basic and Clinical.* 2007;137:67-76.

289. Iwa M, Tateiwa M, Sakita M, et al. Anatomical evidence of regional specific effects of acupuncture on gastric motor function in rats. *Autonomic Neuroscience: Basic and Clinical.* 2007;137:67-76.

290. Liu JL, Chen SP, Gao YH, et al. Effects of repeated electroacupuncture on beta-endorphin and adrenocorticotropic hormone levels in the hypothalamus and pituitary in rats with chronic pain and ovariectomy. *Chin J Integr Med.* 2010;16(4):315-323.

291. Hwang IK, Chung JY, Yoo DY, et al. Effects of electroacupuncture at Zusanli and Baihui on brain-derived neurotrophic factor and cyclic AMP response element-binding protein in the hippocampal dentate gyrus. *J Vet Med Sci.* 2010;72(11):1431-1436.

292. Cho S-Y, Jahng G-H, Park S-U, et al. fMRI study of effect on brain activity according to stimulation method at LI11, ST 36: Painful pressure and acupuncture stimulation of same acupoints. *Journal of Alternative and Complementary Medicine.* 2010;16(4):489-495.

293. Moritz S, Liu MF, Rickhi B, et al. Reduced health resource use after acupuncture for low-back pain. *J Alt Comp Med.* 2011;17(11):1015-1019.

Section 2::

Acupuncture Points and Channels

Chapter 3:: Introducing the Points and Channels

The point tables that follow group acupuncture points according to channel. Although the organ-based naming system for the channels no longer makes sense (if it indeed ever did), it has been retained in order to remain consistent with the World Health Organization (WHO) Standardization of Acupuncture Nomenclature. While retaining this common terminology facilitates communication between those in teaching, research, and clinical practice, it causes confusion because few, if any, points on a given channel have any association with their namesake organ.

Designations of the alphanumeric names of acupuncture points may not include a space between the two-letter channel designation and the point number or, instead, a dash. All are acceptable. For example, the fifth point on the Lung channel may appear as LU 5, LU5, or LU-5. The style selected to denote points in this book utilizes a space between the channel abbreviation and point number.

The indications listed for each point in the chapters of this book provide a glimpse of potential clinical applications and neuroanatomically justifiable or evidentially supported combinations. When available, published trials or experimental evidence pertaining to that point are included. However, medical judgment regarding the appropriate interventions for each patient may necessitate treatment other than acupuncture. For example, although a classical application of LU 4 is chest pain and shortness of breath, patients experiencing these symptoms should receive emergency evaluation and treatment without delay.

The evidential support selected for each point, when available, includes case reports, case series, and uncontrolled trials, along with randomized controlled trials when available. More research, with treatment controls based on a neuroanatomic understanding of acupuncture instead of an energy basis, is certainly needed. Otherwise, research methodology suffers and studies lead to conflicting or confusing results. For example, belief in the energy-meridian concept may prompt a metaphor-based researcher to select verum and sham points too close together. When two points share innervation, one can expect to find non-significant differences between the treatment and control groups, leading skeptics to claim that the effects of acupuncture are essentially those of placebo.

Each point will have listed the alphanumeric code for the channel and individual point number, the Pinyin name of the point, and the English translation of the Pinyin point name. Instead of referring to the San Jiao or Triple Energizer channel by its Chinese name or English name, the term “Triple Heater” was chosen.

The order of channel presentation along with their abbreviations appear below:

Lung (LU)
Large Intestine (LI)
Stomach (ST)
Spleen (SP)
Heart (HT)
Small Intestine (SI)
Bladder (BL)
Kidney (KI)
Pericardium (PC)
Triple Heater (TH)
Gallbladder (GB)
Liver (LR)
Governor Vessel (GV)
Conception Vessel (CV)

Many thanks to the authors of the following core references who provided extensive information concerning acupuncture and anatomy:

- Helms JM, Elorriaga-Claraco A, and Ng A. *Point Locations and Functions.* Berkeley: Medical Acupuncture Publishers, 2000.
- Ellis A, Wiseman N, and Boss N. *Fundamentals of Chinese Acupuncture.* Revised Edition. Brookline: Paradigm Publications, 1991.
- Deadman P and Al-Khafaji M. *A Manual of Acupuncture.* East Sussex, ENGLAND: Journal of Chinese Medicine Publications, 1998.
- Moore KL and Dalley AF. *Clinically Oriented Anatomy.* Fourth Edition. Philadelphia: Lippincott Williams & Wilkins, 1999.
- Netter FH. *Atlas of Human Anatomy.* Second Edition. East Hanover: Novartis, 1997.
- Netter FH. *The Ciba Collection of Medical Illustrations. Volume I. Nervous System. Part I. Anatomy and Physiology.* Summit, NJ: Ciba-Geigy Corporation, 1991.
- Ellis A, Wiseman N, and Boss K. *Grasping the Wind.* Brookline, NJ: Paradigm Publications, 1989.
- Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications.* Stuttgart:Thieme, 2008.
- Simons DG, Travell JG, and Simons LS*. Travell & Simons’ Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half of Body.* 2nd Edition. Baltimore: Williams & Wilkins, 1999.
- Travell JG and Simons DG. *Volume 2. Myofascial Pain and Dysfunction. The Trigger Point Manual. The Lower Extremities.* Baltimore: Williams & Wilkins, 1983.

Chapter 4:: Locating Points on the Body

Chapter Highlights

Safe acupuncture requires a solid grasp of anatomy.

Precision and consistency in point location is a precursor to clinically effective and predictable neuromodulation.

Inaccurate and variable point locations may produce to unexpected results in clinical and research settings.[1,2]

As important as precise, neuroanatomically accurate point location is, the two traditional methods of point location, i.e., proportional and directional systems, do not always lead to the same locus.[3,4] Instead, the emerging recommendation encourages acupuncturists to employ these techniques as rough estimates but to finalize site selection through touch.

Remember, too, that the targets for neuromodulation are not dots imagined on skin but neurovascular passageways, muscle components, or fascial elements. With experience, the ability to visualize layered anatomy during palpation expands as reliance on standard dictated measurements recedes.

One of the main problems pertains to the fact that acupuncture point location relies on a system of anthropometry designed for a monoethnic population from a distant era.[5] Even in Asia, the length and girth of today's patients' limbs and torsos reflect idiosyncrasies of life style, nutrition, adiposity, and genetics. Anthropometric assessments from millennia ago did not foresee or predict today's diverse populations. The mismatch becomes more extreme when one extrapolates the human points and channels onto other species.[6]

Both the proportional and directional methods of locating points utilize the Chinese anatomical inch called a "cun" (pronounced "tsun"); the plural form is also "cun".

Finding a point begins by defining the length of an anatomical segment as a certain number of cun.[7] Cun are relative to a patient's size, allowing for flexibility across individuals and throughout growth stages. For example, the cun count on the forearm remains twelve regardless of its actual length; from infancy to young adulthood and old age, the forearm remains 12 cun long. See Table 4-1 for a complete list of cun distances.

Proportional Method of Point Location

The proportional approach estimates point locations by dividing the distance between two reference points or topographical landmarks into equal-sized components based on conventionally accepted predetermined anthropometric values. For example, in order to locate TH 5, which can be found at roughly 2 cun proximal to the wrist on the dorsal surface, the proportional method would begin by subdividing the 12-cun antebrachium into six segments, each 2 cun long. The proportional method tells us that TH 5 lands between the distal two sixths, as illustrated in Figure 1.

Table 4-1 Cun distances employed for finding points according to the proportional method.[9]

Region	Cun Measurement Between the Following Landmarks	Cun count	Figure
Head/Neck	Right and left ST 8	9	5
	Middle of the eyebrow to the anterior hairline	3	6
	Anterior to posterior hairlines	12	6
	Posterior hairline to the inferior border of C7 spinous process (GV 14)	3	6
	Right and left mastoid processes	9	7
Trunk	Right and left ST 17 (at the nipple)	8	8
	Suprasternal notch (CV 22) to the xiphisternal synchondrosis (or xiphisternal joint) (CV 16)	9	9
	Xiphisternal synchondrosis (joint) (CV 16) to the umbilicus (CV 8)	8	10
	Umbilicus (CV 8) to the superior border of symphysis pubis (CV 2)	5	10
	Center of axilla (HT 1) to the tip of the 11th rib (LR 13)	12	11
	Medial border of the scapula to the posterior midline	3	12
	Inferior border of spinous process of T1 (GV 13) to the tip of the coccyx	30	13
Arm	Superior end of the anterior axillary crease to the cubital crease	9	14
	Cubital crease to the distal wrist crease	12	15
Leg	Superior border of symphysis pubis (CV 2) to the superior tip of the patella	18	16
	Lateral prominence of the greater trochanter to the popliteal crease	19	16
	Popliteal crease to the lateral malleolus	16	17
	Medial tibial condyle to the medial malleolus	13	17
	Gluteal fold (BL 36) to the middle of the popliteal crease (BL 40)	14	18

Directional Method of Point Location

The directional method employs a side-by-side line-up of cun, meted out as thumb widths that each measure out 1 cun. Other digit-based measurements can provide “shorthand” cun counts, as shown below. This approach requires calibration of the practitioner’s hands against the patient’s; it is the patient’s hand size that determines the cun width, but the acupuncturist’s hand finds the points. Therefore, before beginning a treatment, it is common for the practitioner to match her or his hand size against the patient’s. If the two measure about the same, then no adjustments are required. On the other hand, if the practitioner’s hand dimensions differ from the patient’s, one needs a “fudge factor” when measuring cun. Patient adiposity can also complicate cun measurement with the direct method.[8]

Cun “Shorthand”

- 1 cun = the width of the thumb at the interphalangeal joint (Figure 2) or the distance between the proximal and distal interphalangeal joints of the middle finger (Figure 3).
- 1 cun = the width of the apposed index and middle finger measured at the level of the interphalangeal joint of the index finger (Figure 4).
- 3 cun = the width of all four fingers measured at the level of the proximal interphalangeal joint of the index finger (Figure 4).

Summary

As they say in the real estate business, “Location, location, location.” For acupuncture, we might add, “Anatomy, anatomy, anatomy.”

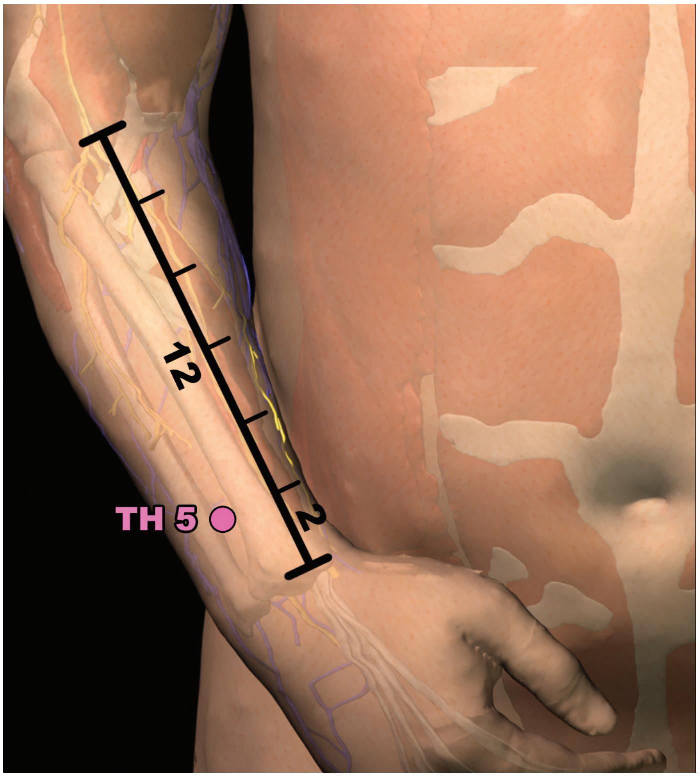


Figure 1. The **proportional method** approximates cun distances by divvying up parts of the body into separate sections and then specifying the relative position of a point in terms of those sections. For example, TH 5, shown in this image, lands 2 cun proximal to the dorsal wrist crease. The cun measurement for the antebrachium equals 12. Therefore, TH 5 falls between the last two sixths, 10 cun distal to the elbow or 2 cun proximal to the wrist. In practice, in order to determine the length of each of the six segments, one first divides the antebrachium into halves and then subdivides each half into thirds, yielding six equal portions. Contrast this method with the **directional approach**, which utilizes the distance of two of the patient’s thumb widths from the dorsal wrist crease. The examiner should arrive at roughly the same region with both methods. However, final point selection should result from palpation for a depression, a report of tenderness from the patient, and/or specification of the exact site for stimulation. In the case of TH 5, this may include the extensor digitorum or extensor digiti minimi tendon, the extensor indicis or extensor pollicis longus muscle, the posterior interosseous nerve, or one of the other structures in the vicinity.

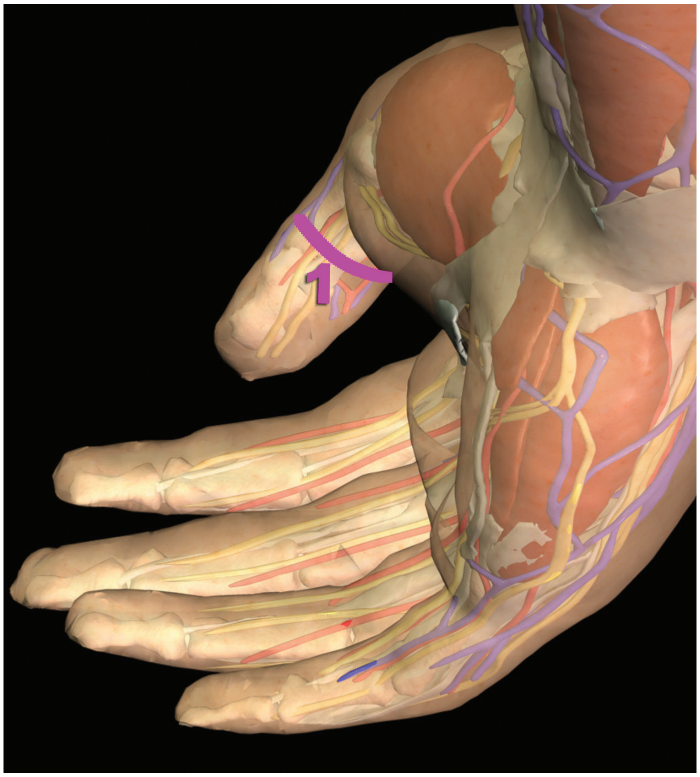


Figure 2. The width of the thumb at the inter-phalangeal joint equals 1 cun.

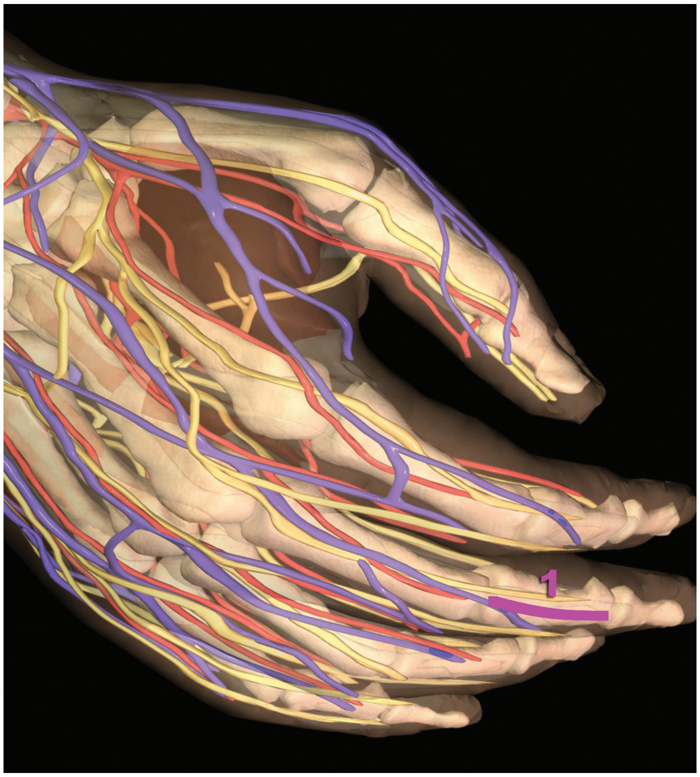


Figure 3. In addition to the thumb width, one can utilize the length of the middle phalanx on the third finger to measure a cun.

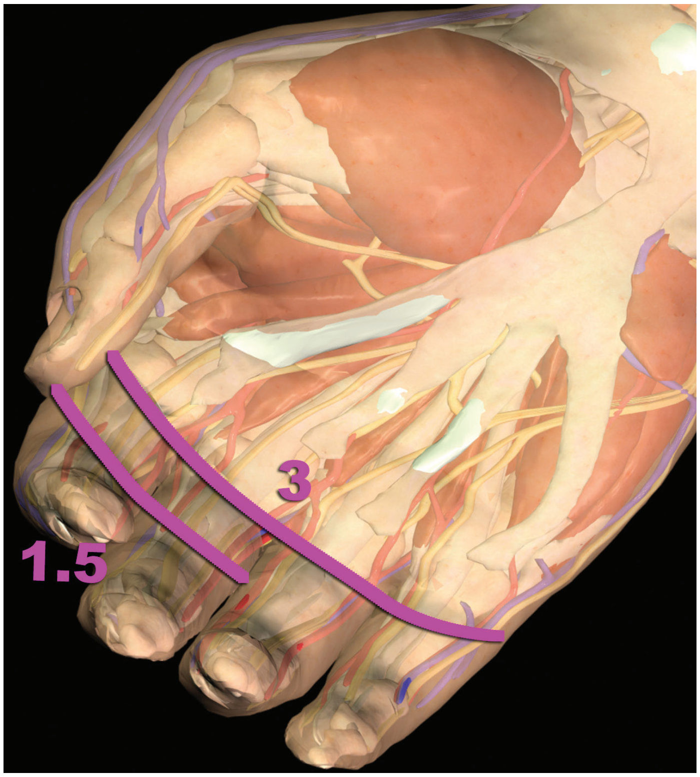


Figure 4. The patient's index and middle fingers held closely together measure 1.5 cun. The width of all four fingers held together counts as 3 cun at the level of the proximal interphalangeal joints.

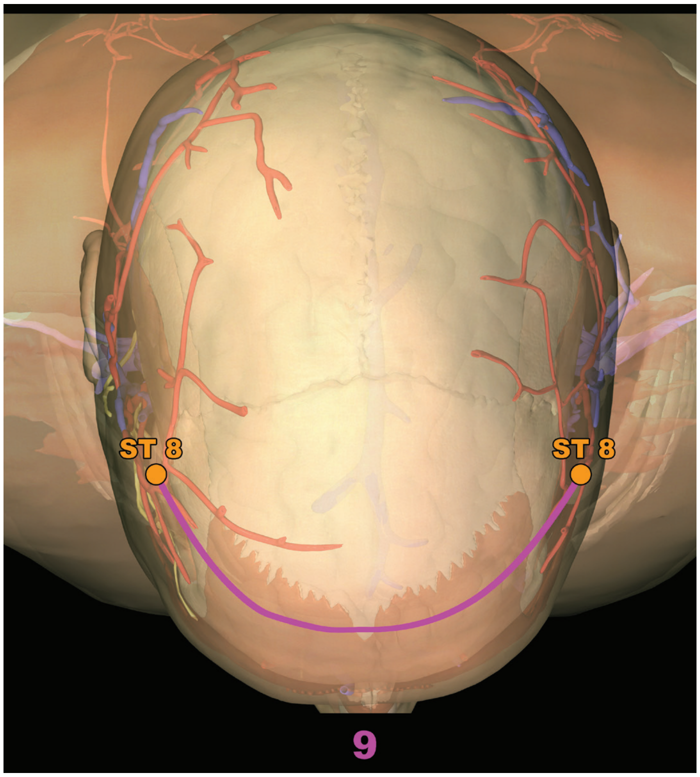


Figure 5. The distance from the right ST 8 to the left equals 9 cun.

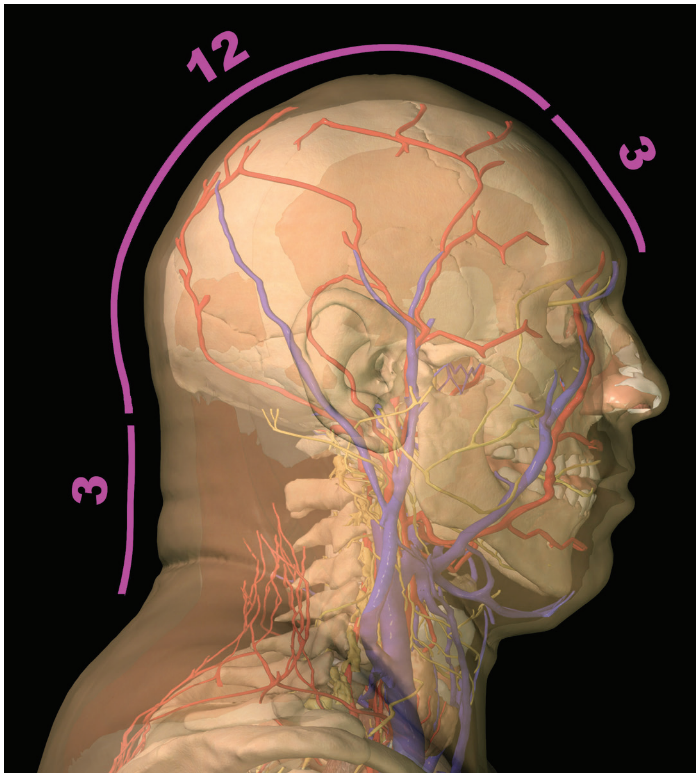


Figure 6. Along the sagittal plane, the distance from glabella to the anterior hairline measures 3 cun. There are 12 cun between the anteior and posterior hairlines and 3 cun from the posterior hairline to the inferior border of C7.

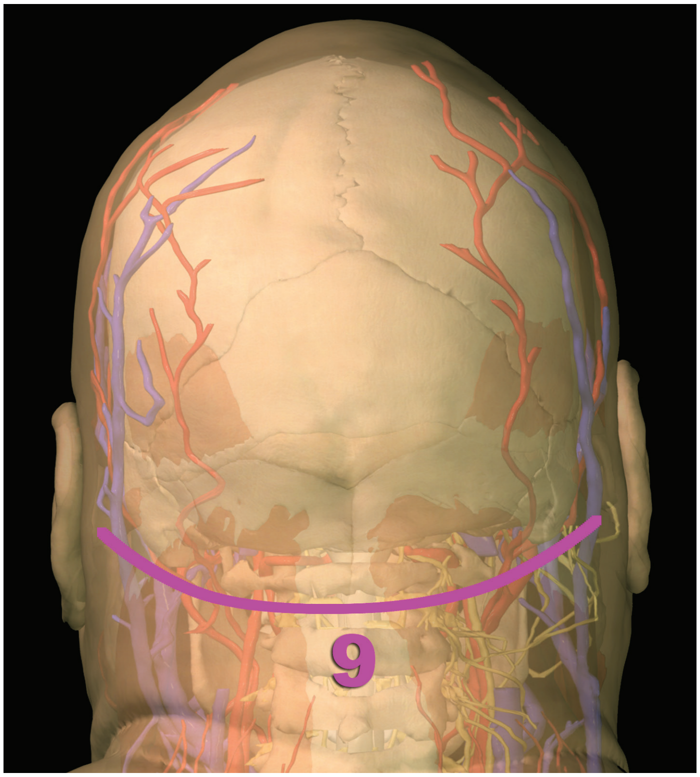


Figure 7. The distance between the right and left mastoid processes approximates 9 cun.

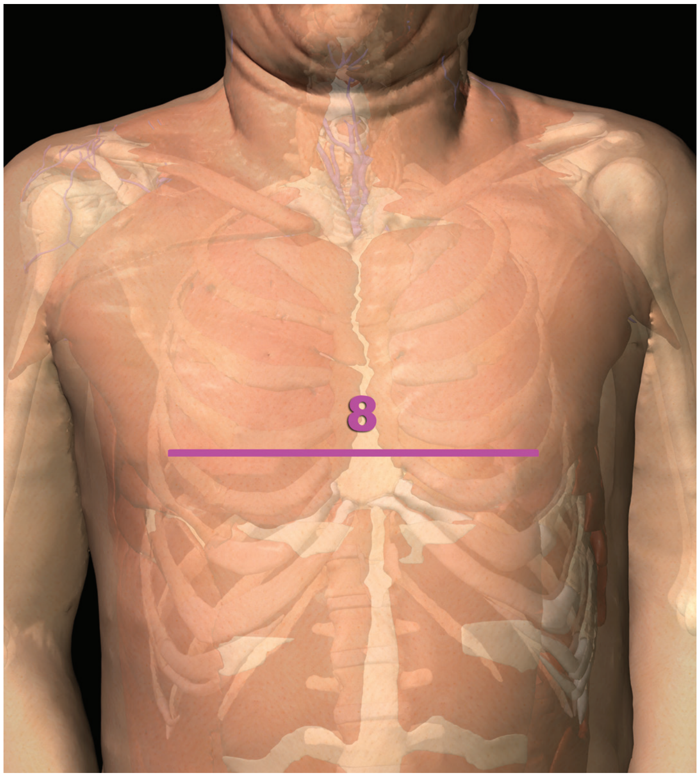


Figure 8. The distance between the two nipples equals 8 cun.

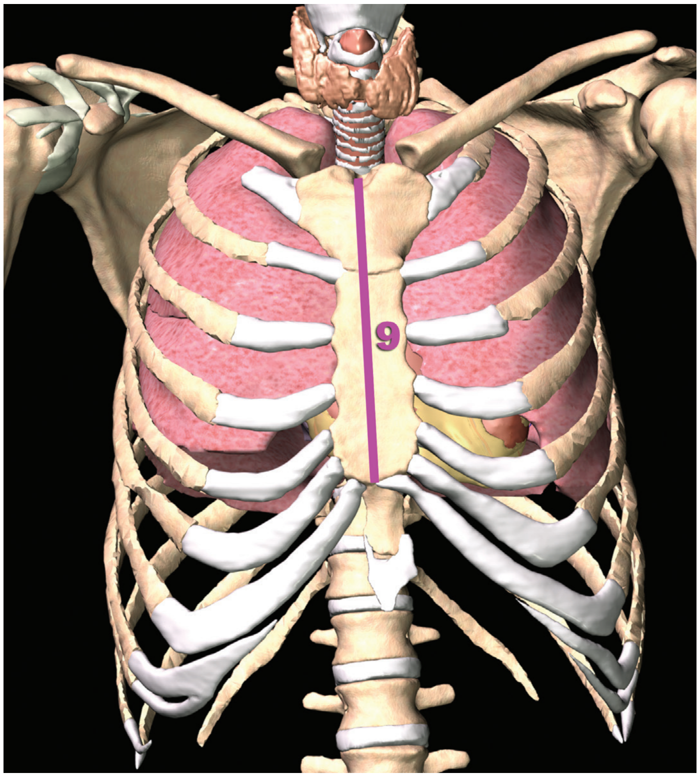


Figure 9. The suprasternal notch to the xiphisternal synchondrosis measures 9 cun.

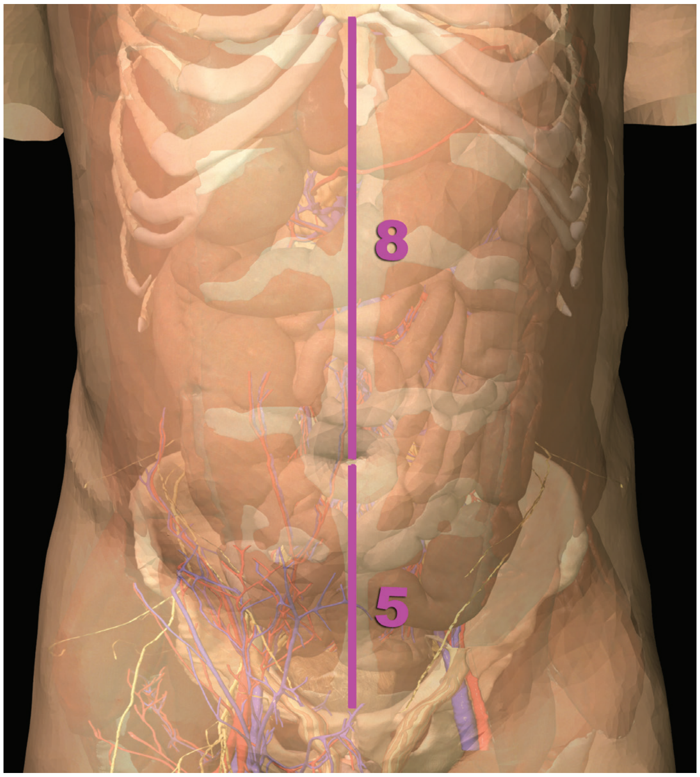


Figure 10. The absence of bony landmarks over the abdomen encourages more reliance on the proportional method of point location when demarcating the location of points on the anterior torso. The distance from the xiphisternal synchondrosis to the umbilicus is 8 cun, but it is only 5 cun from umbilicus to the superior border of the symphysis pubis.

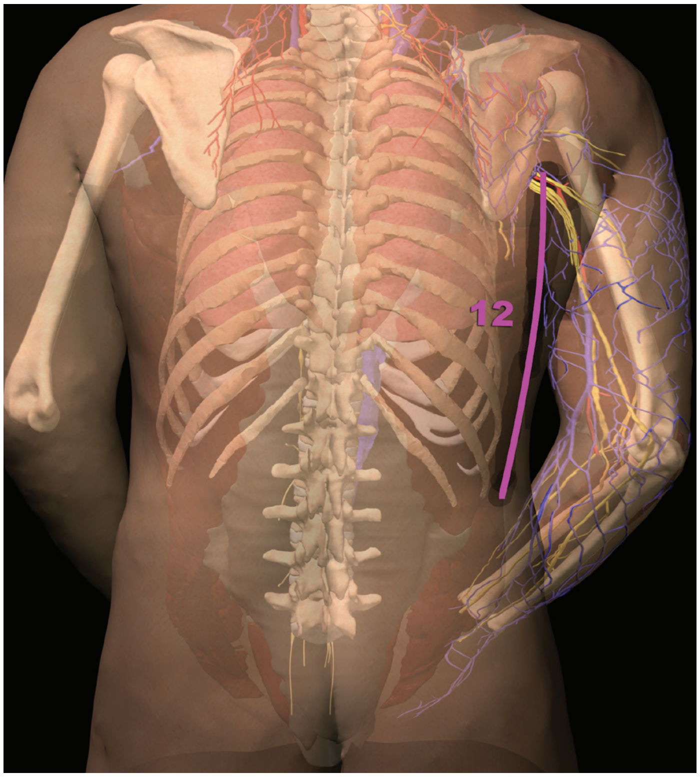


Figure 11. 12 cun cover the distance between the center of the axilla and the tip of the 11th rib.

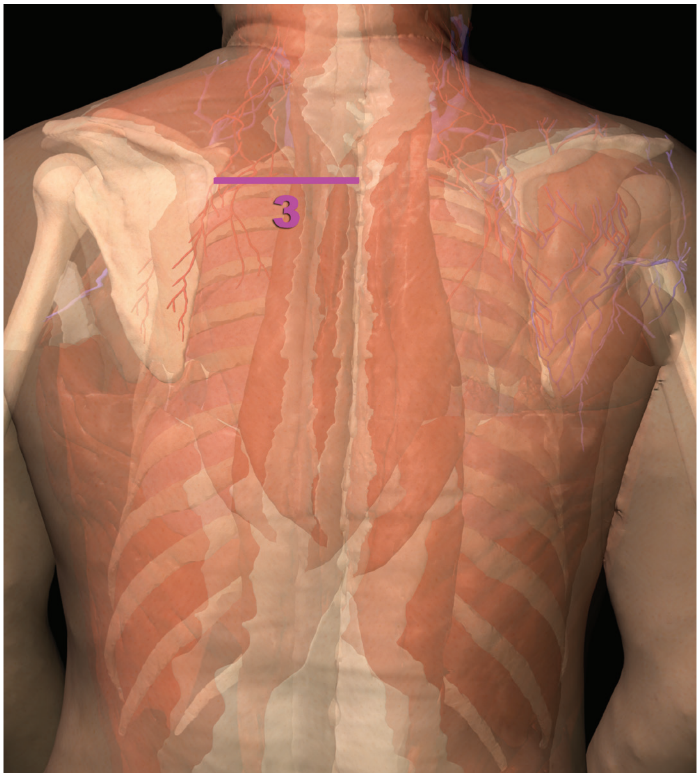


Figure 12. The distance between the medial border of the scapula and the midline is often given as 3 cun. However, the spatial relationship of the scapula and the spine depends on the position of the scapula.

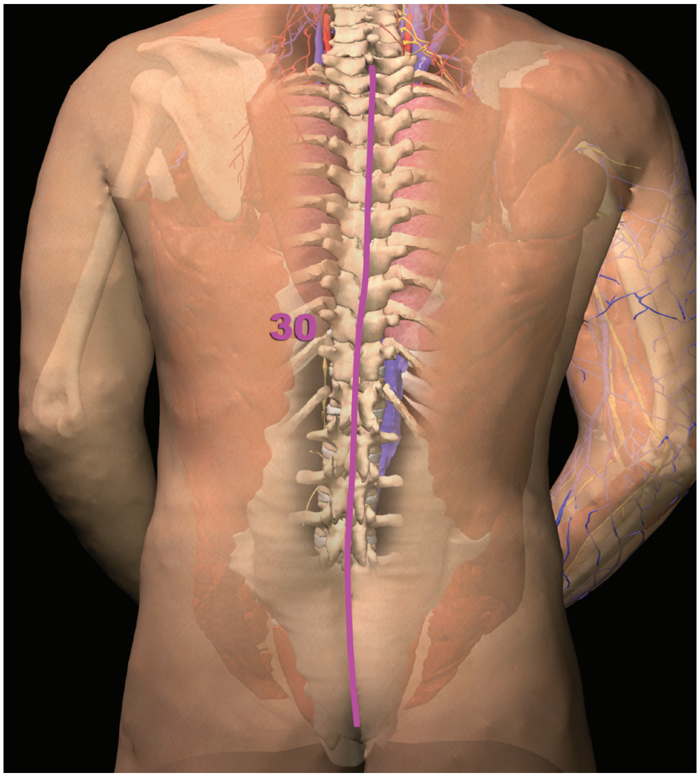


Figure 13. The length of the spine from T1 to the tip of the coccyx equals 30 cun. Note that this individual is missing the 1st rib on the right.

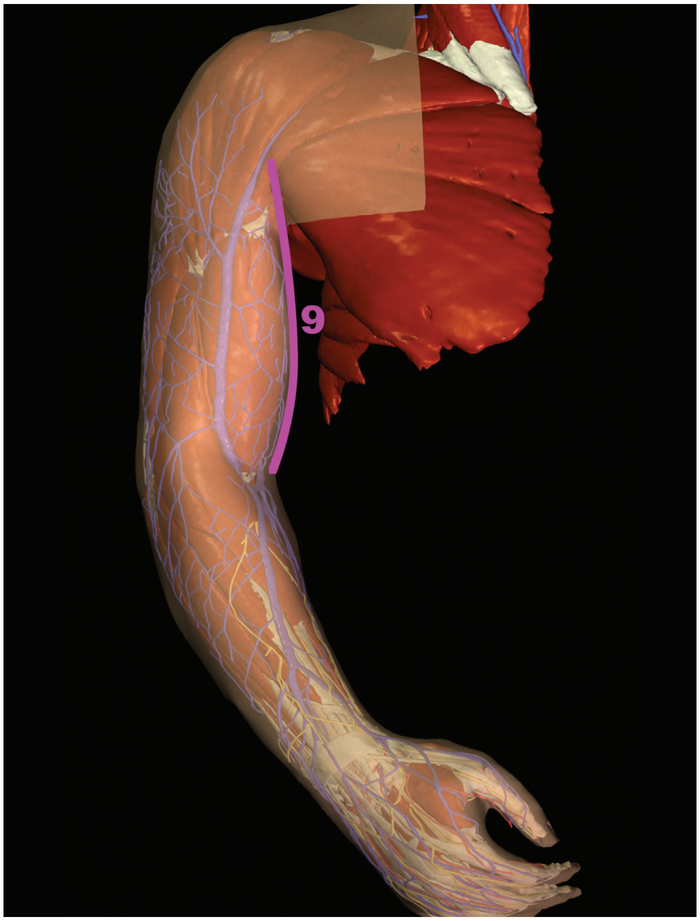


Figure 14. The brachium measures 9 cun from the superior limit of the anterior axillary crease to the elbow.

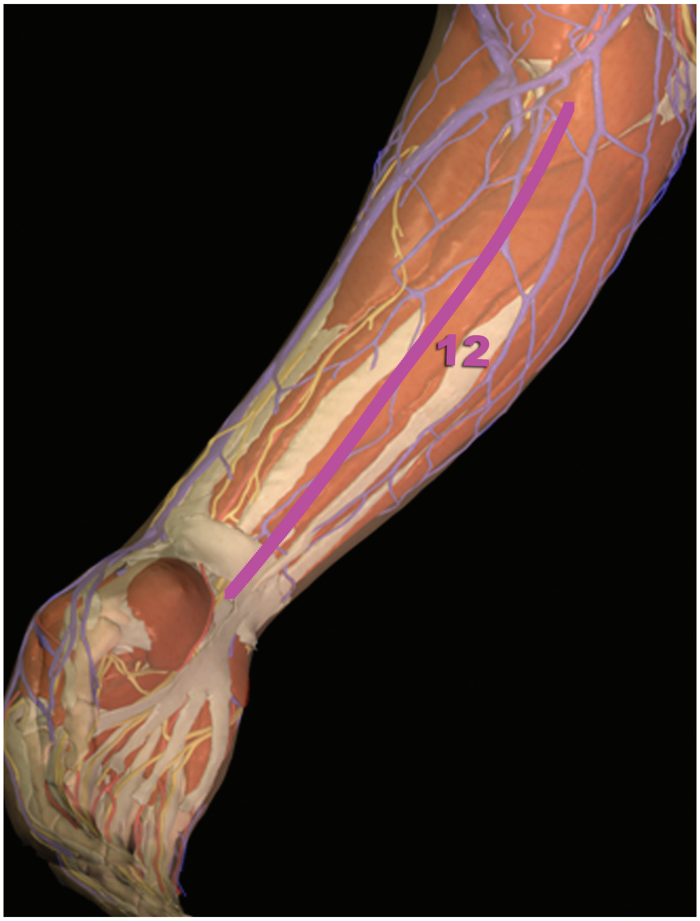


Figure 15. The cun count on the antebrachium is 12. Given the density of acupuncture points located on the antebrachium, this number frequently comes in handy.

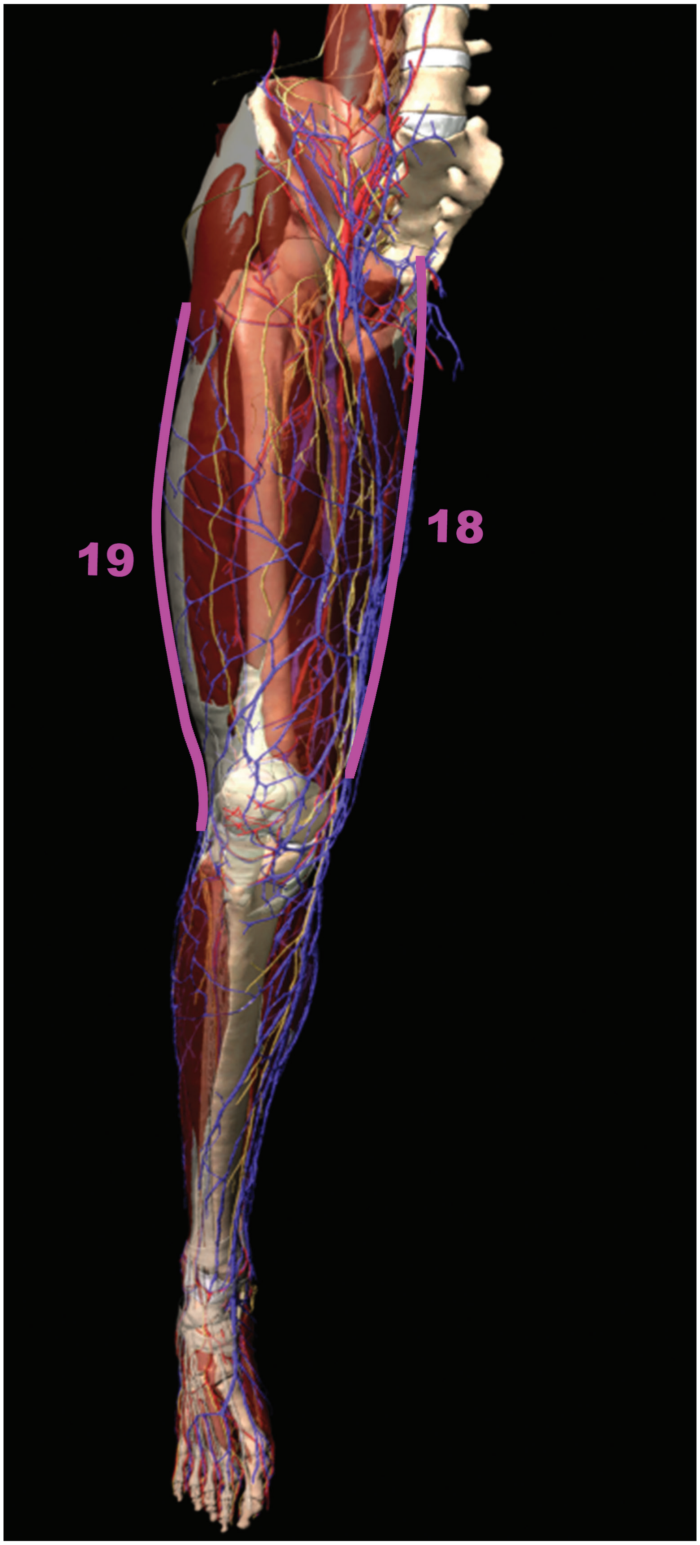


Figure 16. Pelvic limb cun measurements differ on the medial and lateral aspects of the limb, as indicated here for the thigh as well as in the following figure for the crus. This variance arises because the landmarks used in their calculation fall at different heights. On the thigh, the distance between the superior border of the pubic symphysis and the superior tip of the patella measures 18 cun. In contrast, the length of a line drawn from the lateral prominence of the greater trochanter to the popliteal crease equals 19 cun.

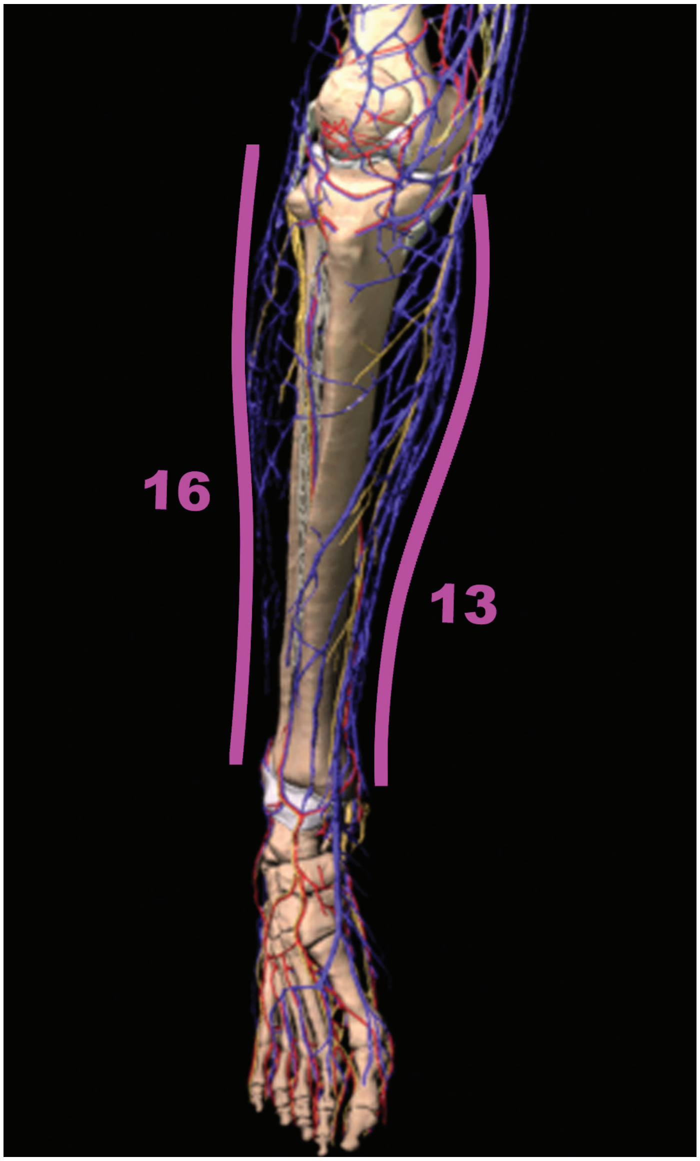


Figure 17. As with the thigh, the cun count on the crus depends on whether one is looking for points on the medial or lateral aspect of the limb. That is, the distance between the popliteal crease and the lateral malleolus is 16 cun while it is only 13 cun from the medial tibial condyle to the medial malleolus.

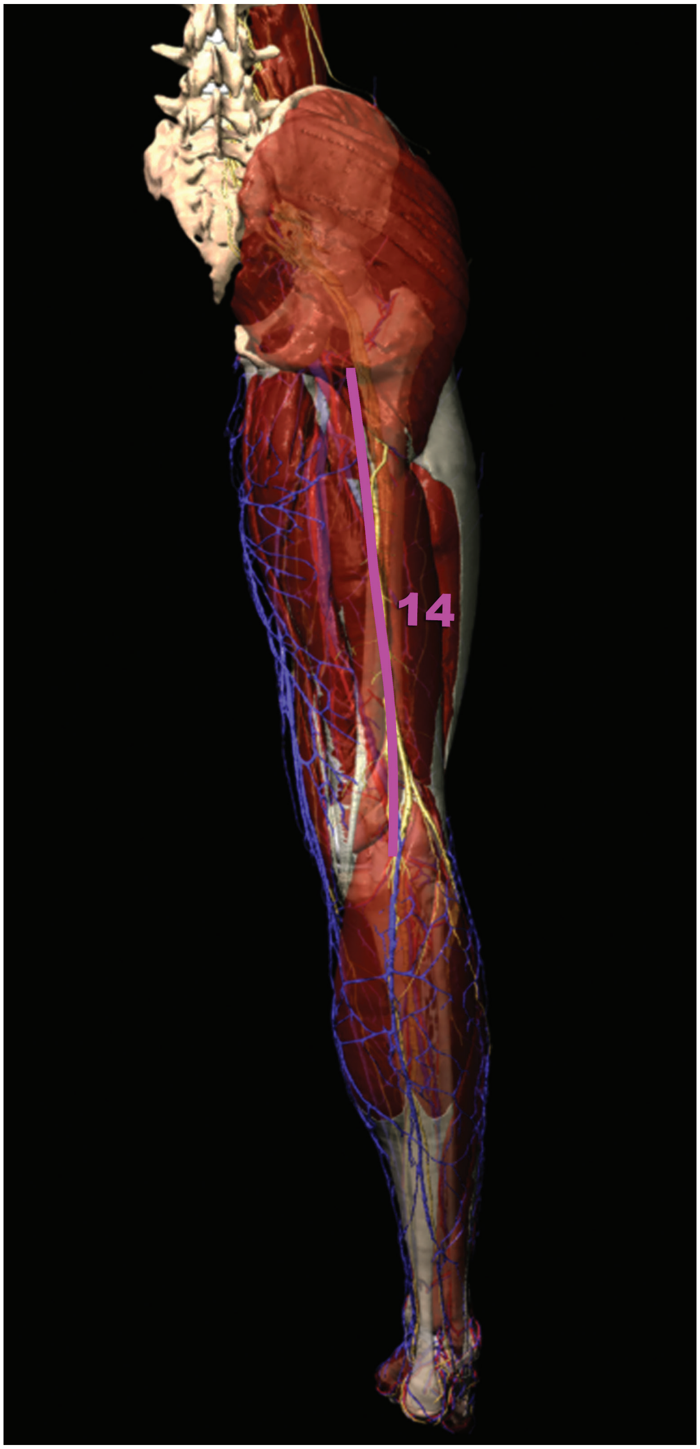


Figure 18. The cun count from gluteal fold to popliteal crease amounts to 14 cun.

References

1. Aird M, Cobbin DM, and Rogers C. A study of the relative precision of acupoint location methods. *Journal of Alternative and Complementary Medicine.* 2002;8(5):635-642.

2. Yin YC, Park H-J, Seo J-C, Lim S, and Koh H-G. An evaluation of the cun measurement system of acupuncture point location. *American Journal of Chinese Medicine.* 2005;33(5):729-735.

3. Coyle M, Aird M, Cobbin D, and Zaslawski C. The cun measurement system: An investigation into its suitability in current practice. *Acupunct Med.* 2000;18(1):10-14.

4. Dorsher P and Johnson A. Accuracy in the use of traditional cun measurement techniques for localizing classical acupoints in the upper extremity: an experimental study. *Medical Acupuncture.* 2010;22(3):191-195.

5. Coyle M, Aird M, Cobbin D, and Zaslawski C. The cun measurement system: An investigation into its suitability in current practice. *Acupunct Med.* 2000;18(1):10-14.

6. Robinson NG. Veterinary Acupuncture – an ancient tradition for modern times. *Alternative & Complementary Therapies.* October 2007. Pp. 259-265.

7. Aird M, Cobbin DM, and Rogers C. A study of the relative precision of acupoint location methods. *Journal of Alternative and Complementary Medicine.* 2002;8(5):635-642.

8. Park H-J, Chae Y, Song M-Y, et al. A comparison between directional and proportional methods in locating acupuncture points using dual-energy X-ray absorptiometry in Korean women. *Am J Chin Med.* 2006;34(5):749-757.

9. Lian Y-L, Chen C-Y, Hammes M, and Kolster BC. *The Seirin Pictorial Atlas of Acupuncture.* Cologne: Könemann Verlagsgesellschaft mbH, 1999. Pp. 12-13.

Chapter 5:: Acupuncture Safety

Chapter Highlights

Compared to other medical treatments, acupuncture has a strong safety record.
Knowledge of anatomy is paramount in order to avoid injury.
Familiarity with the mechanisms of action of each modality included in a medical acupuncture treatment reduces the likelihood of adverse outcomes.

The link between safety and education in acupuncture is well known. As noted by various authors:

"Accidents arrive most often with those who are not fully trained.[1]"

"The distinction between [acupuncture] malpractice and normal practice is an important one because it is malpractice that is the cause of the most serious events including all fatalities.[2,3]"

"Adverse events due to errors of omission include failure to identify serious underlying pathology such as cancer, autoimmune disease, or subtle systemic pathology. Not only does this lead to failure to appropriately refer for a medical opinion and/or further investigations, but it allows the disease process to progress...The risks after failure to refer might be more significant than the other risks associated with acupuncture treatment…Acupuncturists, like conventional doctors, need to recognize both their own limits as well as those of the therapy, so as to minimize the risks of adverse events caused by failure to refer.[4]"

On the other hand, certain authors appear to over-emphasize the dangers, as noted in the following critique of a paper by Ernst et al[32] in which the authors were thought to have overstressed the risks of acupuncture by citing case reports:

"For safety, it is important to know the risks in the context of also knowing the frequency…Any medical intervention or any contact with an incompetent health care provider has the potential to cause damage…In Germany, acupuncture is mainly provided by physicians, and…[large] scale surveys have been conducted. One survey of 9429 German physicians performing more than 760,000 acupuncture treatments reported 2 instances of pneumothorax, one exacerbation of depression, an acute hypertensive crisis, a vasovagal reaction, and an asthma attack with hypertension and angina….To conclude, major adverse effects of acupuncture appear to be rare, and acupuncture is safe in competent hands."[33]

Acupuncture does indeed rank high in safety compared to most medical treatments though, admittedly, underreporting of adverse events likely skews the results.[5,6,7] Studies show that between 6% and 15% of patients experience minor side effects such as pain or bruising at the needling site, tiredness, and transitory exacerbation of their problem.[8,9] These events usually do not prevent patients from seeking further sessions.[10]

Case reports of serious adverse reactions or fatalities following acupuncture, while rare, prove that acupuncture can indeed injure patients.[11] Inadvertent organ puncture occurs when practitioners insert needles too deeply or at incorrect angles. Infections arise when needles penetrating unclean skin surfaces seed bacteria into the underlying tissues of immunocompromised patients. Aquapuncture, or point injection, may cause infection as well, especially when involving non-sterile herbs, extracts, or human placenta.[12,13,14] Needles that break or are embedded intentionally may migrate into organs or the nervous system and cause severe injuries.[15] Acupuncturists who needle pregnant patients must proceed cautiously; the exact rate of injury or miscarriage in this population following acupuncture remains unknown.[16,34] Risks include unintended changes in uterine contractility[17,18] and altered hormonal or prostaglandin levels.

Acupuncturists should know which conditions contraindicate treatment and refer patients elsewhere or consider utilizing a different modality. If acupuncture is indicated but risk factors exist, practitioners should take extra care to ensure safe treatment. (See Table 5-1.) Severely immune deficient patients may be unable to, as one author put it, "meet the challenge of the bacteremia that results when needles penetrate the skin."[19] Other patients with sensitive autonomic nervous systems patients may become syncopal from vasovagal responses.[20] When injury or exacerbations occur as a consequence of acupuncture treatment, practitioners must ensure that the patient receives appropriate medical follow-up and emergency treatment, if required.[21]

Table 5-1 Patient Risk Factors and Potential Adverse Events[22]

Risk factors	Potential Outcomes
• Hemophilia • Advanced liver disease, affecting clotting factor production • Patients taking anticoagulant medications or herbs • Deep needling over vessels[23]	Bleeding or bruising
• HIV • Diabetes • Patients receiving immunosuppressants, such as transplant patients • Skin infections	Infection
• Hypoglycemia • Debilitation • Fear or anxiety about needling • Advanced age	Vasovagal syncope, possibly even convulsive syncope[24]

Table 5-2 Patient Risk Factors and Potential Consequences[29]

Condition or Location	Needling precaution
Scalp	Avoid needling the scalp of infants with open fontanelles, or those with defects in the skull following injury or surgery
Orbit	Points such as ST 1, BL 1, and GB 1 lie close to the orbit and globe. Needling these points incorrectly could damage delicate tissues around or in the eye.
Trunk	Deep, perpendicular needling of points over the thoracic, abdominal, and pelvic regions could damage internal organs or major vessels.
Trapezius	Needling GB 21 deeply, especially in thin or poorly muscled individuals, may cause pneumothorax.
Sternum	Deep needling over the sternum, especially at the level of the 4th intercostal space at CV 17 may enter the pericardium or heart if a congenital sternal foramen exists.
Occipital region	Needling points at the base of the skull below the occiput may injure the brain stem, spinal cord, or vertebral artery if angled toward these structures and inserted deeply. Extra caution is advised when needling GV 16, GV 15, BL 10, and GB 20.[30] Ancient sources suggest that the safe needling direction for GB 20 is toward the contralateral globe; modern researchers suggest that needling should aim toward the apex of the nose. Needling direction for GV 15 and GV 16 has been recommended toward the mouth; see details concerning these points in the following chapters.[31]

Needling Depth and Direction

A medical acupuncturist should have strong familiarity with anatomy before treating patients. Ideally, one should be able to mentally visualize the structures encountered by the needle as the tip courses through skin, subcutaneous tissue and fat, muscle, vessels, organs, bones, etc. Doing so enables the practitioner to guide the angle and depth of needle insertion in a way that will avoid inadvertent puncture of organs, nerves, and major vessels.[25] The desired depth of needle placement depends on treatment targets as well as individual patient characteristics including adiposity, muscularity, and tissue fragility.[26,27,28] For example, the safe needling depth in a patient with a build like the individual represented in this book would differ dramatically from a frail eighty-six year old, ninety pound patient with cancer cachexia.

In any patient, deep, perpendicular needling over the neck, thorax, or abdomen could injure underlying structures. Vessels, nerves, eyes, spinal cord, and the foramen magnum are also vulnerable to injury by needle insertion. (See Table 5-2 for additional precautions.)

Summary

The safety measures recommended in this chapter narrowly focus on some of the more salient aspects of patient selection and needle insertion. To adequately grasp the breadth of safety concerns not only with MA, but also with EA, LA, and acupressure, an acupuncturist must attend a reputable program that enumerates all of the possible negative outcomes from treatment.

References

1. World Health Organization. A standard international acupuncture nomenclature: Memorandum from a WHO meeting. *Bulletin of the World Health Organization.* 68(2):165-169.

2. MacPherson H. Fatal and adverse events from acupuncture: allegation, evidence and the implications. *J Altern Complement Med.* 1999;5(1):47-56.

3. MacPherson H. Guest Editorial: How safe is acupuncture? Developing the evidence on risk. *J Altern Complement Med.* 1999;5(3):223-224.

4. MacPherson H. Fatal and adverse events from acupuncture: allegation, evidence and the implications. *J Altern Complement Med.* 1999;5(1):47-56.

5. Endres HG, Molsberger A, Lungenhausen M, and Trampisch HJ. An internal standard for verifying the accuracy of serious adverse event reporting: the example of an acupuncture study of 190,924 patients. *Eur J Med Res.* 2004;9(12):545-551.

6. MacPherson H. Fatal and adverse events from acupuncture: allegation, evidence and the implications. *J Altern Complement Med.* 1999;5(1):47-56.

7. Ernst E and White AR. Prospective studies of the safety of acupuncture: a systematic review. *Am J Med.* 2001;110:481-485.

8. Chung A, Bui L, and Mills E. Adverse effects of acupuncture. Which are clinically significant? *Canadian Family Physician.* 2003;49:985-989.

9. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *Journal of Emergency Medicine.* 2005;29(1):101-102.

10. MacPherson H, Scullion A, Thomas KJ, and Walters S. Patient reports of adverse events associated with acupuncture treatment: a prospective national survey. *Qual Saf Health Care.* 2004;13:349-355.

11. Ernst E and White AR. Prospective studies of the safety of acupuncture: a systematic review. *Am J Med.* 2001;110:481-485.

12. Centers for Disease Control and Prevention (CDC). Outbreak of mesotherapy-associated skin reactions – District of Columbia area, January-February 2005. *MMWR Morb Mortal Wkly Rep.* 2005;Nov 11;54(44):1127-1130.

13. Chen L, Xie C, and Wu L. Point injection of injection radici astragali for treatment of post-chemotherapy adverse reactions. *J Traditional Chinese Medicine.* 2005;25(1):21-22.

14. Yeom M-J, Lee H-C, Kim G-H, Shim I, Lee H-J, and Hahm D-H. Therapeutic effects of *Hominis placenta* injection into an acupuncture point on the inflammatory responsesin subchondral bone region in adjuvant-induced polyarthritic rat. *Biol Pharm Bull.* 2003;26(10):1472-1477.

15. Yamashita H, Tsukayama H, White AR, Tanno Y, Sugishita C, and Ernst E. Systematic review of adverse events following acupuncture: the Japanese literature. *Complementary Therapies in Medicine.* 2001;9:98-104.

16. Ernst G, Strzyz H, and Hagmeister H. Incidence of adverse effects during acupuncture therapy – a multicentre survey. *Complementary Therapies in Medicine.* 2003;11:93-97.

17. Kim J-S, Na CS, Hwang WJ, Lee BC, Shin KH, and Pak SC. Immunohistochemical localization of cyclooxygenase-2 in pregnant rat uterus by Sp-6 acupuncture. *American Journal of Chinese Medicine.* 2003;31(3):481-488.

18. Lee MK, Chang SB, and Kang D-H. Effects of SP6 acupressure on labor pain and length of delivery time in women during labor. Journal of *Alternative and Complementary Medicine.*

19. White A and Ernst E. (Letter to the Editor.) Learning from adverse events of acupuncture. *Journal of Alternative and Complementary Medicine.* 1999;5(5):395-399.

20. White A and Ernst E. (Letter to the Editor.) Learning from adverse events of acupuncture. *Journal of Alternative and Complementary Medicine.* 1999;5(5):395-399.

21. White A and Ernst E. (Letter to the Editor.) Learning from adverse events of acupuncture. *Journal of Alternative and Complementary Medicine.* 1999;5(5):395-399.

22. Chung A, Bui L, and Mills E. Adverse effects of acupuncture. Which are clinically significant? *Canadian Family Physician.* 2003;49:985-989.
23. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *Journal of Emergency Medicine.* 2005;29(1):101-102.
24. Kung Y-Y, Chen F-P, Hwang S-J, Hsieh J-C, and Lin Y-Y. Convulsive syncope: an unusual complication of acupuncture treatment in older patients. *Journal of Alternative and Complementary Medicine.* 2005;11(3):535-537.
25. MacPherson H. Fatal and adverse events from acupuncture: allegation, evidence and the implications. *J Altern Complement Med.* 1999;5(1):47-56.
26. Lu DP and Lu GP. Anatomical relevance of some acupuncture points in the head and neck region that dictate medical or dental application depending on depth of needle insertion. *Acupuncture & Electrotherapeutics Res., Int J.* 2003;28:145-156.
27. Lin J-G. Studies of needling depth in acupuncture treatment. *Chinese Medical Journal.* 1997;110(2):154-156.
28. Zhang Y. The needling technique and clinical application of point Zhibian. *J Traditional Chinese Medicine*. 2004;24(3):182-184.
29. Chung A, Bui L, and Mills E. Adverse effects of acupuncture. Which are clinically significant? *Canadian Family Physician.* 2003;49:985-989.
30. Zhao J and Jiao BJ. Advances in research on the safety of acupuncture for acupoints GV 15, GV 16, and GB 20 in the treatment of cerebrovascular disease. *Medical Acupuncture.* 2004;15(3):27-28.
31. Zhao J and Jiao BJ. Advances in research on the safety of acupuncture for acupoints GV 15, GV 16, and GB 20 in the treatment of cerebrovascular disease. *Medical Acupuncture.* 2004;15(3):27-28.
32. Ernst E, Lee MS, and Choi TY. Acupuncture: does it alleviate pain and are there serious risks? A review of reviews. *Pain.* 2011;152:755-764.
33. Witt CM, Lao L, and MacPherson H. [Letter to the editor]. Evidence on acupuncture safety needs to be based on large-scale prospective surveys, not single case reports. *Pain.* 2011;152(8):2180.
34. Guerreiro da Silva AV, Nakamura MU, and Guerreiro da Silva JB. “Forbidden points” in pregnancy: do they exist? *British Medical Journal.* 2011; 29(2):135-136.

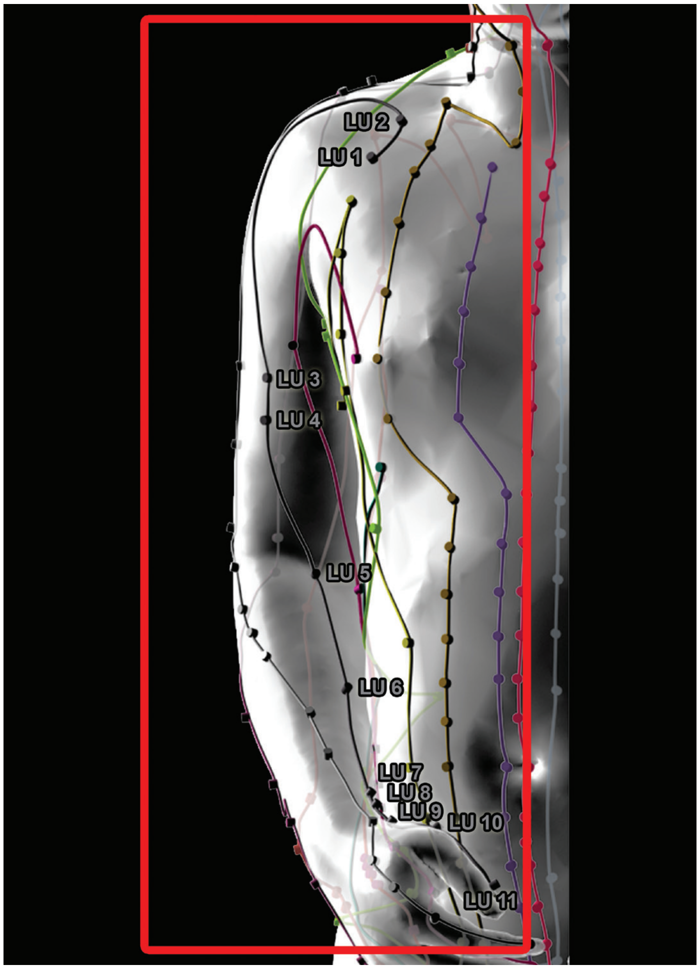
Section 3::

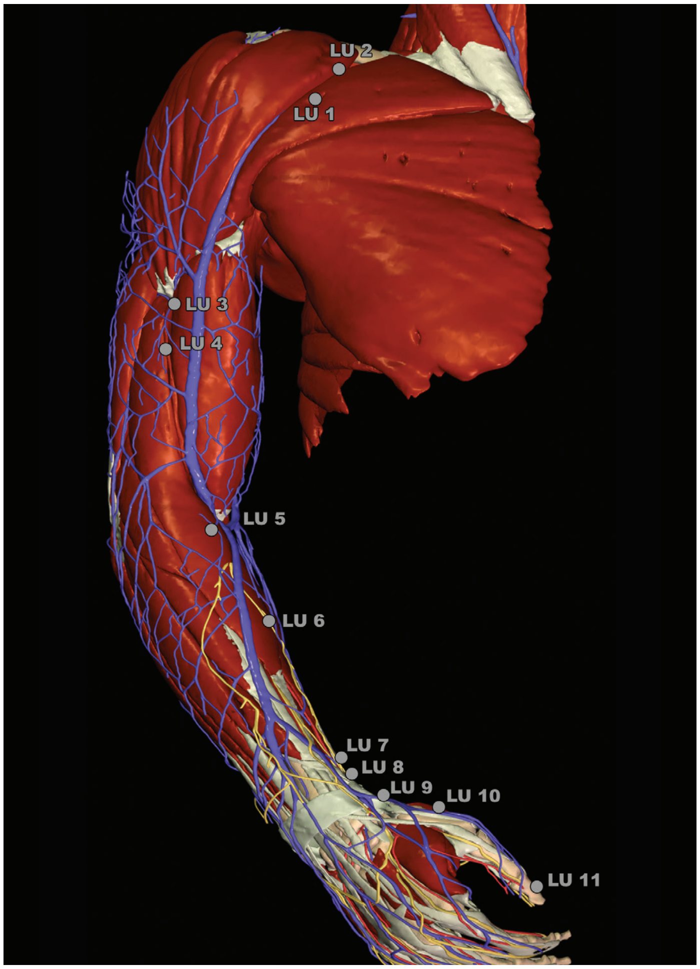
Twelve Paired Channels

Channel 1:: The Lung Channel (LU)

The Lung channel begins at LU 1 in the first intercostal space, medial to the shoulder. It loops over the anterior shoulder and proceeds down the lateral aspect of the biceps brachii muscle to the elbow. Between the elbow and the wrist, the Lung channel hugs the radius. Distal to the wrist, the channel remains on the radial aspect of the hand and ends on the radial side of the thumbnail at LU 11.

The Lung channel describes the course of the cephalic vein and its tributaries.


LU 2
LU 1
LU 3
LU 4
LU 5
LU 6
LU 7
LU 8
LU 9
LU 10
LU 11


LU 2
LU 1
LU 3
LU 4
LU 5
LU 6
LU 7
LU 8
LU 9
LU 10
LU 11

LU 1

Zhong Fu "Central Treasury"

On the lateral pectoral region, approximately at the level of the first intercostal space. LU 1 is found 1 cun inferior and slightly lateral to LU 2.

CAUTION: Needle carefully to avoid pneumothorax.[1] Puncture obliquely in a lateral direction. Deep needling in a medial direction may injure the lung.

Muscles

- **Pectoralis major muscle:** Adducts and medially rotates the humerus. Draws the scapula anteriorly and inferiorly.
- **Pectoralis minor muscle:** Stabilizes the scapula by drawing it against the thoracic wall.
- **Coracobrachialis muscle:** Assists in arm flexion and adduction.
- **Biceps brachii muscle:** Supinates the forearm; flexes the supinated forearm.

Clinical Relevance: Restricted motion of the shoulder, as in adhesive capsulitis (frozen shoulder), soft tissue injury impeding movement, arthritis or other causes of restricted range of motion, rehabilitation following surgery.

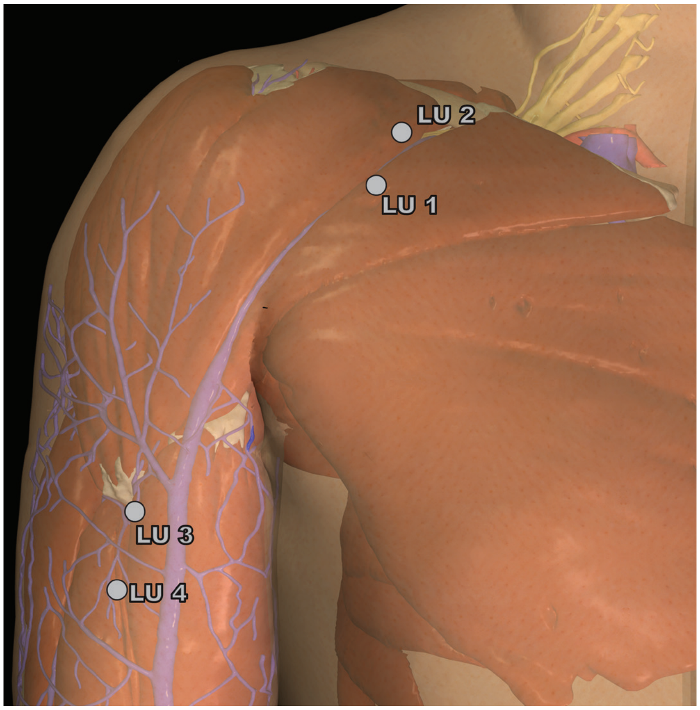


Figure 1-1. The Lung channel emerges from the chest at LU 1, near the entry of the cephalic vein into the deltopectoral groove, the deltopectoral triangle, and subsequently the axillary vein. The indications of LU 1 for lung problems likely relate to the fact that the point falls within the T1 dermatome; the lung receives sympathetic supply from several of the most cranial thoracic spinal cord segments. Also, freeing up the fascia in this region may promote air exchange by allowing fuller thoracic respiratory excursion. This then aids recovery from medical conditions related to or worsened by decreased chest wall mobility such as asthma and chronic obstructive pulmonary disease (COPD). LU 1 and LU 2 coincide with pectoralis major and minor trigger points.

Nerves

- **Supraclavicular nerves (C3, C4):** Supply the skin of the neck and part of the shoulder.
- **1st intercostal nerve (T1):** Supplies sensation to the skin in the first intercostal space.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle and contributes to pectoralis minor innervation via a loop connecting with the medial pectoral nerve.
- **Medial pectoral nerve (C8, T1):** Supplies the pectoralis minor muscle and a portion of the pectoralis major muscle.
- **Musculocutaneous nerve (C5-C7):** Innervates the muscles of the anterior compartment of the arm.
- **Axillary nerve (C5, C6):** Innervates the shoulder joint, skin overlying the inferior part of the deltoid muscle, and the teres minor and deltoid muscles.

Clinical Relevance: Loss of sensation in the anterior shoulder; impaired motor function of shoulder (adduction, internal rotation); instability of the scapula. Weakness or inability to flex and supinate the forearm (antebrachium).

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network of the hand. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.
- **Axillary artery:** Supplies blood to the arm.
- **Axillary vein:** Lies medial to the axillary artery and arises from the union of the brachial veins.

Clinical Relevance: Impaired circulation to or from the thoracic limb; edema.

Lymphatics

- **Deltopectoral lymph nodes:** While most of the lymphatic vessels traveling alongside the cephalic vein enter the apical group of axillary lymph nodes, some enter the deltopectoral nodes.

Clinical Relevance: Deficient or faulty lymphatic drainage of thoracic limb; avoid needling enlarged lymph nodes.

Organ

- **Lung:** The lung lies medial to LU 1.

Clinical Relevance: Inadequate lung expansion or air expulsion as in asthmatic individuals. Caution required in all patients, especially those with local muscle atrophy or hyperexpansion of lungs ("barrel chest").

Indications and Potential Point Combinations

- **Respiratory disorders:** cough, dyspnea, bronchitis, pneumonia, tuberculosis, and asthma, chronic obstructive pulmonary disease:[2] LU 1, BL 13, BL 12, LU 7, LI 4.
- **Local pain or restricted motion of the shoulder, including the scapula:** LU 1, local trigger points depending on pain pattern, myofascial restrictions, and somatic dysfunctions in the spine.

Evidence-Based Applications

- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/ LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[3]

References

1. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupuncture in Medicine.* 2004;22(1):40-43.
2. Bockenhauer SE, Chen H, Julliard KN, et al. Measuring thoracic excursion: reliability of the cloth tape measure technique. *J Am Osteopath Assoc.* 2007;107:191-196.
3. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. *Medical Acupuncture.* 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.

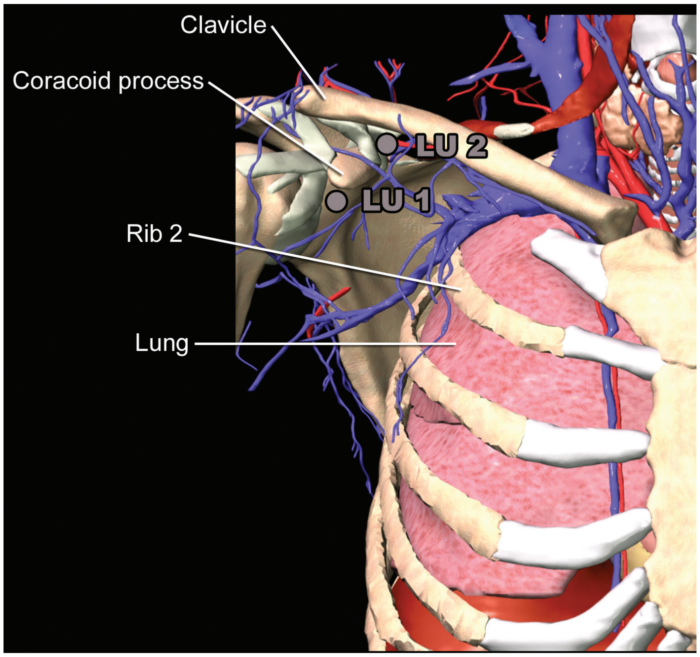

Clavicle
Coracoid process
LU 2
LU 1
Rib 2
Lung

Figure 1-2. As the "Central Treasury", or "Central Residence", LU 1 metaphorically breathes life into the acupuncture network. Located near the lungs where inhaled air enters the bloodstream, the circulation of Qi (correctly translated as vital air) begins.

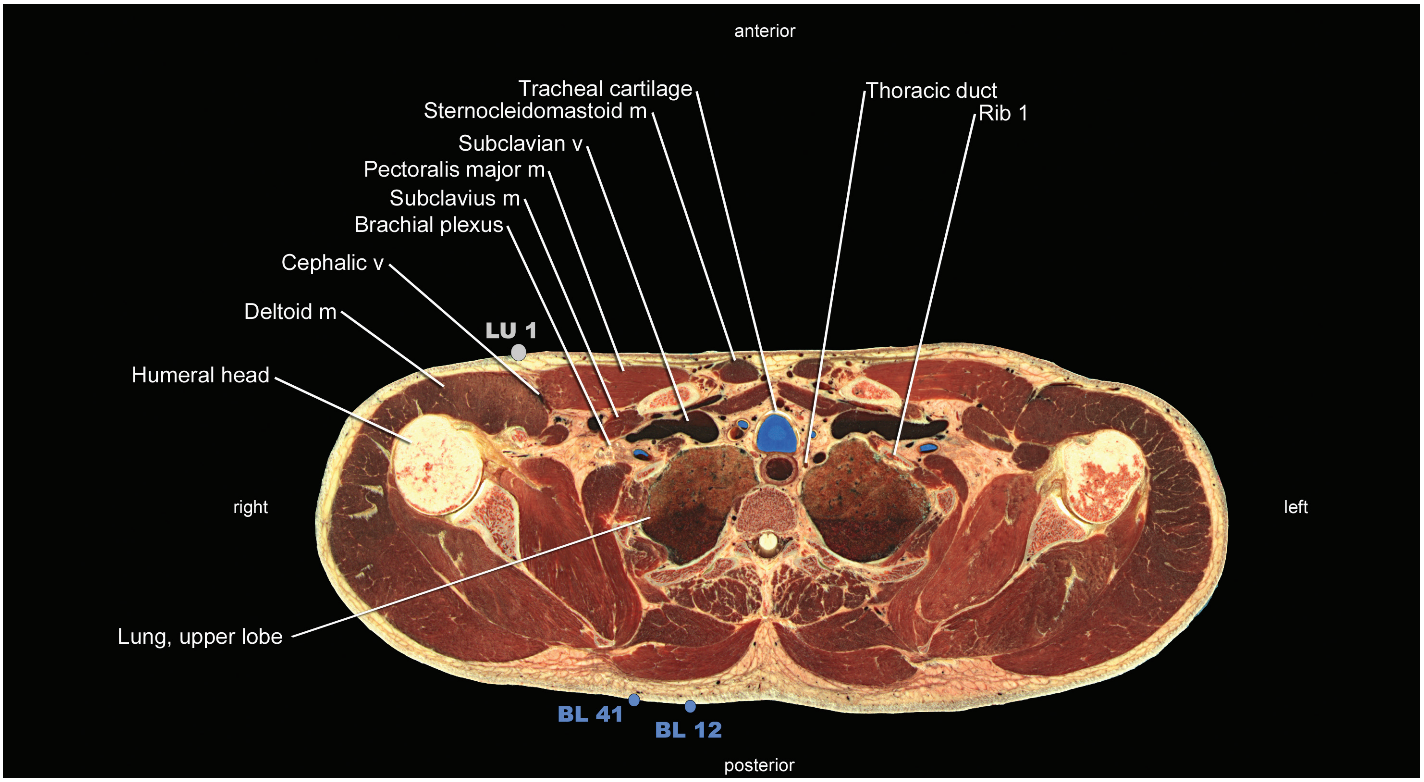

anterior
Tracheal cartilage
Sternocleidomastoid m
Subclavian v
Pectoralis major m
Subclavius m
Brachial plexus
Cephalic v
Deltoid m
LU 1
Humeral head
Thoracic duct
Rib 1
right
left
Lung, upper lobe
BL 41
BL 12
posterior

Figure 1-3. This cross section at the level of LU 1 examines the spatial relationships between LU 1, the cephalic vein, the brachial plexus, and the upper lobe of the lung.

LU 2

Yun Men "Cloud Gate"

In a depression below the lateral end of the clavicle, medial to the coracoid process and in the depression (or triangle) bordered by the deltoid muscle, pectoralis major muscle, and the clavicle.

CAUTION: Needle carefully to avoid pneumothorax.[1] Puncture obliquely in a lateral direction. Deep needling in a medial direction may injure the lung.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[2]

Fascia

- **Clavipectoral fascia:** Encloses the pectoralis minor and subclavius muscles. Envelops the muscles of the anterior thoracic wall.

Clinical Relevance: Fascial restriction Impairing shoulder mobility, evidence of nerve entrapment or irritability due to compression.

Muscles

- **Deltoid muscle:** The anterior part flexes and medially rotates the arm.
- **Pectoralis major muscle**: Adducts and medially rotates the humerus. Draws the scapula anteriorly and inferiorly.
- **Pectoralis minor muscle:** Stabilizes the scapula by drawing it against the thoracic wall, inferiorly and anteriorly.
- **Subclavius muscle**: Anchors and depresses the clavicle.
- **Serratus anterior muscle**: Holds the scapula against the thoracic wall, rotates, and protracts it. This muscle is used when "boxing" or reaching in a forward direction.

Clinical Relevance: Pain or weakness when adducting or medially rotating shoulder. Shoulder injury affecting joint integrity and/or stability.

Nerves

- **Supraclavicular nerves (C3, C4)**: Innervates the skin of the neck and part of the shoulder.
- **Nerve to the subclavius (C5, C6)**: Supplies the subclavius muscle.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle and contributes to pectoralis minor innervation via a loop connecting with the medial pectoral nerve.
- **Medial pectoral nerve (C8, T1):** Supplies the pectoralis minor muscle and a portion of the pectoralis major muscle.
- **Lateral cord of the brachial plexus (C5-C7):** Anterior divisions of the superior and middle trunks form the lateral cord of the brachial plexus.
- **Axillary nerve (C5, C6):** Innervates the shoulder joint, skin overlying the inferior part of the deltoid muscle, and the teres minor and deltoid muscles.
- **Long thoracic nerve (C5-C7):** Supplies the serratus anterior muscle.

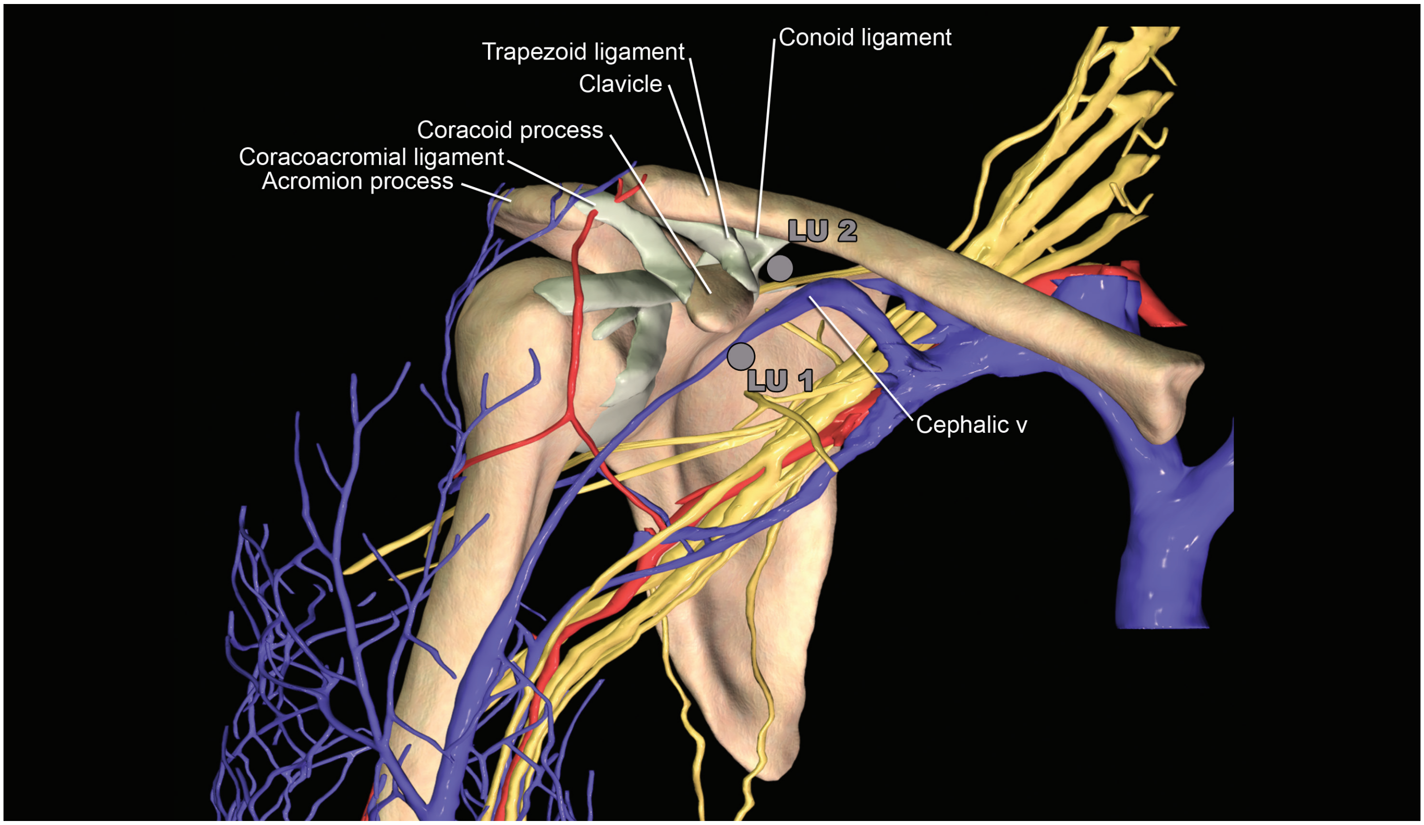


Figure 1-4. In keeping with the indications for LU 2 related to shoulder problems, this image illustrates the proximity of LU 2 to ligaments at the lateral end of the clavicle.

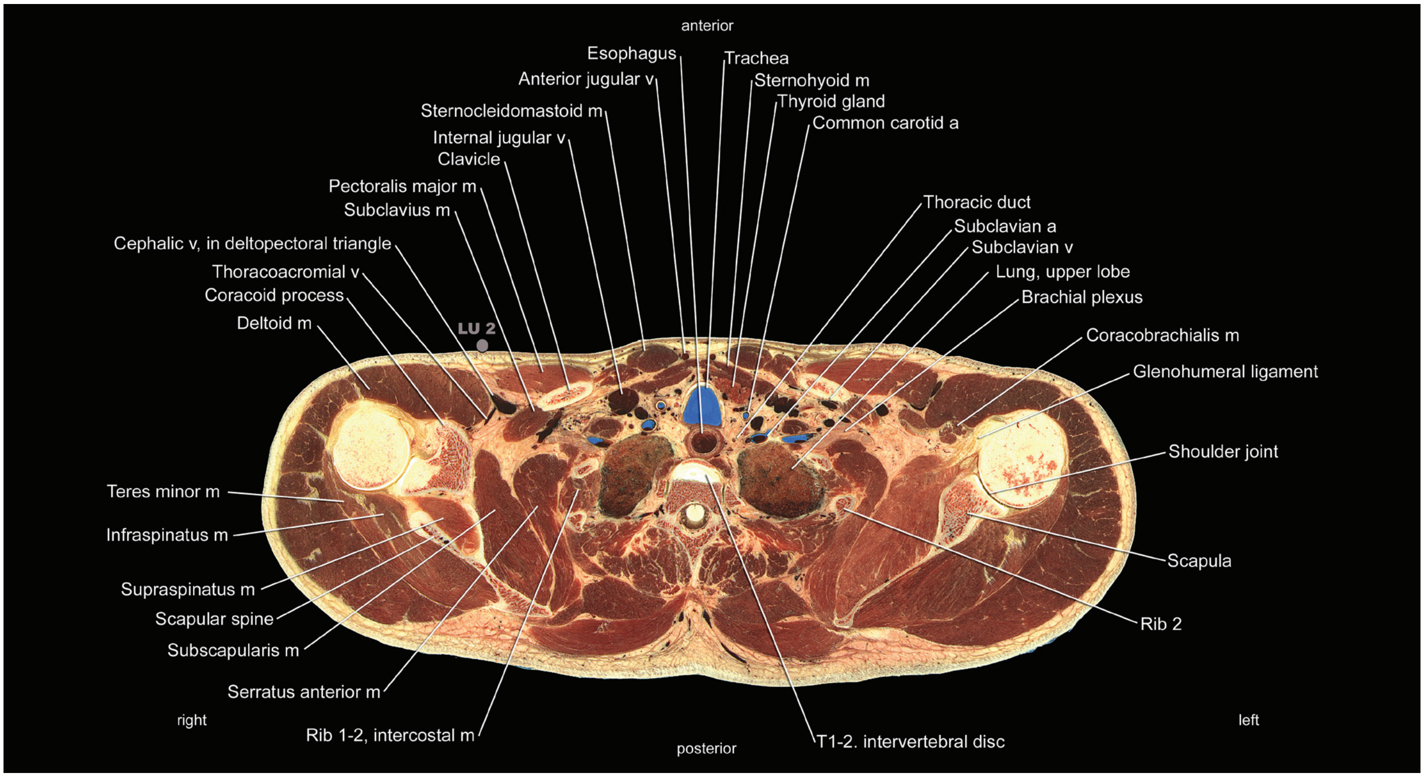

anterior
Esophagus
Anterior jugular v
Trachea
Sternohyoid m
Thyroid gland
Common carotid a
Sternocleidomastoid m
Internal jugular v
Clavicle
Pectoralis major m
Subclavius m
Thoracic duct
Subclavian a
Subclavian v
Lung, upper lobe
Brachial plexus
Cephalic v, in deltopectoral triangle
Thoracoacromial v
Coracoid process
Deltoid m
LU 2
Coracobrachialis m
Glenohumeral ligament
Shoulder joint
Teres minor m
Infraspinatus m
Scapula
Supraspinatus m
Scapular spine
Rib 2
Subscapularis m
Serratus anterior m
right
left
Rib 1-2, intercostal m
posterior
T1-2. intervertebral disc

Figure 1-5. LU 2 as "Cloud Gate" alludes to the travel of the mists or clouds of Qi (as vital air and circulating nourishment) through the channels. LU 2 resides close to the lung and also over the cephalic vein, demonstrating the anatomic proximity of this point to both respiratory and vascular structures.

Clinical Relevance: Loss of sensation or motor function in the anterior shoulder vicinity.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.

Indications and Potential Point Combinations

- **Respiratory disorders:** cough, dyspnea, bronchitis, pneumonia, tuberculosis, and asthma: LU 2, LU 1, GV 14, BL 12, BL 13, LI 4.
- **Restricted motion of the shoulder, especially external rotation:** Needling LU 2 may affect restrictions in the axillary and clavipectoral fascia, thereby freeing structures contained within these planes and indirectly benefiting shoulder mobility and respiration. Consider additional points as indicated by the patient's restriction and palpation examination.

Evidence-Based Applications

- Patients who received EA (at LU 2, LU 7, and PC 6) prior to heart valve replacement surgery exhibited significantly lower serum troponin 1 release following aortic cross-clamp removal. This indicates potential benefit of EA in terms of reducing **reperfusion injury** from cardiac ischemia.[3]

References

1. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupuncture in Medicine.* 2004;22(1):40-43.
2. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
3. Yang L, Yang J, Wang Q, et al. Cardioprotective effects of electroacupuncture pretreatment on patients undergoing heart valve replacement surgery: a randomized controlled trial. *Ann Thorac Surg.* 2010;89:781-786.

LU 3

Tian Fu "Celestial Storehouse"

On the lateral aspect of the upper arm, 3 cun distal to the inferior limit of the anterior axillary fold, on the radial side of the biceps brachii muscle along the lateral bicipital groove, approximately at the level of insertion of the deltoid muscle. The tip of the nose is just able to reach this location.

Muscles

- **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.
- **Brachialis muscle:** Flexes the elbow.

Clinical Relevance: Pain or weakness with elbow flexion or antebrachial supination.

Nerves

- **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.

Clinical Relevance: Elbow flexor weakness, musculocutaneous nerve entrapment from local myofascial restriction, regional numbness or altered sensation.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Degenerative joint disease of the elbow or other elbow dysfunction worsened by impaired oxygenation and elimination of metabolic end-products through circulatory waste removal.

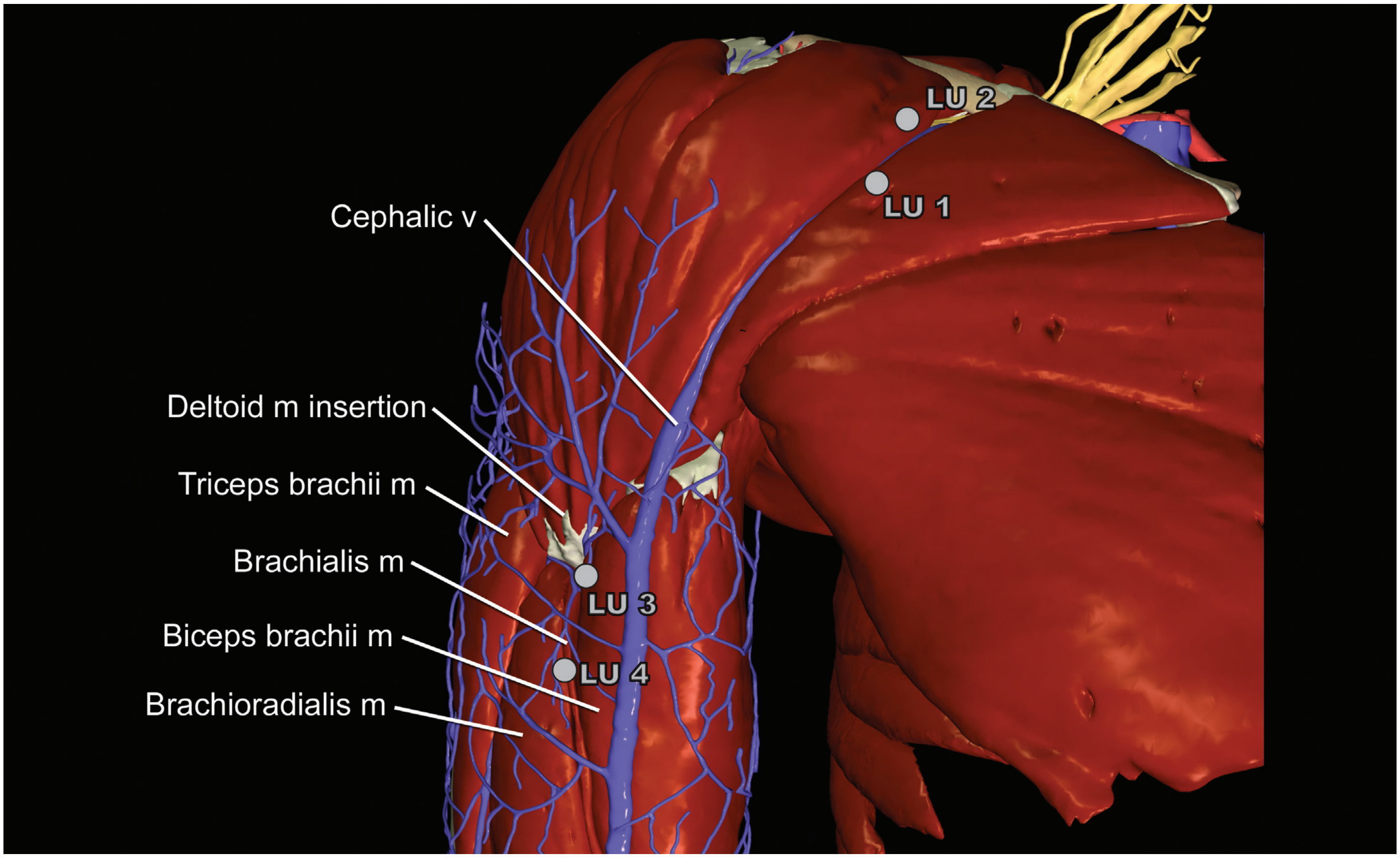


Figure 1-6. LU 3 and LU 4 reside on the lateral aspect of the biceps brachii muscle, in the lateral bicipital groove. The muscular intersections taking place in this region explain these points' value in treating myofascial restrictions and pain in the anterior brachium. LU 3, in particular, stands at the juncture of the myotendinous region of the biceps brachii and the insertion of the deltoid, heightening the potential for myofascial pain at this site. Considering the metaphoric actions attributed to this point, LU 3, as "Celestial Storehouse", receives the Qi (vital air and nutrients) that circulate in the cephalic vein coursing through this furrow.

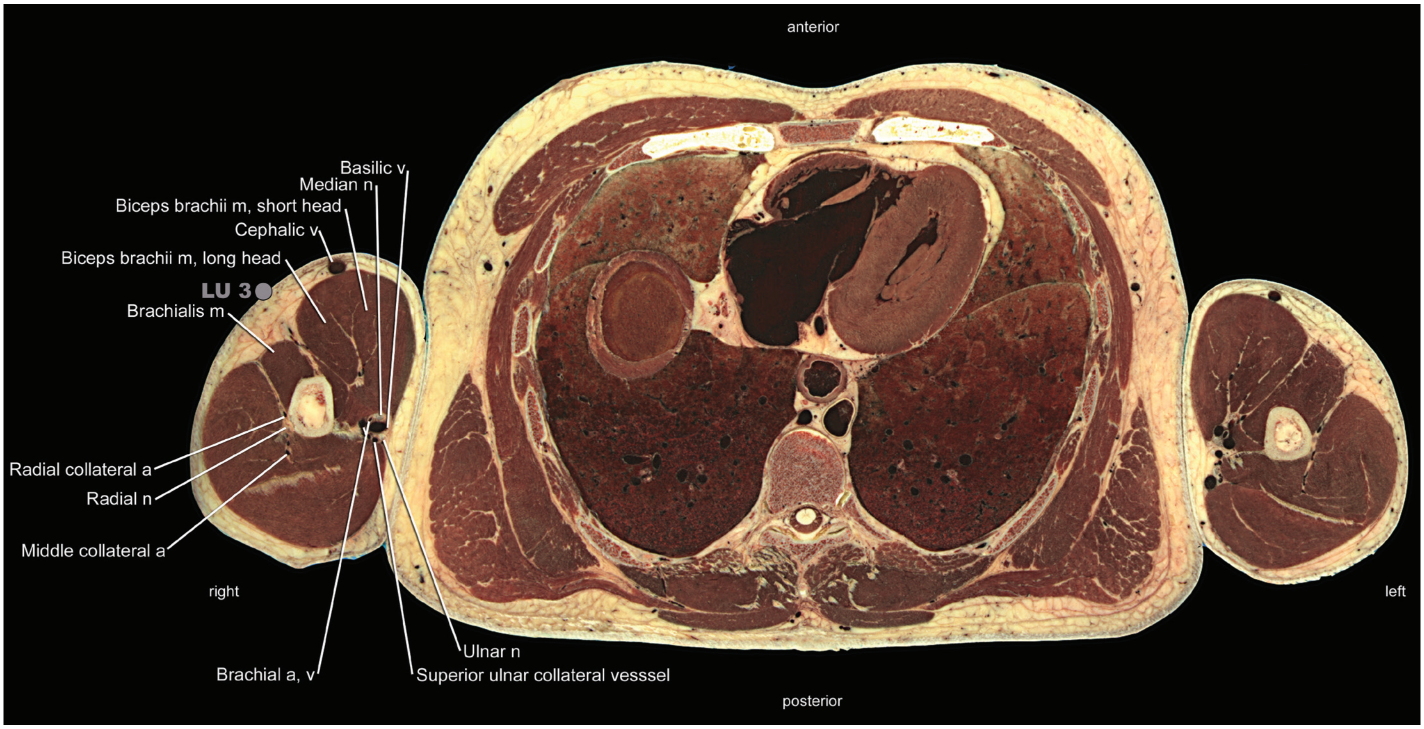

anterior
Basilic v
Median n
Biceps brachii m, short head
Cephalic v
Biceps brachii m, long head
LU 3
Brachialis m
Radial collateral a
Radial n
Middle collateral a
right
left
Ulnar n
Brachial a, v
Superior ulnar collateral vesssel
posterior

Figure 1-7. This view provides another perspective of the relationship of LU 3 to the muscles shown in the previous figure.

Indications and Potential Point Combinations

- **Bicipital tendinitis or strain:** LU 3, LI 15, TH 14, other local tender points.
- **Arm pain:** As a biceps brachii trigger point, LU 3 should be examined for tenderness, along with other muscles in the brachium to determine the location of myofascial dysfunction or the potential source of arm pain, including arthrodial, osseous, and neural structures (rule out nerve entrapments).

LU 4

Xia Bai "Pressing White"

1 cun distal to LU 3 (or 4 cun distal to the axillary fold) on the radial side of the biceps brachii muscle, along the lateral bicipital groove.

Muscles

- **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.
- **Brachialis muscle:** Flexes the elbow.

Clinical Relevance: Compromised elbow flexion; restricted elbow extension due to anterior compartment shortening.

Nerves

- **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.

Clinical Relevance: Faulty elbow flexion due to motor nerve damage; pain or paresthesias in the cubital fossa and proximal, radial aspect of the forearm.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Elbow edema or compromised circulation; conditions affecting vascular supply to distal extremities, such as functional peripheral vascular disease (PVD) from smoking, stress, cold exposure, work involving vibrating machinery or organic PVD due to inflammatory, thrombotic, atherosclerotic, infectious, or degenerative circumstances.

Indications and Potential Point Combinations

- **Pain in upper arm or shoulder**

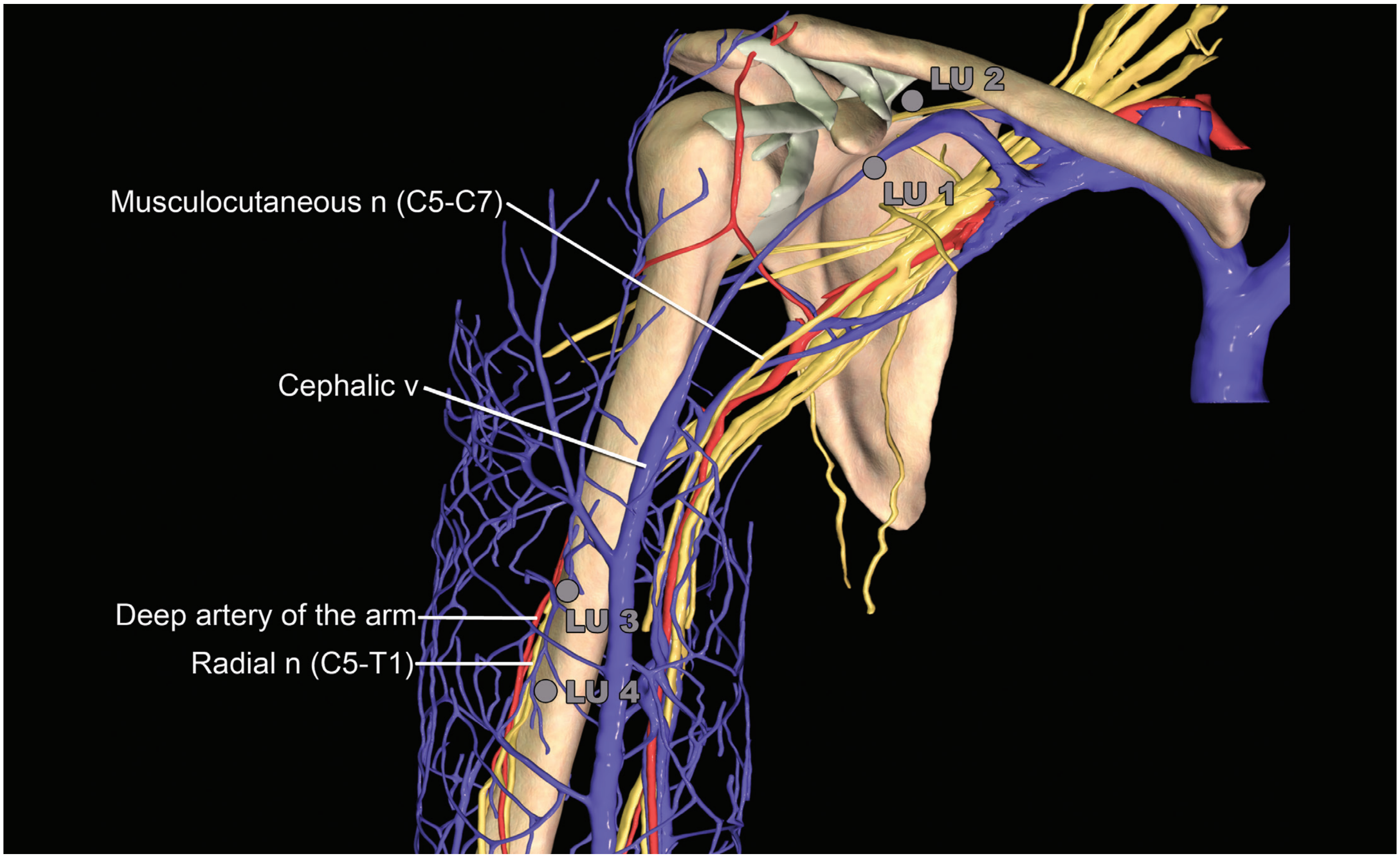


Figure 1-8. LU 3 and LU 4 relate to the musculocutaneous nerve, the deep artery of the arm, and the cephalic vein.

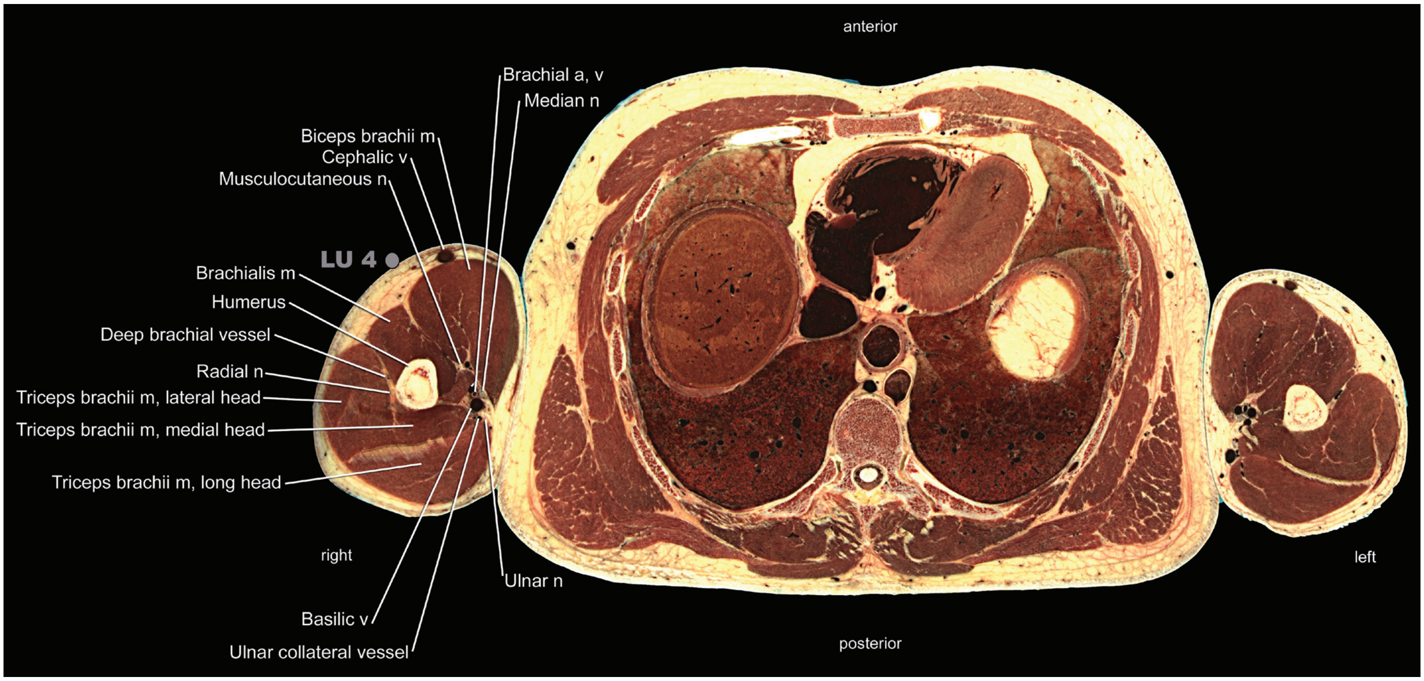

anterior
Brachial a, v
Median n
Biceps brachii m
Cephalic v
Musculocutaneous n
LU 4
Brachialis m
Humerus
Deep brachial vessel
Radial n
Triceps brachii m, lateral head
Triceps brachii m, medial head
Triceps brachii m, long head
right
Ulnar n
left
Basilic v
Ulnar collateral vessel
posterior

Figure 1-9. LU 4, adjacent to the brachialis muscle, addresses myofascial trigger points that arise in this location and radiate to the base of the thumb, near LU 10. Myofascial dysfunction in the brachialis that impinges upon the superficial sensory branch of the radial nerve may result in tingling, altered sensation, and numbness in the proximal thumb. (Simons DG, Travell JG, and Simons LS. Travell & Simons' Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half of Body. 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 661-662.) Its name, "Pressing White", comes from an ancient method of finding this point which involved pressing the lighter skin on the medial surface of the arm against the chest. The site at which the nipple met the brachium identified the location of LU 4.

LU 5

Chi Ze "Cubit Marsh"

At the cubital crease, on the radial (i.e., lateral) side of the tendon of the biceps brachii muscle. Locate with the elbow slightly flexed.

Muscles

- **Biceps brachii tendon:** The biceps brachii muscle supinates the forearm and then can flex the elbow.
- **Brachialis muscle:** Flexes the elbow.
- **Brachioradialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Elbow pain, degenerative joint disease, local tendinitis.

Nerves

- **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. It continues as the lateral antebrachial cutaneous nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the cubital region, medial distal brachium, radial volar aspect of the forearm, and a small portion of the dorsal radial aspect of the distal forearm.
- **Inferior lateral cutaneous nerve of the arm (C5, C6):** Supplies the lateral aspect of the distal brachium and proximal antebrachium. A branch of the radial nerve; it may be a branch of the posterior cutaneous nerve of the forearm in certain individuals.
- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.

Clinical Relevance: Weak elbow flexion; sensory loss or changes in the cubital fossa.

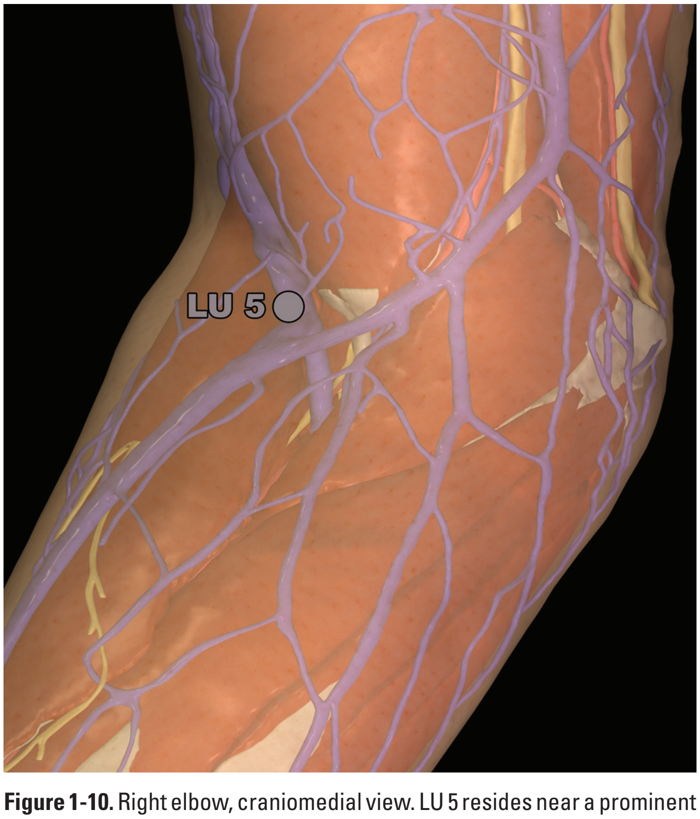


Figure 1-10. Right elbow, craniomedial view. LU 5 resides near a prominent venous intersection inthe cubital fossa. This shallow depression in the elbow signifying a confluence of figurative waterways warrants the name "Cubit Marsh".

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Radial recurrent artery:** Branches from the radial artery and returns to the elbow region to participate in the elbow anastomoses.
- **Anterior branch (also known as the radial collateral branch) of the deep artery of the arm (profunda brachii artery):** Participates in the anastomoses around the elbow.

Clinical Relevance: Elbow edema, altered vascular supply or drainage, peripheral vascular disease affecting elbow function, swelling of distal thoracic limb with impaired venous drainage.

Indications and Potential Point Combinations

- **Respiratory conditions:** dyspnea, cough, pleuritis, asthma, pharyngitis: LU 5, LU 1, BL 13, LI 4.
- **Pain in elbow and shoulder:** LU 5, LU 2, LI 15, LI 11, isolate particular causes of pain and address accordingly (i.e., joint, myofascial, or neuropathic pain).
- **Skin disorders:** LU 5, LU7, LI4, ST 36, GV 14.

Evidence-Based Applications

- A case series indicated that LU 5 and CV 23 effectively treated **pseudobulbar paralysis.**[1]
- Spinal reflexes that exist between elbow articular afferents and the cardiac sympathetic efferent nerve may provide the avenues for **somatoautonomic reflexes** attributed to LU 5.[2]
- Injection of vitamin K3 into LU 5 reduced episodes of mild to moderate **hemoptysis** in patients suffering from respiratory ailments.[3]
- Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of **lateral epicondylalgia.**[4]

References

1. Wang C, Du S, Li H, and Ding Z. 120 cases of pseudobulbar paralysis treated by needling Lianquan and Chize. *Journal of Traditional Chinese Medicine.* 1998;18(2):96-98.
2. Nakayama T, Suzuki A, and Ito R. The articulo-cardiac sympathetic reflex in spinalized, anesthetized rats. *J Physiol Sci.* 2006;56(2):137-143.
3. Zhang L, Li Y. Two hundred and fifty-eight cases of hemoptysis treated by injection of vitamin K3 into Chize point. *J Tradit Chin Med.* 2004;24(3):177-179.
4. Haker E and Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. *Clin J Pain.* 1990;6(3):221-226.

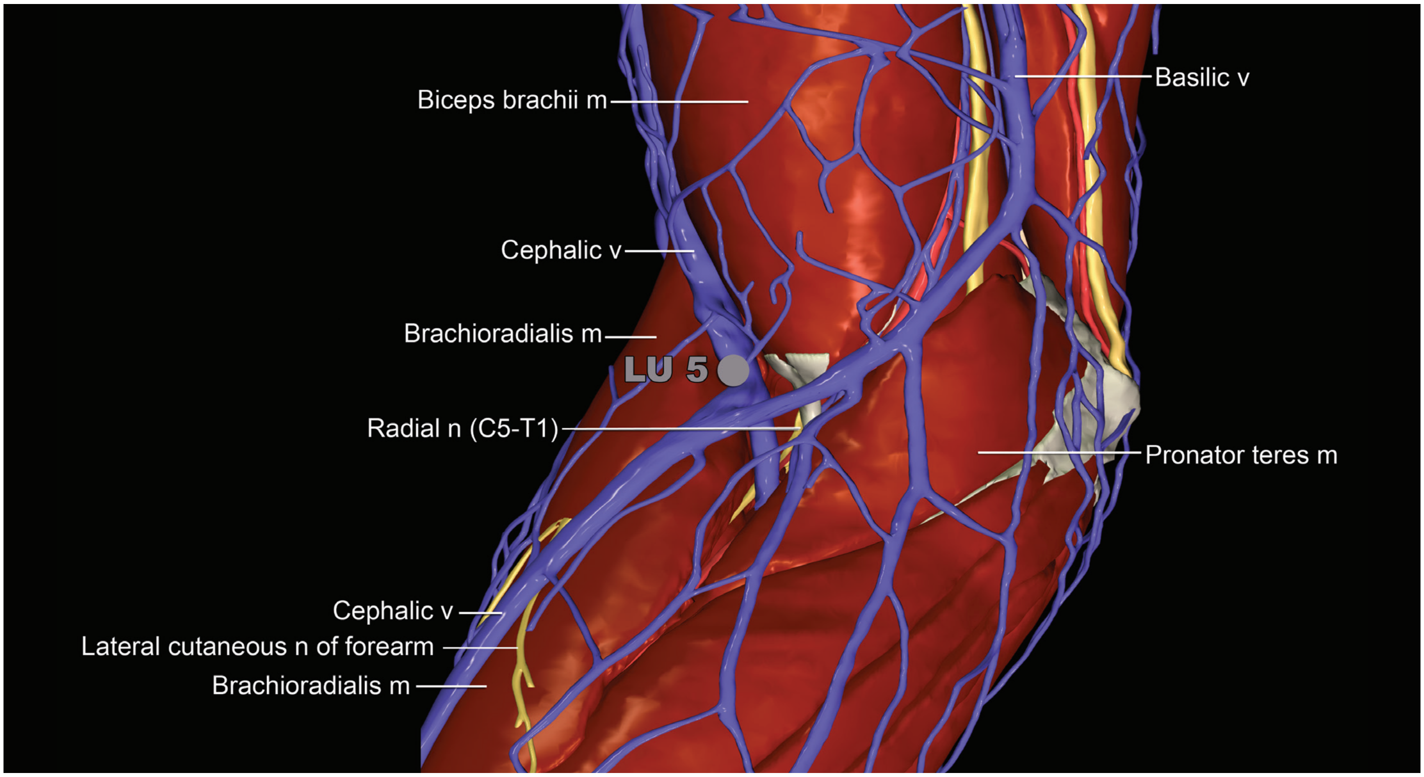

Biceps brachii m
Basilic v
Cephalic v
Brachioradialis m
LU 5
Radial n (C5-T1)
Pronator teres m
Cephalic v
Lateral cutaneous n of forearm
Brachioradialis m

Figure 1-11. LU 5 often appears in treatments for elbow pain, in part because of its close association with the biceps tendon and the brachioradialis muscle.

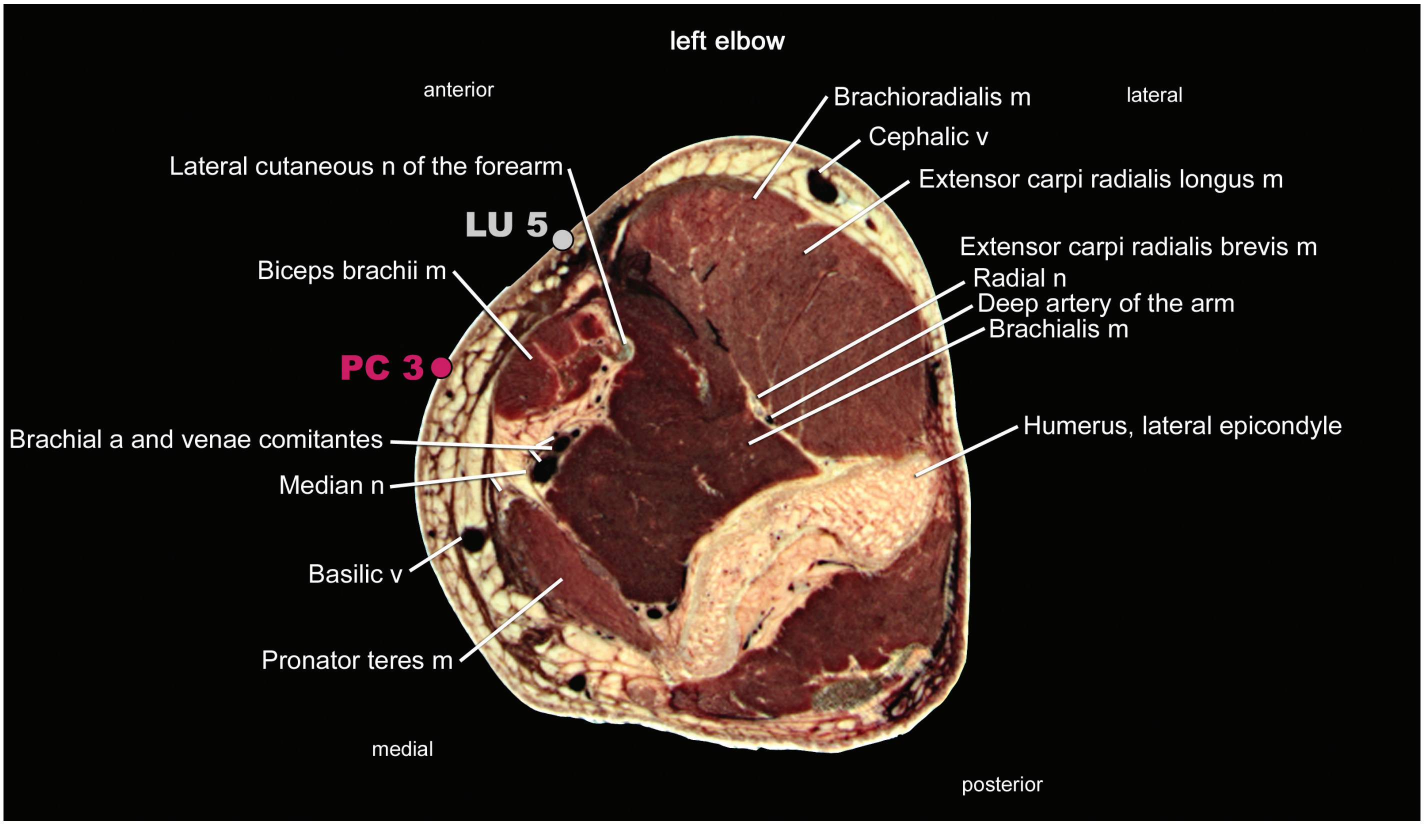

left elbow
anterior
lateral
Brachioradialis m
Cephalic v
Lateral cutaneous n of the forearm
Extensor carpi radialis longus m
LU 5
Extensor carpi radialis brevis m
Biceps brachii m
Radial n
Deep artery of the arm
Brachialis m
PC 3
Humerus, lateral epicondyle
Brachial a and venae comitantes
Median n
Basilic v
Pronator teres m
medial
posterior

Figure 1-12. LU 5 impacts strong movers of the thoracic limb that appear in this cross section.

LU 6

Kong Zui "Collection Hole" or "Biggest Hole"

On the anterior forearm, on the ulnar side of the brachioradialis muscle, on the line connecting LU 5 and LU 9; 5 cun below LU 5, 7 cun above LU 9. Or, divide the distance between LU 5 and LU 9 in half. Take LU 6 1 cun proximal to this midpoint.

Muscles

- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Pronator teres muscle:** Flexes the forearm at the elbow, and pronates the forearm.
- **Flexor carpi radialis muscle:** Flexes and abducts the hand at the wrist.
- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist joint.
- **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist joint.

Clinical Relevance: Weakness of the hand or wrist due to myofascial restriction or pain generated from somatic dysfunction of the forearm and digital flexors.

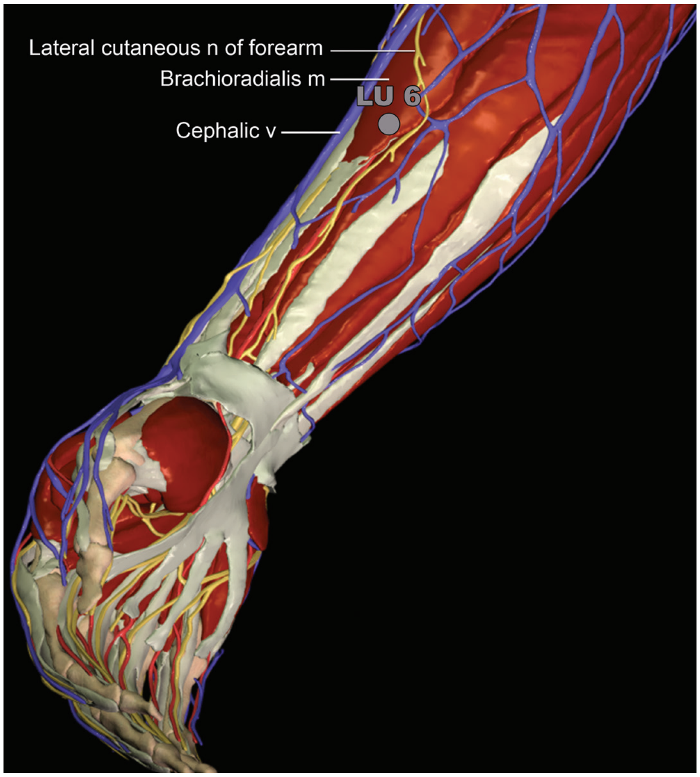


Figure 1-13. LU 6, the "Collection Hole" occupies a position on the flexor surface of the antebrachium where the examiner can palpate a "hole" alongside the brachioradialis muscle. The "Xi-Cleft" point of the Lung channel which, according to Chinese medical lore, collects blood and Qi. Anatomically, the Xi-Cleft points occur near myotendinous junctures, as seen here.

Nerves

- **Median nerve (C6-T1):** Innervates the flexors of the forearm, including the pronator teres, flexor digitorum superficialis and flexor carpi radialis muscles.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.
- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.
- **Deep branch of the radial nerve (C7, C8):** Supplies the extensor carpi radialis brevis muscle.

Clinical Relevance: Weakness in motor function of the forearm and digital flexors; nerve entrapment due to myofascial restriction in this area; sensory changes due to local or more proximal sources of nerve entrapment or irritation (including brachial plexus and spinal nerve egress through encroaching foramina).

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Radial artery:** Provides, with the ulnar artery, all of the blood to the hand. Provides muscular branches to the flexor and extensor muscles on the radial side of the forearm, the radial recurrent artery, the superficial palmar branch of the radial artery, the palmar carpal branch of the radial artery, and the dorsal carpal branch of the radial artery.
- **Radial veins:** These paired veins arise from the radial side of the deep venous arcade, which is associated with the deep palmar arterial arch.

Clinical Relevance: Circulatory dysfunction or edematous maladies affecting the distal thoracic limb.

Indications and Potential Point Combinations

- **Respiratory problems:** dyspnea, cough, bronchitis, asthma: LU 6, LU 7, LI 4, BL 12, BL 13, GV 14.
- **Throat problems: tonsillitis, laryngitis, pharyngitis:** LU 6, LI 11, LI 4, CV 22.
- E**lbow pain and restricted range of motion related to restriction in the forearm flexor muscles:** LU 6, LU 5, LU 7, associated trigger points.

Evidence-Based Applications

- Electroacupuncture at LI 4 and LU 6 **normalized the pattern of leukocytes**, and decreased heart rate.[1]
- Electroacupuncture delivered at the homeostatic points LI 4 and ST 36, as well LU 6 for salivary gland stimulation and ST 6 may have **lessened stress and fatigue** in female athletes. This was

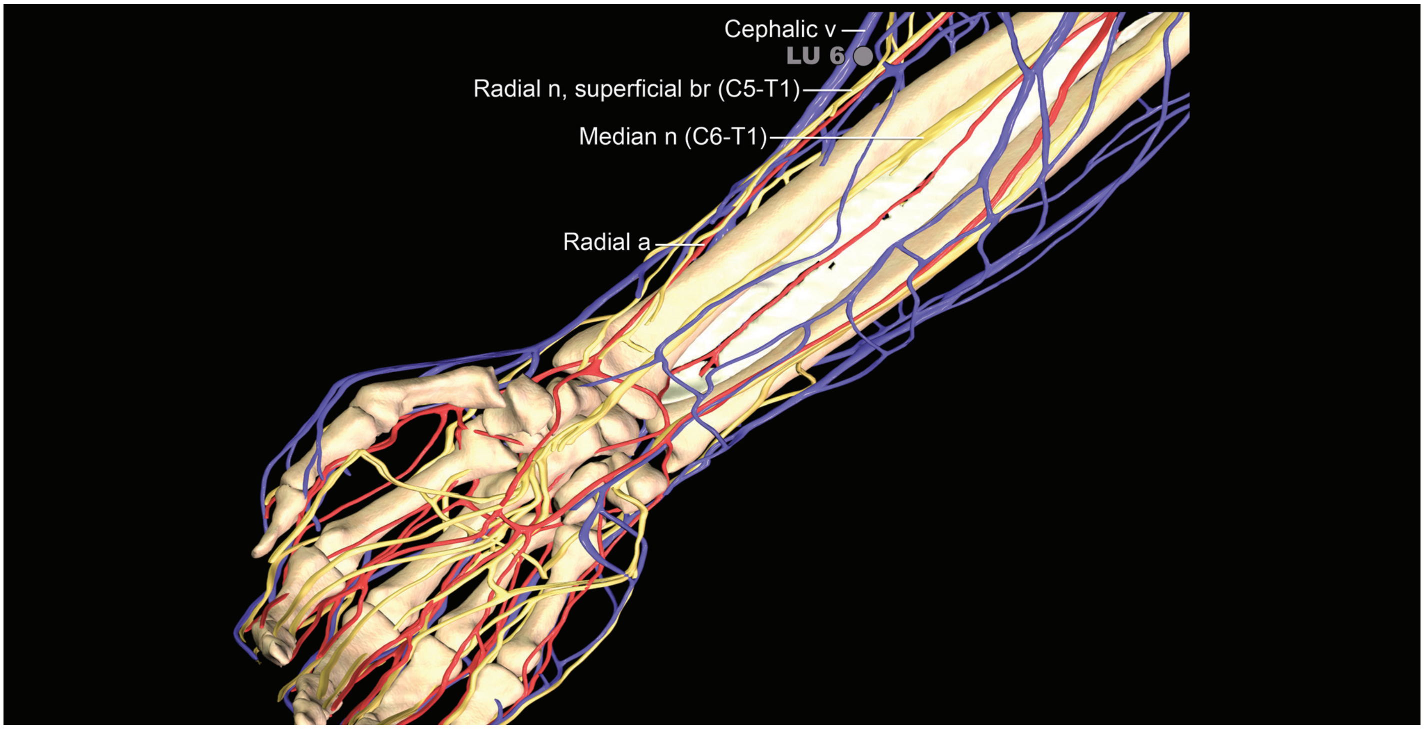

Cephalic v
LU 6
Radial n, superficial br (C5-T1)
Median n (C6-T1)
Radial a

Figure 1-14. This view depicts the close communication between LU 6 and the radial nerve.

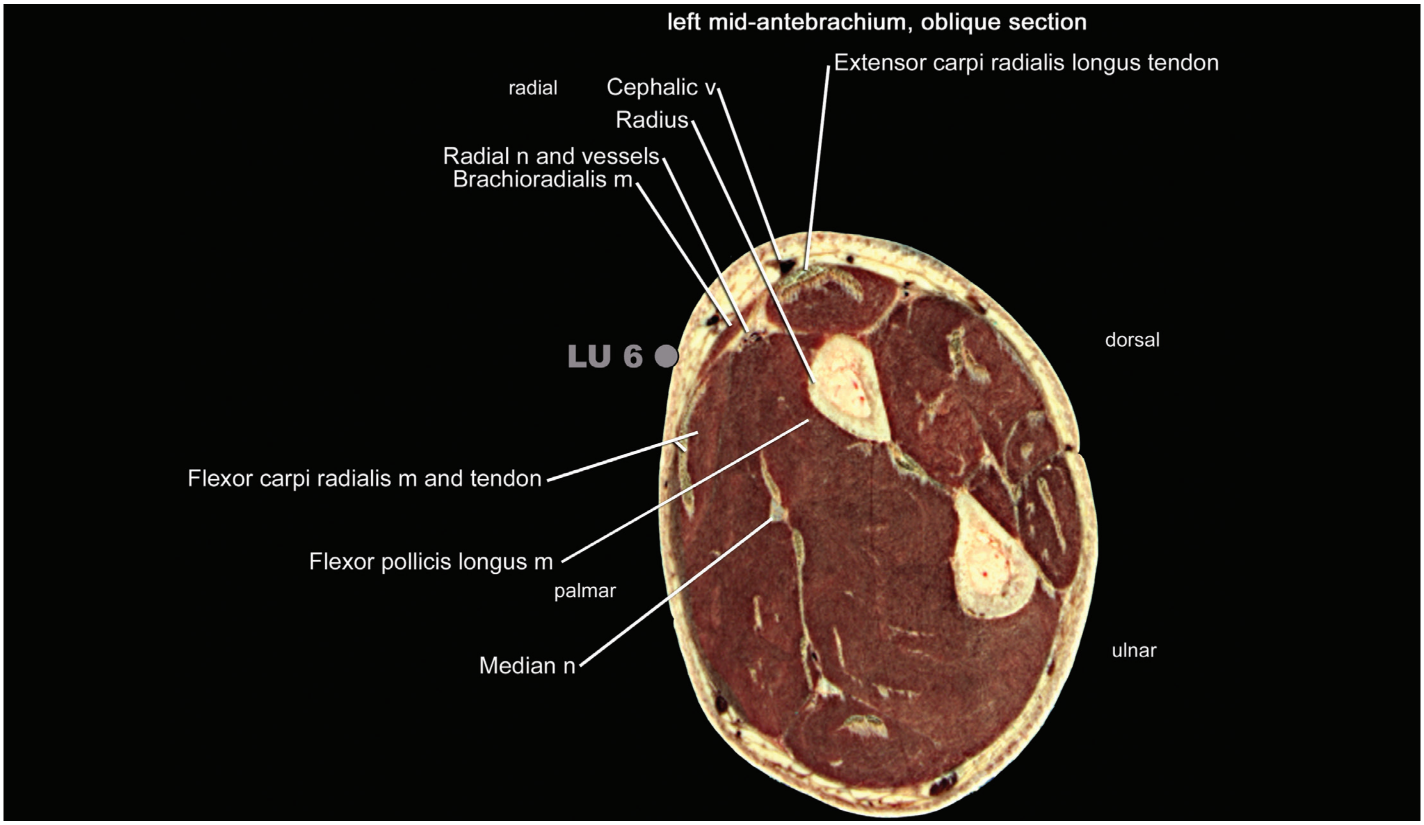

left mid-antebrachium, oblique section
Extensor carpi radialis longus tendon
radial
Cephalic v
Radius
Radial n and vessels
Brachioradialis m
LU 6
dorsal
Flexor carpi radialis m and tendon
Flexor pollicis longus m
palmar
Median n
ulnar

Figure 1-15. This cross sectional view provides additional perspective of the relationship between LU 6 and surrounding structures.

evidenced by 1) inhibition of salivary secretory immunoglobulin A (SIgA) levels during competition in female athletes, 2) inhibition of the exercise-induced increase in salivary cortisol during competition, 3) diminished subjective assessments of muscle tension, physical and mental fatigue, and 4) better emotional health.[2]

- A 40-minute treatment of needling at LU 10 and LU 6 reportedly delivered an "immediate **antiasthmatic** effect"[3]

References

1. Mori H, Nishijo K, Kawamura H, and Abo T. Unique immunomodulation by electroacupuncture in humans possibly via stimulation of the autonomic nervous system. *Neuroscience Letters.* 2002;320:21-24.
2. Akimoto T, Nakahori C, Aizawa K, et al. Acupuncture and responses of immunologic and endocrine markers during competition. *Med Sci Sports Exerc.* 2003;35(8):1296-1302.
3. Zang J. Immediate antiasthmatic effect of acupuncture in 192 cases of bronchial asthma. *J Tradit Chin Med.* 1990;10(2):89-93.

LU 7

Lie Que “Broken Sequence” or “Divergent Breach”

In a depression on the radial aspect of the distal, volar antebrachium, 1.5 cun proximal to the wrist joint, just proximal to the styloid process of the radius.

Muscles

- **Brachioradialis tendon:** Flexes the forearm at the elbow.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius to the ulna.
- **Flexor pollicis longus muscle:** Flexes the phalanges of the thumb.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.
- **Extensor pollicis brevis muscle:** Extends the thumb’s proximal phalanx.
- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint:
- **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist joint.

Clinical Relevance: Restricted, painful, or weak wrist movement. Impaired motor function of the thumb due to pain or disuse.

Nerves

- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

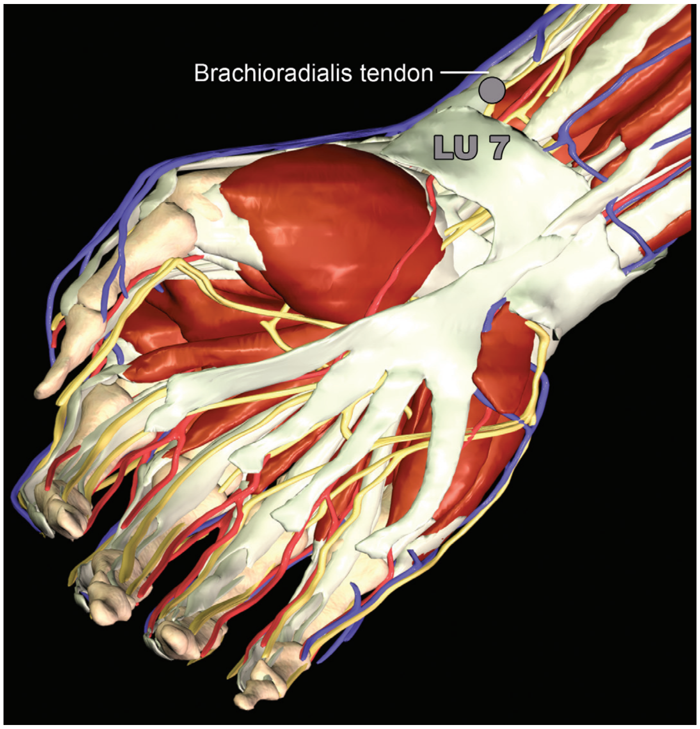


Figure 1-16. LU 7 lies in the groove along the ulnar aspect of the brachioradialis tendon, as shown here.

- **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which are innervated by the median nerve) as well as the radial aspect of the wrist.
- **Radial nerve, deep branch (C7, C8):** Innervates the extensor carpi radialis brevis muscle.
- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.
- **Median nerve (C6-T1):** Innervates the flexors of the forearm.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve, the posterior interosseous nerve innervates the abductor pollicis longus muscle, the extensor pollicis longus and brevis muscles, the extensor digitorum, the extensor digiti minimi, and the extensor carpi ulnaris muscles, and the extensor indicis muscle.
- **Anterior interosseous nerve (C8, T1):** From the median nerve, the anterior interosseous nerve innervates the flexor pollicis longus and the pronator quadratus muscles.

Clinical Relevance: Nerve damage or entrapment affecting motor function of the thumb, hand, or wrist. Sensory changes or loss impacting the radial aspect of the wrist or thumb. Neuropathic or other sources of pain in the wrist or thumb.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral circulation at the wrist.
- **Radial veins:** Paired veins arise from the radial side of the deep venous arcade, which follows the deep palmar arterial arch.

Clinical Relevance: Peripheral vascular disease or lymphatic congestion affecting the distal forearm, wrist, and/or hand. Do not needle through edematous tissue; select another method of neuromodulation such as manual lymphatic drainage or laser therapy.

Indications and Potential Point Combinations

- **Upper and lower respiratory problems, including rhinitis, tonsillitis, pharyngitis, cough:** LU 7, LU 5, LI 4, LI 11, BL 12, BL 13, BL 23, GV 14.
- **Skin disorders:** LU 7, LI 14, LI 11, GV 14, ST 36.
- **Worry, grief, sadness:** LU 7, LR 3, HT 7, HT 3, GV 20.
- **Neck pain and stiffness:** LU 7, local cervical trigger points, GB 21, BL 23.
- **Pain in the trigeminal nerve distribution:** LU 7, LI 4, local facial points as indicated by the pain presentation.

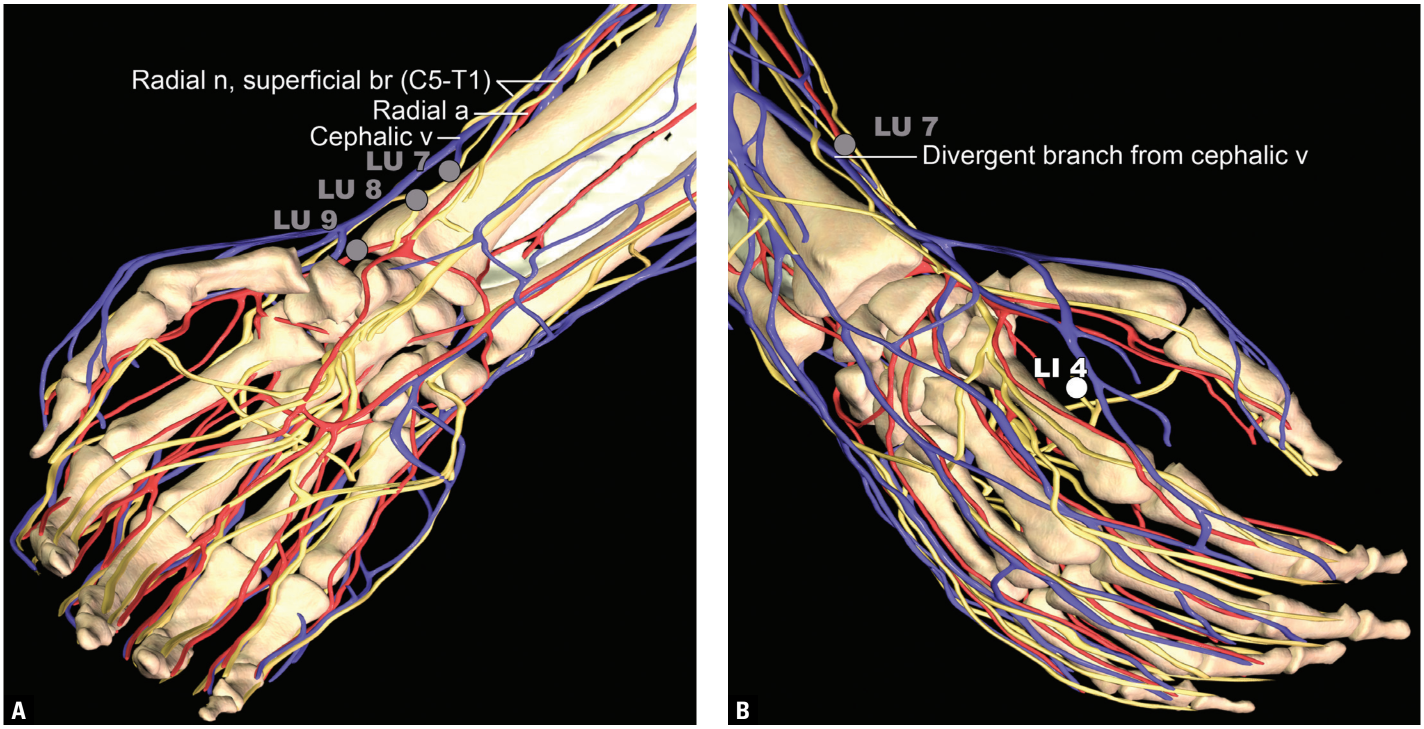

Radial n, superficial br (C5-T1)
Radial a
Cephalic v
LU 7
LU 8
LU 9
A
LU 7
Divergent branch from cephalic v
LI 4
B

Figure 1-17A and B. "Broken Sequence", for LU 7, refers to the divergent neurovascular pathways that progress toward LI 4 on the dorsum of the hand, shown more clearly in Figure 1-17A.

Evidence-Based Applications

- Laser acupuncture at LU 7, LI 4, GB 14, and GB 20 reduced **chronic tension headache**.[2]
- Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a reduction of minimum alveolar concentration (MAC) of isoflurane by 16.7% in dogs. Acupunc-ture-assisted anesthesia thus **potentiated the anesthetic effects of volatile anesthetic agents**.[3]
- Following a series of acupuncture treatments, men with **poor sperm quality** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[4]
- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[5]
- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[6,7]
- Patients who received EA (at LU 2, LU 7, and PC 6) prior to heart valve replacement surgery exhibited significantly lower serum troponin 1 release following aortic cross-clamp removal. This indicates potential benefit of EA in terms of reducing reperfusion injury from cardiac ischemia.[8]
- Acupuncture at LU 7, ST 8, GB 4, GB 5, GB 20, and GV 14 afforded large cost-savings for **migraineurs** who would otherwise have missed work, according to a controlled trial testing acupuncture against conventional drug treatment.[9]
- Acupuncture at LU 7, ST 40, GB 20, and GV 20, as well as plum-blossom hammer tapping at GV 14, alleviated vertigo and related symptoms in a majority of patients in a case series of patients with **vertebrobasilar ischemic vertigo.**[10]

References

1. Donoso MV, Miranda R, Irarrazaval MJ, et al. Neuropeptide Y is released from human mammary and radial vascular biopsies and is a functional modulator of sympathetic cotransmission. J Vasc Res. 2004;41:387-399.
2. Ebneshahidi NS, Heshmatipour M, Moghaddami A, Eghtesadi-Araghi P. The effects of laser acupuncture on chronic tension headache – a randomised controlled trial. Acupuncture in Medicine. 2005;23(1):13-18.
3. Culp LB, Skarda RT, and Muir WW 3rd. Comparisons of the effects of acupuncture, electroacupuncture, and transcutaneous cranial electrical stimulation on the minimum alveolar concentration of isoflurane in dogs. Am J Vet Res. 2005;66(8):1364-1370.
4. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. Archives of Andrology. 1997;39:155-161.
5. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. Medical Acupuncture. 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.
6. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate bronchodilating response in asthma patients. J Chin Med Assoc. 2005;68(12):591-594.
7. Chu K-A, Wu Y-C, Ting Y-M, Wang H-C, and Lu J-C. Acupuncture therapy results in immediate bronchodilating effect in asthma patients. J Chin Med Assoc. 2007;70(7):265-268.
8. Yang L, Yang J, Wang Q, et al. Cardioprotective effects of electroacupuncture pretreatment on patients undergoing heart valve replacement surgery: a randomized controlled trial. *Ann Thorac Surg.* 2010;89:781-786.
9. Liguori A, Petti F, Bangrazi A, et al. Comparison of pharmacological treatment versus acupuncture treatment for migrained without aura – analysis of socio-medical parameters. *J Tradit Chin Med.* 2000;20(3):231-240.
10. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *J Trad Chin Med.* 2009;29(2):87-89.

LU 8

Jing Qu “Channel Ditch”

On the radial, volar aspect of the wrist, 1 cun above the wrist crease (and also LU 9, at the level of the joint), in the depression between the radial artery and the styloid process of radius.

Muscles

- **Brachioradialis tendon:** The brachioradialis muscle flexes the forearm at the elbow.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius to the ulna.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.
- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint.

Clinical Relevance: Tendonitis or myofascial dysfunction affecting wrist mobility, strength, and comfort. Tendinitis or local soft tissue restriction impairing thumb function and causing pain.

Nerves

- **Brachioradialis tendon:** The brachioradialis muscle flexes the forearm at the elbow.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius to the ulna.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.
- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint.

Clinical Relevance: Tendonitis or myofascial dysfunction affecting wrist mobility, strength, and comfort. Tendinitis or local soft tissue restriction impairing thumb function and causing pain.

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.
- **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches**: these anastomoses provide collateral circulation at the wrist. Chinese pulse diagnosis assesses the quality of the impulse at various positions along the radial artery, including locations over LU 7, LU 8, and LU 9. System wide changes such as aging and stress alter histological features in the arterial wall, leading to changes in pulse quality.[2,3] For example, the Chinese pulse diagnosis of “liver qi stagnation” associated with emotional turmoil, taut pulse, and chest pain would equate with sympathetic nervous system arousal in contemporary biomedicine.
- **Radial veins:** These paired veins arise from the radial side of the deep venous arcade, which is associated with the deep palmar arterial arch.

Clinical Relevance: Circulatory insufficiency or compromise that

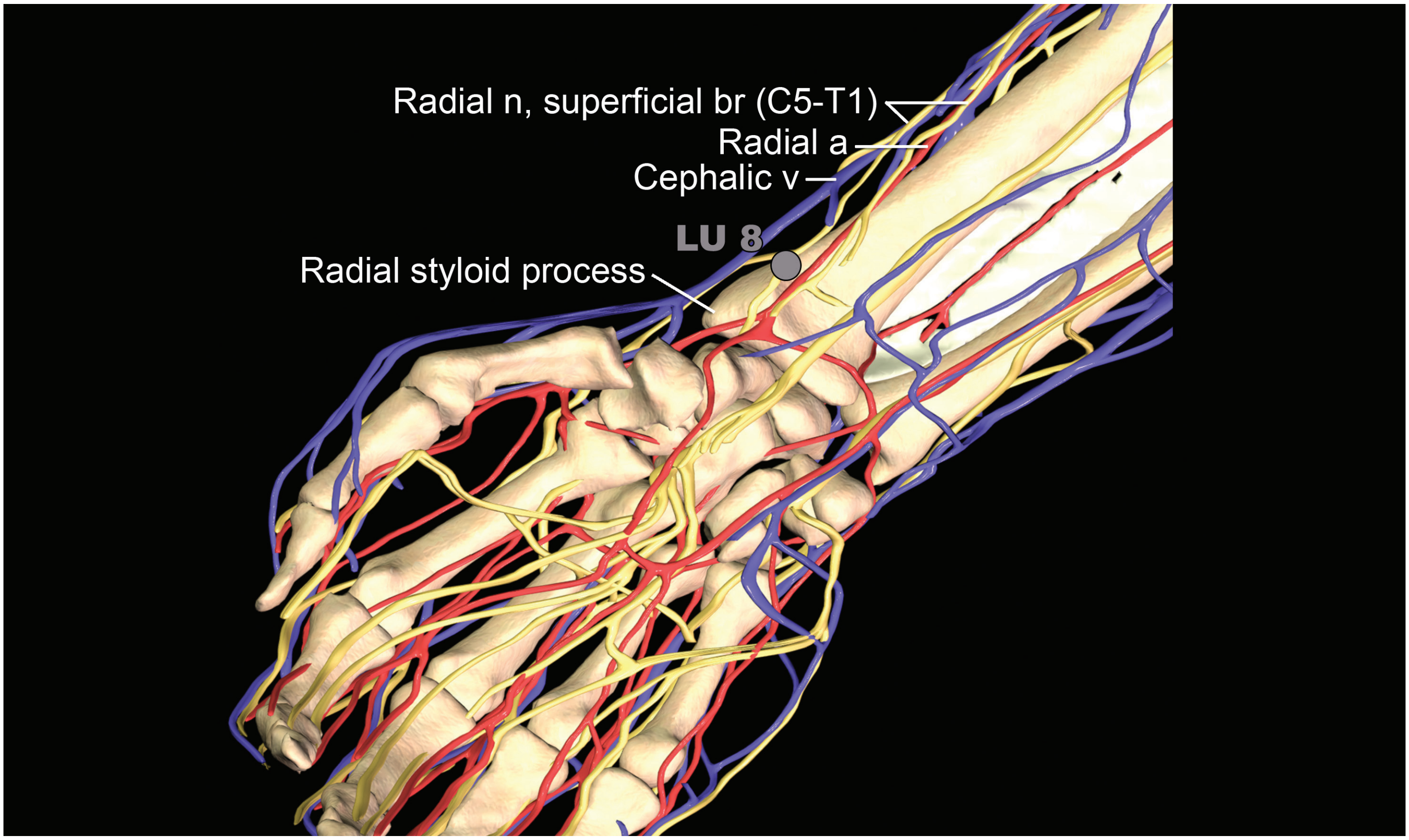


Figure 1-18. LU 8, the “Channel Ditch” point snugs up close to the prominence that forms the radial styloid process.

limits oxygenation of distal tissues and elimination of metabolic waste and fluid accumulation.

Indications and Potential Point Combinations

- **Wrist pain:** LU 8 if tender. Check also PC 7, other local points. Identify myofascial restrictions in brachioradialis muscle and flexor pollicis longus (for referred pain).

References

1. Staras K, Chang H-S, and Gilbey MP. Resetting of sympathetic rhythm by somatic afferents causes post-reflex coordination of sympathetic activity in rat. *Journal of Physiology*. 2001;533.2:537-545.
2. Barry MM, Foulon P, Touati G, et al. Comparative histological and biometric study of the coronary, radial and left internal thoracic arteries. *Surg Radiol Anat*. 2003;25:284-289.
3. Giannattasio C, Failla M, Lucchina S, et al. Arterial stiffening influence of sympathetic nerve activity. Evidence from hand transplantation in humans. *Hypertension*. 2005;45:608-611.

LU 9

Tai Yuan "Great Abyss"

On the radial, volar (palmar) aspect of the wrist in the depression on the radial side of the radial artery, distal to the styloid process of radius. Level with HT 7 at the proximal border of the pisiform bone. On the ulnar aspect of the abductor pollicis longus tendon.

Muscles

- **Abductor pollicis longus tendon:** Abducts the thumb and extends it at the carpometacarpal joint.
- **Extensor pollicis brevis tendon:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.
- **Flexor pollicis longus muscle:** Flexes the phalanges of the thumb.
- **Brachioradialis tendon:** Flexes the forearm at the elbow.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist.

Clinical Relevance: Wrist pain from degenerative joint disease, other joint ailments; myofascial dysfunction of wrist tendons; loss of wrist function. Thumb pain, myofascial dysfunction in the thenar eminence impacting thumb mobility, strength, comfort.

Nerves

- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

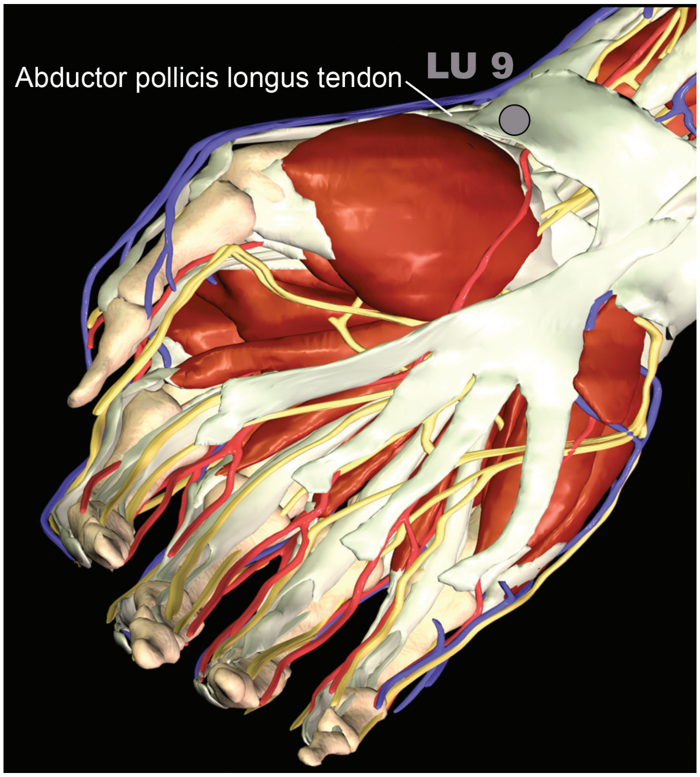


Figure 1-19. This image shows LU 9 on the ulnar aspect of the abductor pollicis longus tendon.

- **Radial nerve (C5-C7):** Innervates the brachioradialis and extensor carpi radialis longus muscles.
- **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which the median nerve supplies) as well as the radial aspect of the wrist. Somatic afferent stimulation from the superficial radial nerve resets sympathetic discharges.[1]
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve, the posterior interosseous nerve innervates the abductor pollicis longus muscle, the extensor pollicis longus and brevis muscles, the extensor digitorum, the extensor digiti minimi, and the extensor carpi ulnaris muscles, and the extensor indicis muscle.
- **Anterior interosseous nerve (C8, T1):** From the median nerve, the anterior interosseous nerve innervates the flexor pollicis longus and the pronator quadratus muscles.
- **Median nerve (C6, C7):** Innervates the flexor carpi radialis muscle.

Clinical Relevance: Wrist or radiating thumb pain; neuropathic, inflammatory, or entrapment-related nerve irritation.

Vessels

- **Radial artery and the communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral circulation at the wrist.
- **Radial veins:** Arise from the deep venous arcade, associated with the deep palmar arterial arch.

Clinical Relevance: Peripheral vascular disease states affecting circulatory supply to the hand; generalized autonomic tone related to input from sympathetic afferents in the periphery; compression of local neurovascular supply from tension in the flexor retinaculum or other connective tissue or bone overgrowth in this region of the wrist.

Indications and Potential Point Combinations

- **Respiratory problems:** Cough, sore throat, bronchitis, asthma, emphysema: LU 9, LU 7, LU 2, BL 13, ST 36.
- **Pain in the forearm or wrist:** Try to identify the source; consider LU 9 for local pain or pain along the radial aspect of the forearm; add myofascial trigger points.
- **Epistaxis:** LU 9, LI 4, ST 44, GV 20.

Evidence-Based Applications

- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary Raynaud's syndrome, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[2]
- Acupuncture at LU 9, LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67, LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with staphylococcal-infected skin wounds following a poor 50-day response to antibiotics.[3]

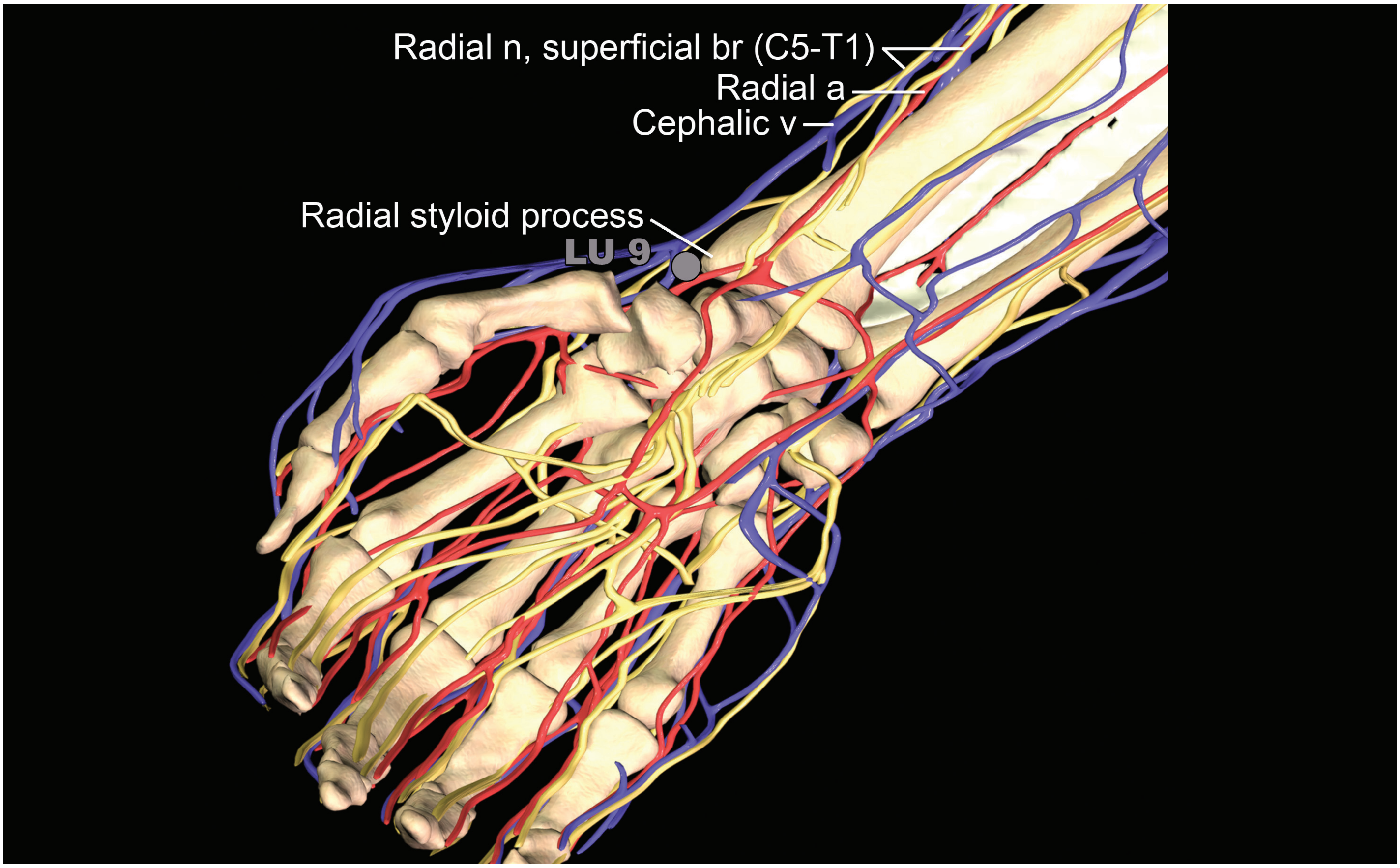


Figure 1-20. LU 9 lines up with the radiocarpal joint. Its name, “Great Abyss” connotes the deep depression one palpates at this site. The classical indication of LU 9 as an influential point for vasculature probably reflects the influence of local sympathetic afferents on blood flow through autonomic nervous system modulation.

References

1. Staras K, Chang H-S, and Gilbey MP. Resetting of sympathetic rhythm by somatic afferents causes post-reflex coordination of sympathetic activity in rat. *Journal of Physiology*. 2001;533.2:537-545.

2. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud’s syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine*. 1997;241:119-124.

3. Diogenes MSB, Carvalho ACC, and Tabosa AMF. Acupuncture and moxibustion as fundamental therapeutic complements for full recovery of staphylococcal skin infection after a poor 50-day treatment response to antibiotics. *J Alt Comp Med*. 2008;14(6):757-761.

LU 10

Yu Ji "Fish Border"

On the thenar eminence, midway along the shaft of the first metacarpal bone, in a depression along the dorsal/palmar skin border.

Muscles

- **Abductor pollicis brevis muscle:** Abducts the thumb and extends the thumb at the carpometacarpal joint.
- **Opponens pollicis muscle:** Allows thumb opposition as when picking up an object.
- **Flexor pollicis brevis muscle:** Flexes the thumb.

Clinical Relevance: Loss of thumb strength and opposability, whether due to myofascial trigger points, arthritic pain, or muscle atrophy.

Nerves

- **Radial nerve, superficial branch (C6-C8):** Innervates the skin over the palmar region surrounding the 1st metacarpophalangeal joint and the dorsum of the radial aspect of the hand (except for the dorsal fingertips, which are innervated by the median nerve) as well as the radial aspect of the wrist
- **Palmar cutaneous branch of the median nerve (C6-C8):** Innervates the skin over the radial palmar region.
- **Median nerve, recurrent branch (C6-T1):** Innervates the thenar muscles: the abductor pollicis brevis, flexor pollicis brevis (superficial part), and opponens pollicis.
- **Ulnar nerve (C6, C7):** Supplies the deep part of the flexor pollicis brevis muscle.

Clinical Relevance: Thumb pain or numbness, carpal tunnel syndrome or other nerve entrapment pathologies.

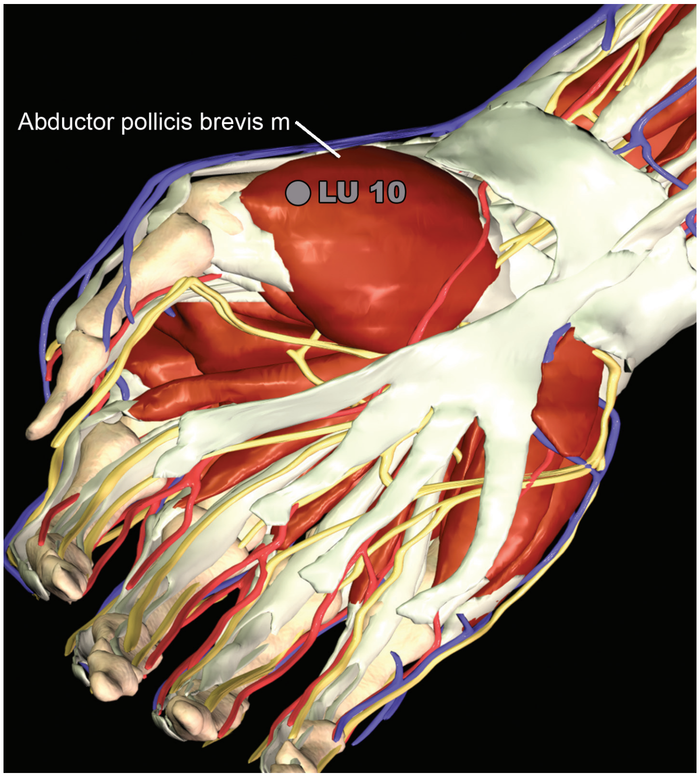


Figure 1-21. LU 10 resides at the midpoint of the first metacarpal bone along the dorsal-palmar border. The term "Fish Border" connotes the fish-like shape of the thenar eminence. Its "border" identifies the dorso-palmar skin junction where the color changes.

Vessels

- **Superficial palmar arch venous branches:** Its radial branches drain to the cephalic vein.
- **Deep venous arcade:** This series of anastomosing venous arches gives rise to the deep veins of the forearm, including the radial veins. The deep venous arcade parallels the deep palmar arterial arch.
- **Communications between the deep palmar arterial arch and the palmar carpal arches:** These anastomoses provide collateral supply to the wrist.

Clinical Relevance: Peripheral vascular disease, including Raynaud's disease or syndrome; thumb joint malfunction due to deficient oxygen perfusion.

Indications and Potential Point Combinations

- **Respiratory conditions, especially associated with inflammation:** cough, hemoptysis, fever, laryngitis, pharyngitis, tonsillitis, pneumonia, chest restriction, dyspnea: LU 10, LI 4, ST 36, KI 6, LI 11, BL 13, BL 14, GV 14.
- **Thumb pain from arthritis:** LU 10, LU 7, LI 4, local points as indicated by palpation.

Evidence-Based Applications

- A 40-minute treatment of needling at LU 10 and LU 6 reportedly delivered an "immediate **antiasthmatic** effect".[1]

References

1. Zang J. Immediate antiasthmatic effect of acupuncture in 192 cases of bronchial asthma. *J Tradit Chin Med.* 1990;10(2):89-93.

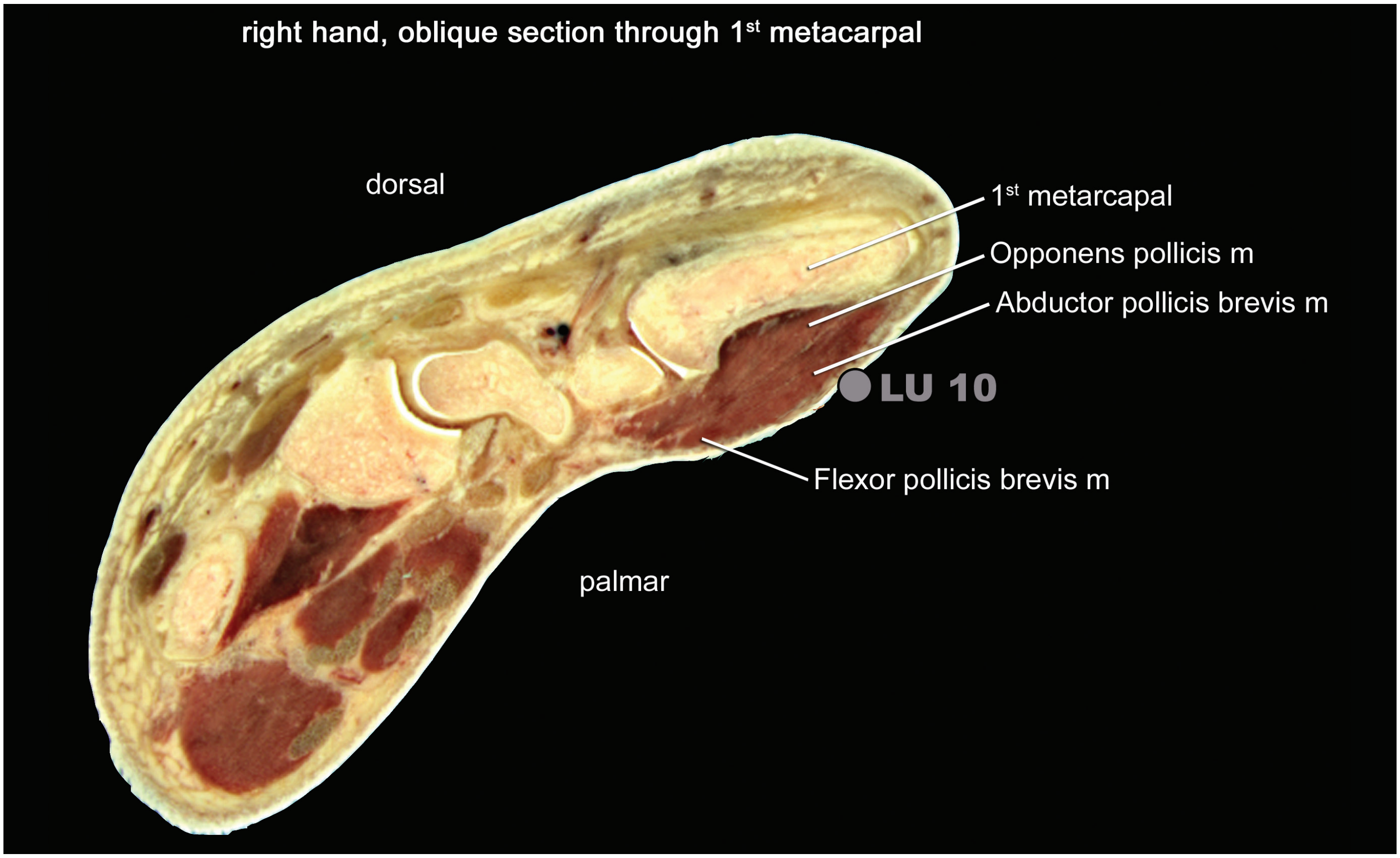

right hand, oblique section through 1st metacarpal
dorsal
1st metarcapal
Opponens pollicis m
Abductor pollicis brevis m
LU 10
Flexor pollicis brevis m
palmar

Figure 1-22. This oblique section identifies the relationship between LU 10 and muscles of the thenar eminence, so often beset by myofascial restriction leading to thumb pain. LU 10 corresponds to the motor point of the abductor pollicis brevis muscle. (Liu Y, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med.* 1975;3(4):347-358.)

LU 11

Shao Shang "Lesser Merchant"

On the radial side of the base of the thumb nail, the width of a Chinese leek leaf (approximately 0.1 cun; more like a chive than a leek) from the corner of the nail.

Nerves

- **Distal network of the proper palmar digital n. , from the median nerve (C6):** Provides sensation and sympathetic supply to the thumb.

Clinical Relevance: Local sensory loss; systemic autonomic dysfunction impacted through actions of the nervi vasorum and sympathetic supply.

Vessels

- **Distal network of proper palmar digital artery:** Participates in the arteriovenous network at the tip of the finger. No longitudinal arteries run along the dorsum; instead, branches from the proper palmar digital artery anastomosed along like links in a chain.

The most distal arterial branches turn into twigs on either side of the base of the nail that anatomose with their opposing partners, creating an arch at the nail matrix where the endpoints of the channels sit. Thus, these "ting" or endpoints associate intimately with small, physiologically active vessels.

- **Distal network of proper palmar digital vein:** Participates in the arteriovenous network at the tip of the thumb.
- **Note on the neurovascularization of the fingers:** The pattern of vessels supplying the hand creates a complex area of study that still poses challenges for anatomists. Morphologic variations in the neurovascular supply for the thoracic limb may result from factors related to limb position during development.

Comparative anatomy note: Quadrupeds such as the dog exhibit a highly developed counter-current heat exchange system with abundant arteriovenous anastomoses and notable dermal venous plexuses in their footpads. These anatomic features give the paw the capacity to resist damage from contact with cold surfaces. Vasodilation of proximal vessels in the limb bolsters blood supply to the surface of the pad on the paw.[5]

Clinical Relevance: Problems with local or systemic autonomic tone and thermal regulation.

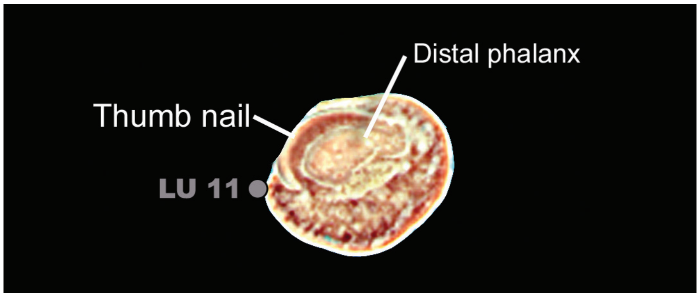


Figure 1-23. Note the small lumen of the vessel underlying LU 11, next to the thumb nail. This tiny location as the most distal point placement qualifies LU 11 for the name "Lesser Merchant".

Indications and Potential Point Combinations

- **Typically used alone, LU 11 may help restore breathing, promote resuscitation, stop febrile seizures:** Needle or bleed to break fever and sweat patient

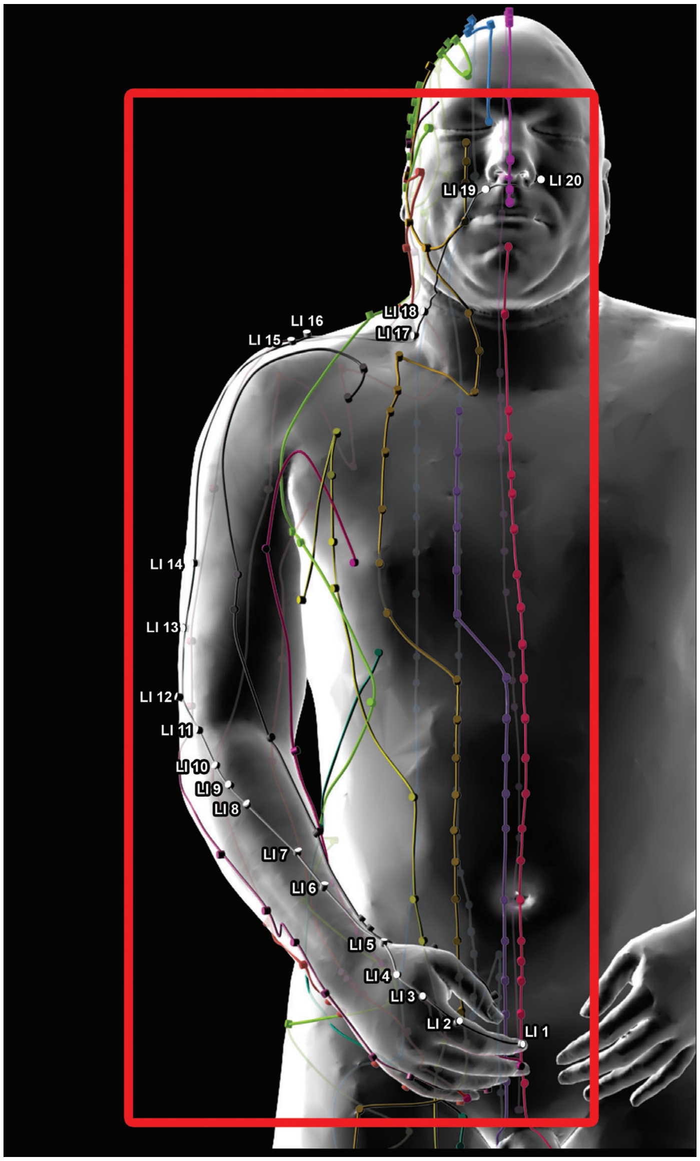
Evidence-Based Applications

- Bloodletting at LU 11 or LI 1 in children may prevent and treat laryngospasm occurring post-extubation.[6]
- Acupuncture at LU 9, and all the ting points (LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67), as well as LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with staphylococcal-infected skin wounds following a poor 50-day response to antibiotics.[7]
- Figure 1-23. Note the tiny vessel extending from the thumb nail to LU 11. The point's small size suits the name "Lesser Merchant".

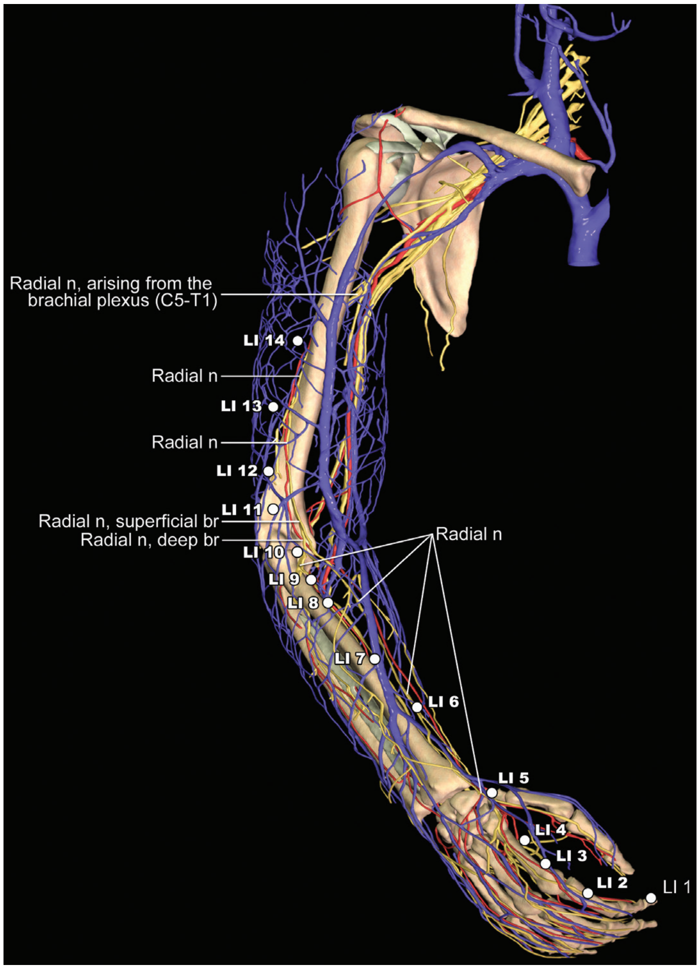
References

1. Endo T, Kojima T, and Hirase Y. Vascular anatomy of the finger dorsum and a new idea for coverage of the finger pulp defect that restores sensation. *J Hand Surg.* 1992;17A:927-932.
2. Windisch G. Unusual vascularization and nerve supply of the fifth finger. *Ann Anat.* 2006;188:171-175.
3. Lee CK, Chien TJ, Hsu JC, Yang CY, Hsiao JM, Huang YR, and Chang CL. The effect of acupuncture on the incidence of postextubation laryngospasm in children. *Anaesthesia.* 1998;53:910-924.
4. Saghei M and Razavi S. Bloodletting acupuncture for the prevention of stridor in children after tracheal extubation: a randomized, controlled study. *Anaesthesia.* 2001;56:961-964.
5. Ninomiya H, Akiyama E, Simazaki K, et al. Functional anatomy of the footpad vasculature of dogs: scanning electron microscopy of vascular corrosion casts. *Veterinary Dermatology.* 2011;22:475-481.
6. Lee CK, Chien TJ, Hsu JC, et al. The effect of acupuncture on the incidence of postextubation laryngospasm in children. *Anesthesia.* 1998;53(9):917-920.
7. Diogenes MSB, Carvalho ACC, and Tabosa AMF. Acupuncture and moxibustion as fundamental therapeutic complements for full recovery of staphylococcal skin infection after a poor 50-day treatment response to antibiotics. *J Alt Comp Med.* 2008;14(6):757-761.

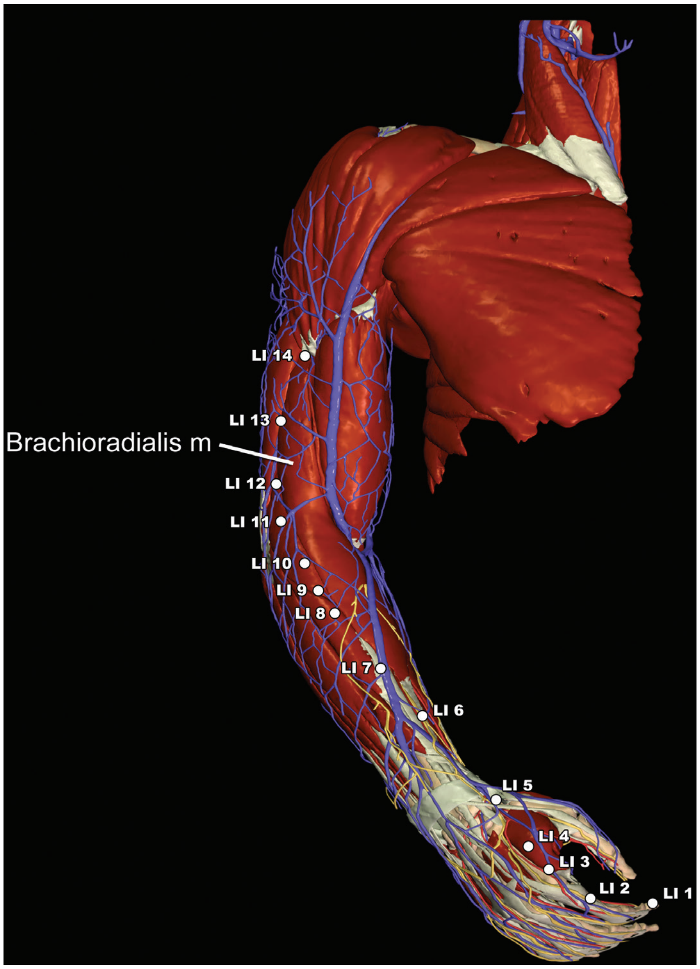
Channel 2:: The Large Intestine (LI)


LI 20
LI 19
LI 18
LI 17
LI 16
LI 15
LI 14
LI 13
LI 12
LI 11
LI 10
LI 9
LI 8
LI 7
LI 6
LI 5
LI 4
LI 3
LI 2
LI 1

The LI channel commences at LI 1 on the radial side of the index finger. Following its course toward the nose, the LI line follows the pathway determined by the radial nerve to the mid-humerus. After reaching the acromion and then the face, the LI channel arrives at LI 20, lateral to the contralateral naris.



The tight relationship between the radial nerve and the LI channel becomes apparent when tracing the course of both from the mid-humerus to the index finger.



The brachioradialis muscle overlies the radial artery and nerve as it travels from brachium to wrist. Thus, the LI channel describes the course of both the radial nerve and the brachioradialis muscle.

Chinese Medicine doctrine claims that several LI points such as LI 4 and LI 11 "clear heat", especially in the head, neck, or cranial thorax. The metaphor "clearing heat" suggests anti-inflammatory, anti-sympathetic effects.

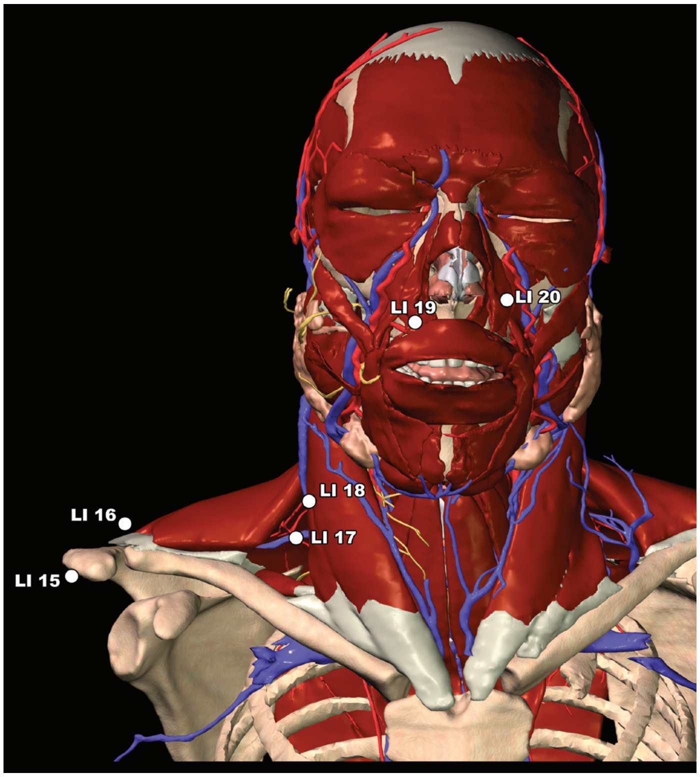
The LI channel commences at LI 1 on the radial side of the index finger.

After tracking the radial nerve to the mid-humerus, the LI line jumps to the shoulder, ascends the neck, and crosses under the nose to LI 20, the only channel to start on one side of the body and end on the other.

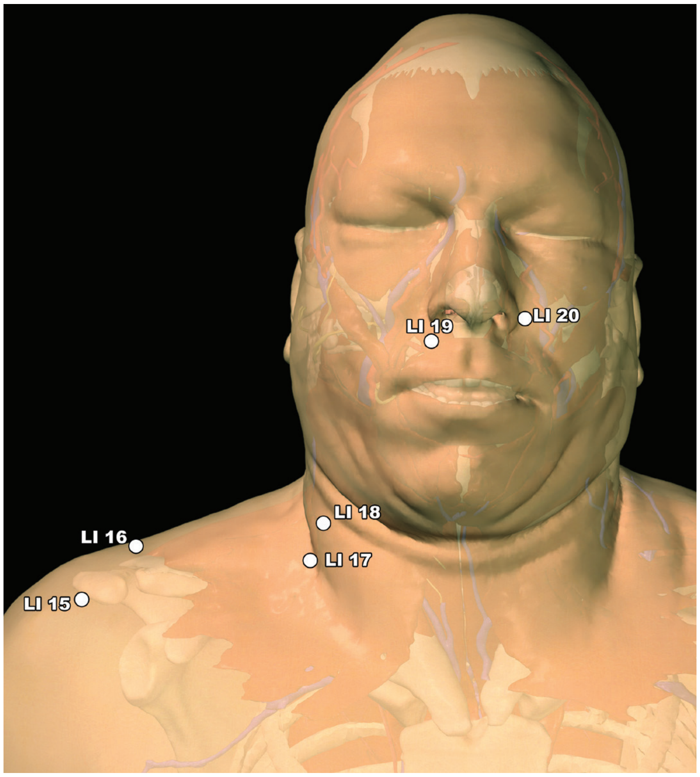
The generalized (rather than local neural or musculoskeletal) effects of stimulating points on the LI channel involve somatosympathetic pathways that reflex through the trigeminocervical segments of the spinal cord.[1,2,3] These neuroanatomic connections explain the frequent appearance of LI points for toothache, migraine, facial myofascial and sinus pain.[4,5,6,7,8,9]

References

1. Lenaerts ME, Oommen KJ, Couch JR, et al. Can vagus nerve stimulation help migraine? *Cephalalgia*. 2008;28:392-395.
2. Deriu F, Podda MV, Chessa G, and Tolu E. Trigeminal integration of vestibular and forelimb nerve inputs. *Archives Italiennes de Biologie*. 1999;137:63-73.
3. Phelan KD and Falls WM. The spinotrigeminal pathway and its spatial relationship to the origin of trigeminospinal projections in the rat. *Neuroscience*. 1991;40(2):477-496.
4. Deriu F, Milia M, Sau G, Podda MV, et al. Modulation of masseter exteroceptive supporession by non-nociceptive upper limb afferent activation in humans. *Exp Brain Res*. 2003;150:154-162.
5. Deriu F, Milia M, Podda MF, Chessa G, et al. Jaw muscle response to stimulation of type II somatosensory afferents of limbs in the rat. *Exp Brain Res*. 2001;139:209-215.
6. Deriu F, Milia M, Sau G, Podda MV, et al. Non-nociceptive upper limb afferents modulate masseter muscle EMG activity in man. *Exp Brain Res*. 2002;143:286-294.
7. Bossy J. Implication of the spinal nucleus of the trigeminal nerve in acupuncture. *Acupuncture & Electro-Therapeutics Res.*, Int J. 1986;11:177-190.
8. Menétrey D and Basbaum AI. Spinal and trigeminal projections to the nucleus of the solitary tract: a possible substrate for somatovisceral and viscerovisceral reflex activation. *Journal of Comparative Neurology*. 1987;255:439-450.
9. Shoja MM, Tubbs RS, Ansarin K, et al. Proposal for the existence of a nasogastric reflex in humans, as a potential cause of upper gastrointestinal symptoms. *Medical Hypotheses*. 2007, in press.



LI points treat afflictions of the face and mouth through neuroanatomic connections between cervical and trigeminal neurons. Trigeminocervical reflexes account for the spreading and referred pain patterns from migraine and sinusitis discomfort. Afferent stimulation from medical acupuncture and related techniques modulates nociceptive input to the CNS, activating endogenous analgesic mechanisms such as endogenous opioidergic systems in the periaqueductal gray.



Topographical locations of LI points on the head, neck, and shoulder region.

LI 1

Shang Yang "Metal Yang"

On the radial side of the base of the nail of the index finger, the width of a Chinese leek leaf from the corner of the nail.

Nerves

- **Median nerve (C6):** Distal branches of the proper palmar digital nerve from the median nerve provide sensation and sympathetic input to the index finger.
- **Note about fingertip nerve supply:** The highly sensate fingertip contains sensory end organs between the volar digital skin and the nail that allows for accurate prehension of small objects.[5] The proper palmar digital nerve accompanies its arterial companion on the ventral ulnar and radial aspects of the fingers. Proximal to the base of the nail fold, the nerve divides and sends branches into the pulp of the finger as well as to the nail bed.[1] These nerve fibers provide only part of the sensory supply to the nail bed. Additional sensation is supported by structures known as "glomus bodies", identified as intertwining clusters of fine vessels and nerves. Glomus bodies modulate blood flow to the fingertip by controlling fine vessel diameter. The close proximity of glomus bodies to the nail allows for thermal transfer, similar to the heat exchange that takes place when one places a hand against a window pane.[2] Too, the finger's tip serves as a temperature regulator, highlighting the indications of Ting points such as LI 1 for heat stroke and fever.

Clinical Relevance: Distal index finger numbness or nerve damage; intensive activation of autonomic reflexes influencing attention and arousal as well as heat distribution; autonomic reflexes to the head and neck through trigeminocervical reflexes.

Vessels

- **Distal network of dorsal branches of proper palmar digital artery of the radial side of the index finger:** Distributes to the fingertip.
- **Dorsal digital artery and vein:** Participate in the arteriovenous network at the tip of the finger.
- **Nailfold and fingertip microvasculature:** Blood flow in the nail bed and surrounding region correspond to circulatory dynamics. Microcirculatory pressure and blood flow at the distal points of acupuncture channels may afford insight into a patient's general wellness.[4] Too, microvessels in the nailfold capillary beds may serve as microcosmic windows into the macrocosmic alterations reflected in the vasculature, characteristic of conditions such as autoimmune rheumatic diseases.[3] Blood flow in the nail bed and surrounding region reflects circulatory dynamics; measuring microcirculatory pressure and blood flow may yield insights into a patient's overall cardiovascular status.[4] The highly sensate fingertip contains sensory end organs between the volar digital skin and the nail that allows for accurate prehension of small objects.[5] The fingertip also serves as a temperature regulator, highlighting the indications of Ting (most distal channel points) such as LI 1 for heat stroke and fever.

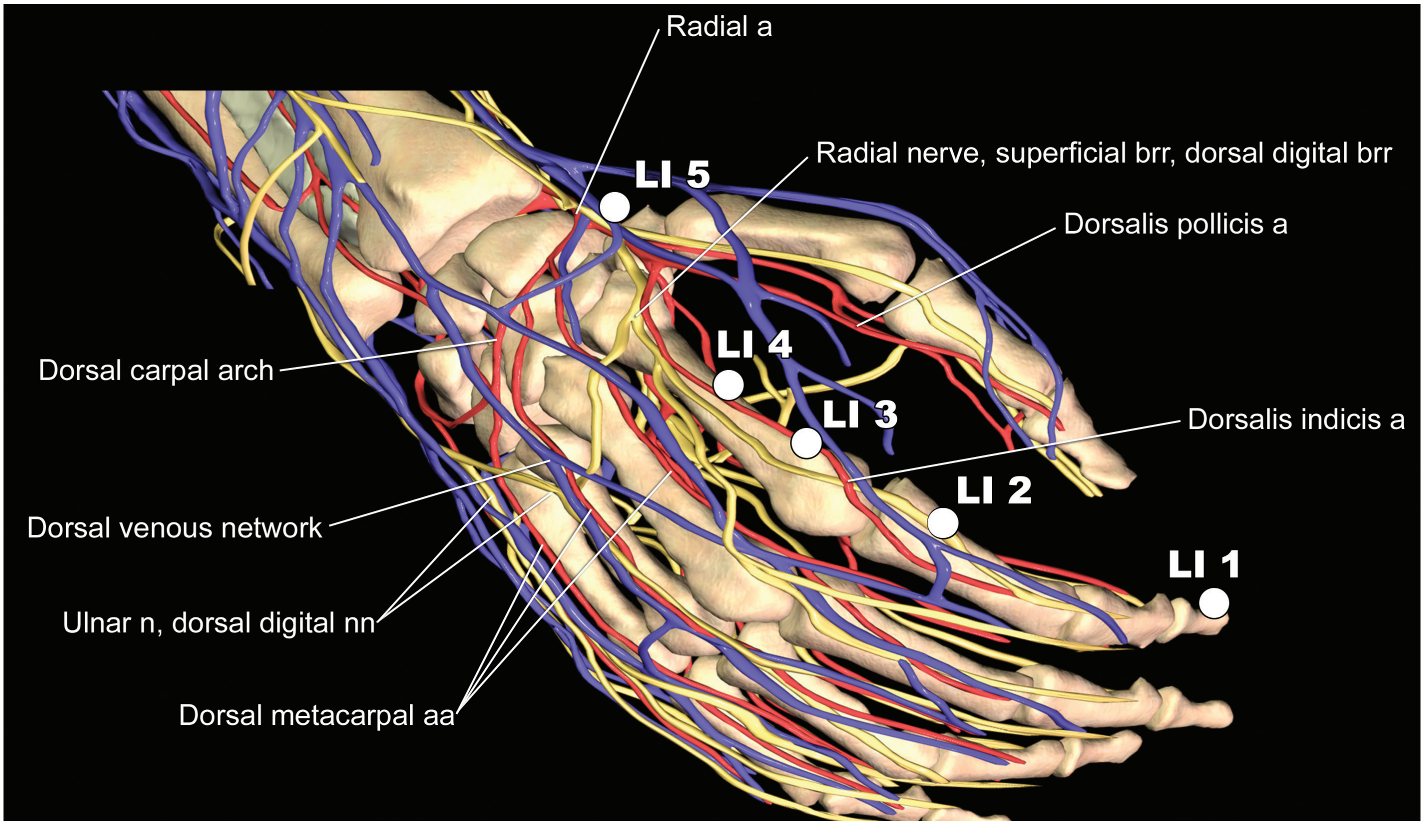


Figure 2-1. LI 1 exemplifies a typical "Ting" point or most distal point on the channel, lying just lateral to the base of the nail in densely neurovascular tissue. The microcirculatory network in this region offers an opportunity to deliver clinically relevant hemodynamic and temperature regulation through acupuncture treatment.

Clinical Relevance: As noted above in the section on LI 1 nerve supply, the rich arteriovenous supply of the distal finger produces profound autonomic shifts in hemodynamics and alertness, seemingly disproportionate to the vessels' sizes in this region.

Indications and Potential Point Combinations

- **Conditions of inflammation, hyperthermia, or sympathetic nervous system arousal, including heat stroke, fever, pharyngitis, tonsillitis, conjunctivitis:** LI 1, LI 4, LI 11, GV 14, ST 36.
- **Numbness of index finger:** LI 1, LI 2, LI 3, LI 4.
- **Coma:** LI 1, HT 9, consider other ting points.

Evidence-Based Applications

- Bloodletting at LU 11 or LI 1 in children may prevent and treat **laryngospasm** occurring post-extubation.[6]
- Acupuncture at LU 9, and all the ting points (LU 11, LI 1, PC 9, TH 1, HT 9, SI 1, KI 1, SP 1, LR 1, ST 45, GB 44, BL 67), as well as LI 4, CV 17, ST 36, ST 40, BL 58, SP 6, KI 7, and moxibustion at GV 14 resulted in rapid improvement in a 13-month old child with **staphylococcal-infected skin wounds** following a poor 50-day response to antibiotics.[7]

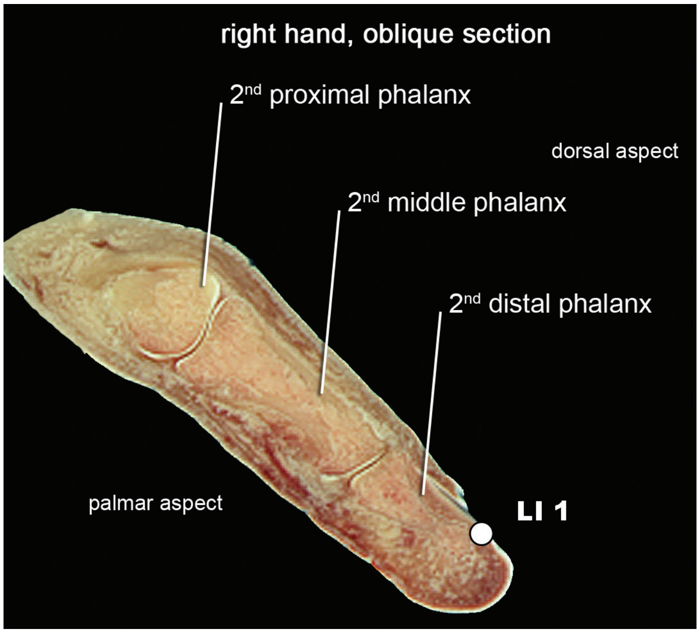


Figure 2-2. This section through the index finger shows the proper palmar digital artery coursing along the volar (palmar) surface toward the network of capillaries at the tip. LI 1, "Shang Yang", refers to the relation of this point to a Yang (hollow) organ and the metal phase, or element, both ideas from Chinese medicine. The association of organs and acupuncture points with the five phases (or elements) of metal, water, wood, fire, and earth is quaint but abstract and, as such, untestable.

References

1. Zook EG. Anatomy and physiology of the perionychium. *Clinical Anatomy*. 2003;16:1-8.
2. Zook EG. Anatomy and physiology of the perionychium. *Clinical Anatomy*. 2003;16:1-8.
3. Cutolo M, Sulli A, Secchi ME, et al. Nailfold capillaroscopy is useful for the diagnosis and follow-up of autoimmune rheumatic diseases. A future tool for the analysis of microvascular heart involvement? *Rheumatology*. 2006;45:iv43-iv46.
4. Myers JB. "Capillary band width", the "nail (band) sign": A clinical marker of microvascular integrity, inflammation, cognition and age. A personal viewpoint and hypothesis. *J Neurol Sci*. 2009, doi: 10.1016/j.jns.2009.02.320.
5. Zook EG. Anatomy and physiology of the perionychium. *Clinical Anatomy*. 2003;16:1-8.
6. Lee CK, Chien TJ, Hsu JC, et al. The effect of acupuncture on the incidence of postextubation laryngospasm in children. *Anesthesia*. 1998;53(9):917-920.
7. Diogenes MSB, Carvalho ACC, and Tabosa AMF. Acupuncture and moxibustion as fundamental therapeutic complements for full recovery of staphylococcal skin infection after a poor 50-day treatment response to antibiotics. *J Alt Comp Med*. 2008;14(6):757-761.

LI 2

Er Jian "Second Space"

On the radial side of the index finger, in a depression distal to the 2nd metacarpophalangeal joint, at the junction of the base and the shaft of the proximal phalanx, along the dorsal/palmar skin junction.

Tendons

- **First dorsal interosseous tendon:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and flex the metacarpophalangeal joints.
- **First lumbrical tendon:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.
- **Extensor digitorum tendon:** Extends the fingers at the metacarpophalangeal joints and the hand at the wrist.
- **Extensor indicis tendon:** Extends the index finger and helps extend the hand. Allows the index finger to operate independently of other fingers.

Clinical Relevance: Difficult or painful index finger movement; degenerative joint disease or other causes of arthralgia and arthrosis of the 2nd metacarpophalangeal joint, leading to tendinopathy; overuse syndromes.

Nerves

- **Radial nerve (C5-C8):** Supplies all muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of this deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm innervates the skin of the posterior the forearm to the wrist. The posterior antebrachial cutaneous nerve innervates the lateral arm, posterior forearm, and wrist.
- **Median nerve (C6-T1):** Gives motor function to the lumbrical muscles of the 2nd and 3rd digits and sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (i.e., thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. The median nerve branches into the recurrent (thenar), lateral, medial, and palmar cutaneous nerves. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

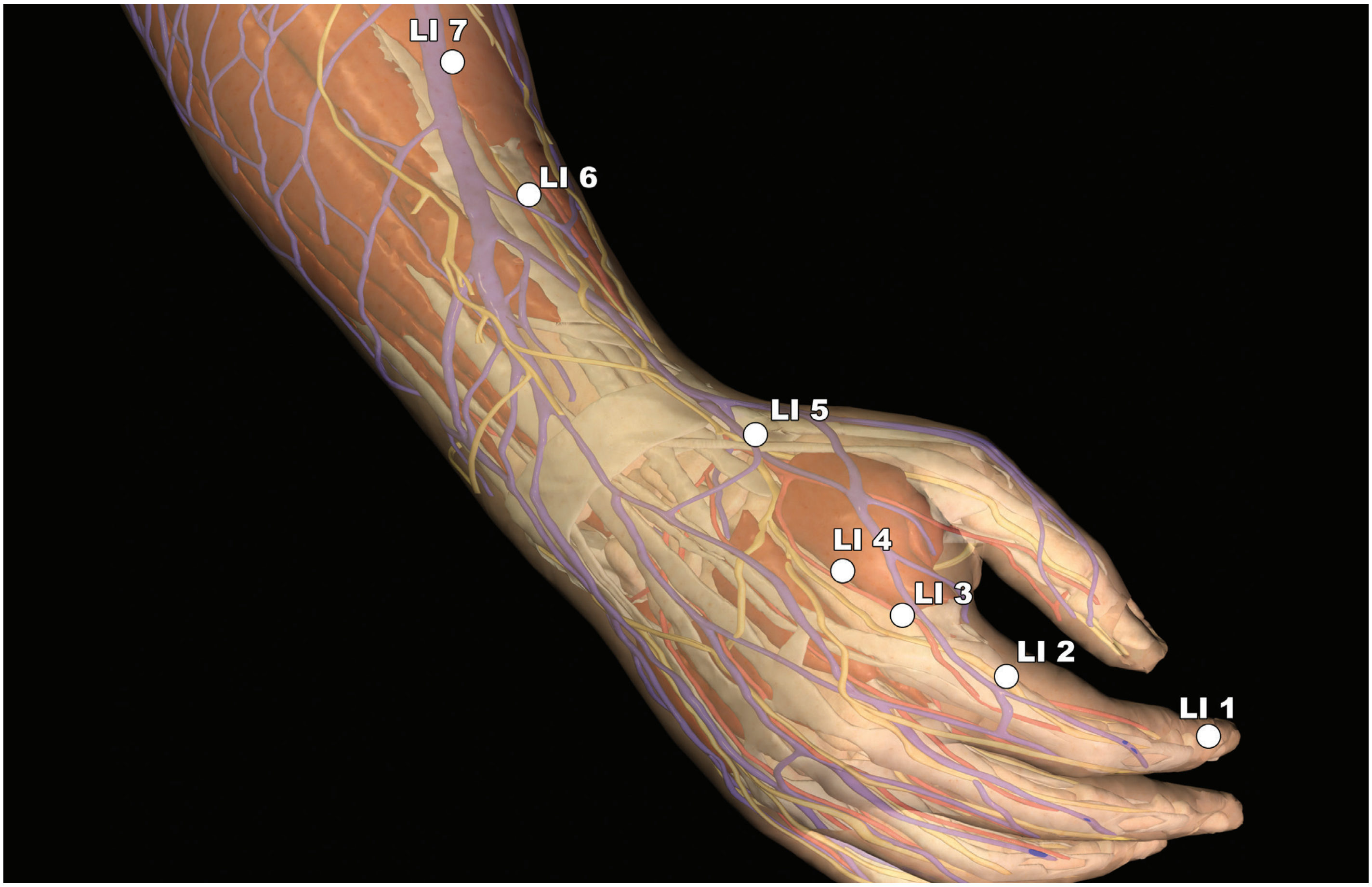


Figure 2-3. LI 2, "Second Space", the second point on the channel, sits at the metacarpophalangeal joint on the second (index) finger.

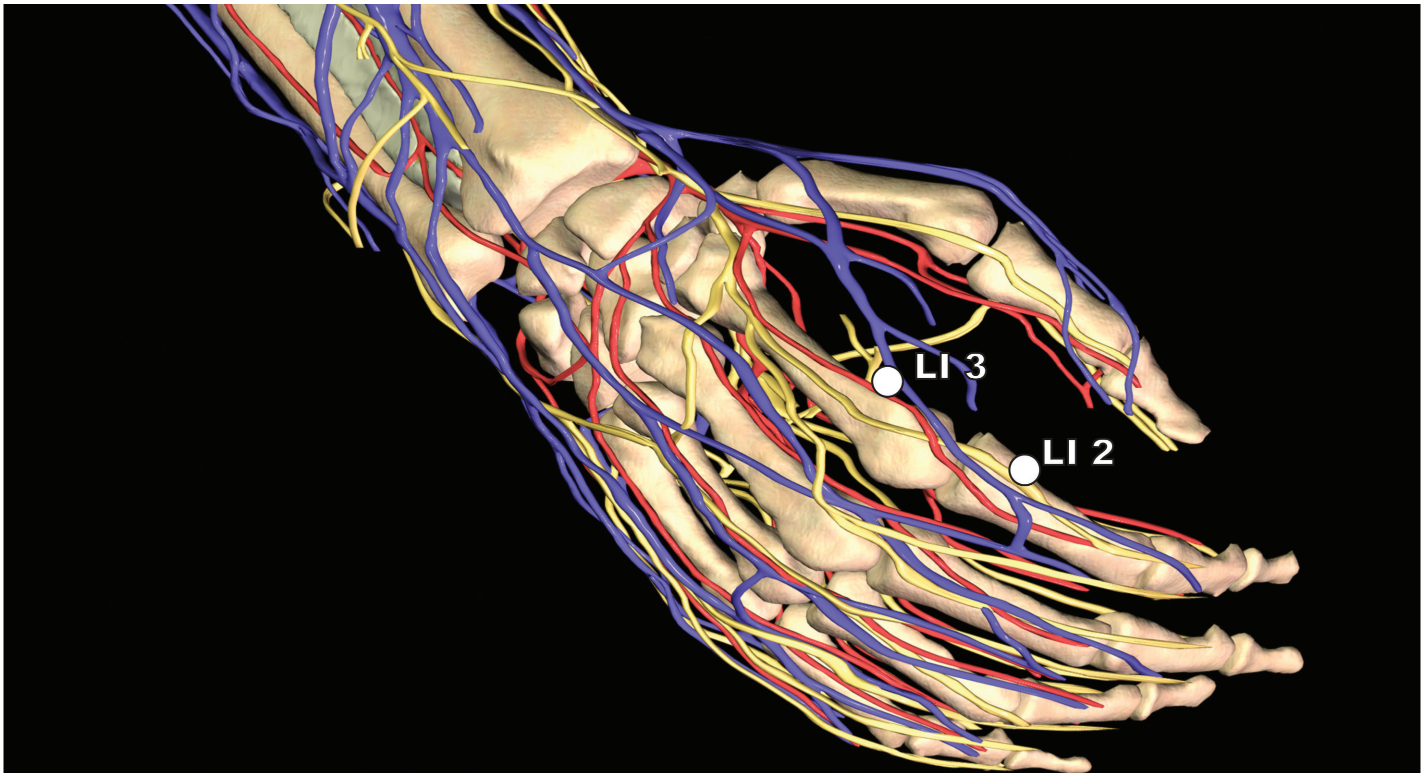


Figure 2-4. Both LI 2 and LI 3 treat local joint pain based on their periarticular locations. Their dense sympathetic and somatic sensory supply confer added effects on autonomic regulation.

Clinical Relevance: Carpal tunnel syndrome or other causes of median nerve entrapment; radial nerve injury, post-traumatic recovery of index finger injury; overuse syndromes involving the 2nd metacarpophalangeal joint.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Radialis indicis artery:** Arises from either the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.
- **Dorsalis indicis artery:** Supplies the dorsal radial aspect of the index finger.
- **Dorsal digital artery and vein:** Circulates blood to and from the fingertip, respectively.
- **Proper palmar digital artery and vein:** Distributes to the fingertip.

Clinical Relevance: Peripheral vascular disease affecting index finger mobility and/or tissue health.

Indications and Potential Point Combinations

- **Index finger arthralgia at the metacarpophalangeal joint:** LI 2, LI 3, LI 4.

Evidence-Based Applications

- Unilateral, manual acupuncture at LI 2 produced bilateral activation of the insula and operculum (sites in the brain associated with gustation and salivation) as well as improved saliva production compared to stimulation of a sham site.[1]

References

1. Deng G, Hou BL, Holodny AI, et al. Functional magnetic resonance imaging (fMRI) changes and saliva production associated with acupuncture at LI-2 acupuncture point: a randomized controlled study. *BMC Complementary and Alternative Medicine*. 8:137. doi:10.1186/1472-6882-8-37

LI 3

San Jian "Third Space"

On the radial side of the index finger, in a depression proximal to the 2nd metacarpophalangeal joint and head of the 2nd metacarpal bone, at the dorsal/palmar skin junction.

Muscles

- **First dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and flex the metacarpophalangeal joints.
- **First lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.
- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.

Clinical Relevance: Difficult or painful index finger movement; restricted apposition of the thumb and forefinger (index finger); degenerative joint disease or other causes of arthralgia and arthrosis of the 2nd metacarpophalangeal joint, leading to tendinopathy; overuse syndromes.

Nerves

- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.
- **Median nerve (C6-T1):** Innervates all of the thenar muscles, except for the adductor pollicis and deep head of the flexor pollicis brevis. Supplies the lumbrical muscles for the 2nd and 3rd digits and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

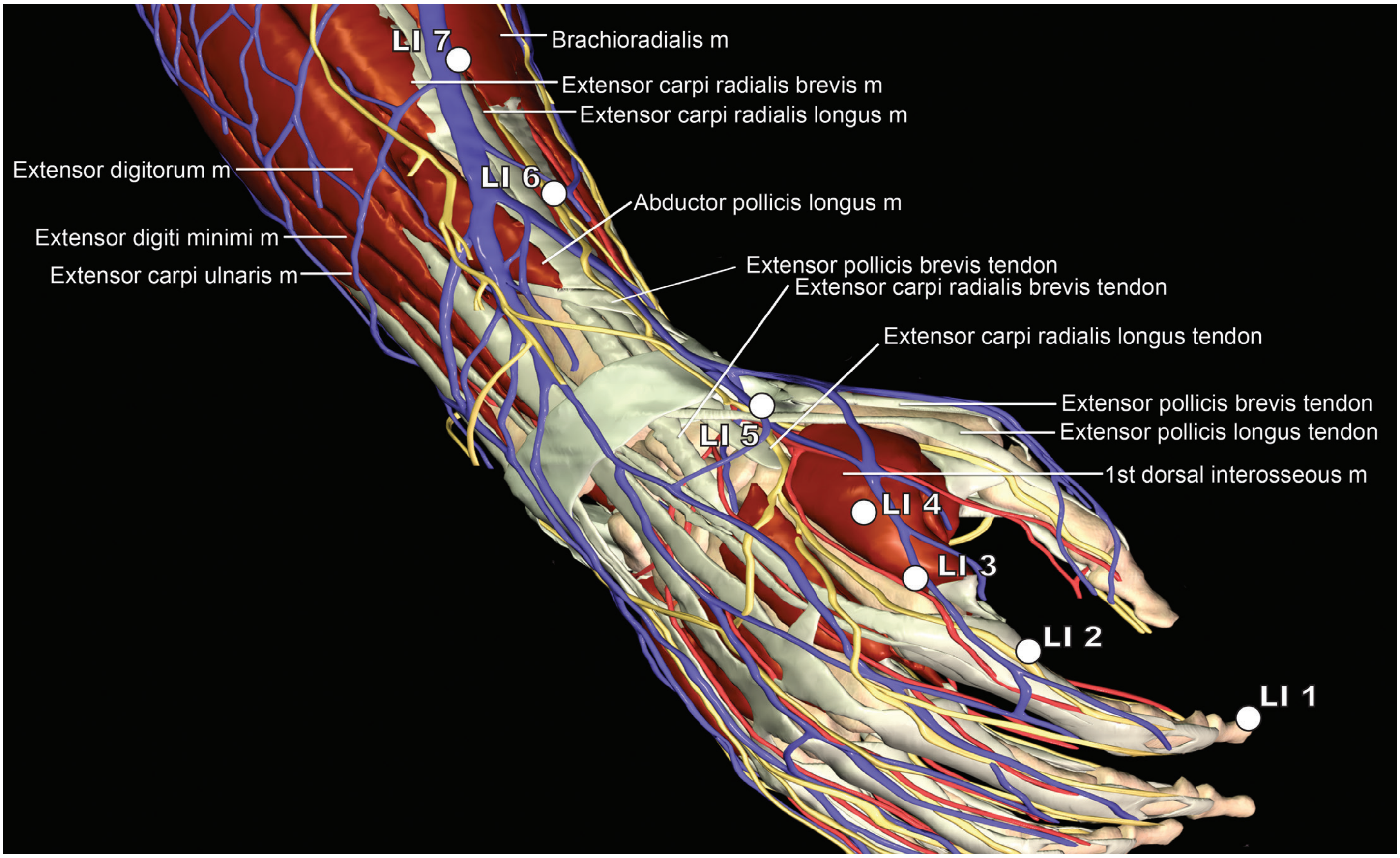

LI 7
Brachioradialis m
Extensor carpi radialis brevis m
Extensor carpi radialis longus m
Extensor digitorum m
LI 6
Abductor pollicis longus m
Extensor digiti minimi m
Extensor carpi ulnaris m
Extensor pollicis brevis tendon
Extensor carpi radialis brevis tendon
Extensor carpi radialis longus tendon
Extensor pollicis brevis tendon
Extensor pollicis longus tendon
LI 5
1st dorsal interosseous m
LI 4
LI 3
LI 2
LI 1

Figure 2-5. LI 3, "Third Space", identifies this third point on the LI channel.

- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles, i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It splits into four branches: the palmar cutaneous, dorsal, superficial, and deep branches of the ulnar nerve. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring fingers. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal little finger, the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), as well as the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Carpal tunnel syndrome or other causes of median nerve entrapment; radial nerve injury, post-traumatic recovery of index finger injury; overuse syndromes involving the 2nd metacarpophalangeal joint; dysfunction of intrinsic muscles of the hand from ulnar or median neuropathy.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Radialis indicis artery:** Arises from the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.
- **Dorsalis indicis artery:** Courses along the dorsal radial aspect of the index finger.

Clinical Relevance: Peripheral vascular disease affecting index finger mobility and/or tissue health.

Indications and Potential Point Combinations

- **Index finger arthralgia at the metacarpophalangeal joint:** LI 3, LI 2, LI 4.

LI 4

He Gu “Union Valley”

On the dorsum of the first interosseous space of the hand, closer to the index finger than the thumb, at the midpoint of the shaft of the 2nd metacarpal bone, in the belly of the first interosseous dorsalis muscle. The point occurs at the highest part of the muscle bulge when the thumb and index finger are squeezed together. Take LI 4 at the point where the bulge is level with the end of the crease.

Caution when treating pregnant women!

Muscles

- **First dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.
- **First lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.
- **Adductor pollicis muscle:** Adducts the thumb toward the middle finger.
- **Extensor pollicis longus tendon:** Extends the distal phalanx of the thumb at the metacarpophalangeal joint and the interphalangeal joint.

Clinical Relevance: Complaints of thumb pain and arthritis may develop not only due to joint degeneration, but also myofascial trigger points in the thumb movers (i.e., flexors, extensors, abductors, adductors). Thus, one should employ scientific, medical acupuncture and related techniques (SMARTs) to address soft tissue restriction and trigger point pathology that limits motion from a regional perspective as well as treat pain and tenderness locally.

Nerves

- **Radial nerve (C5-C8):** Supplies all the muscles in the dorsal brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the dorsal forearm to the wrist. The posterior antebrachial cutaneous nerve supplies the skin of the lateral brachium, dorsal antebrachium, and wrist.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. Its four terminal nerves include: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin overlying the carpal bones on the ulnar

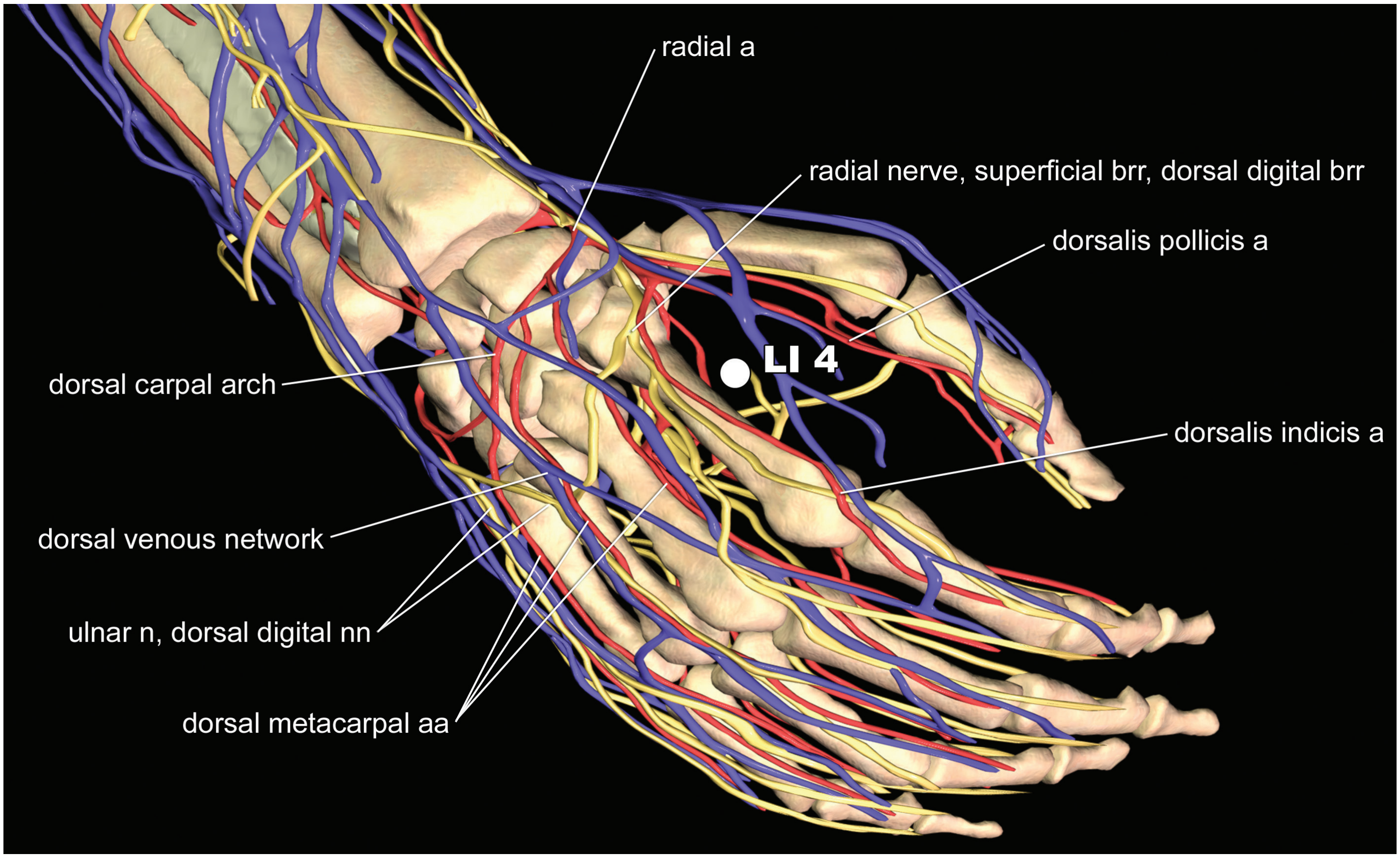


Figure 2-6. LI 4 sits midway along the radial aspect of the shaft of the second metacarpal bone, seen here, and also in the mid-belly of the first dorsal interosseous muscle, as shown in Figure 2-7. The name “Hegu” refers both to a mountain metaphorically formed when approximating the thumb and forefinger. “Hegu” also means “Union Valley”, for the dip that develops by pulling those digits apart.

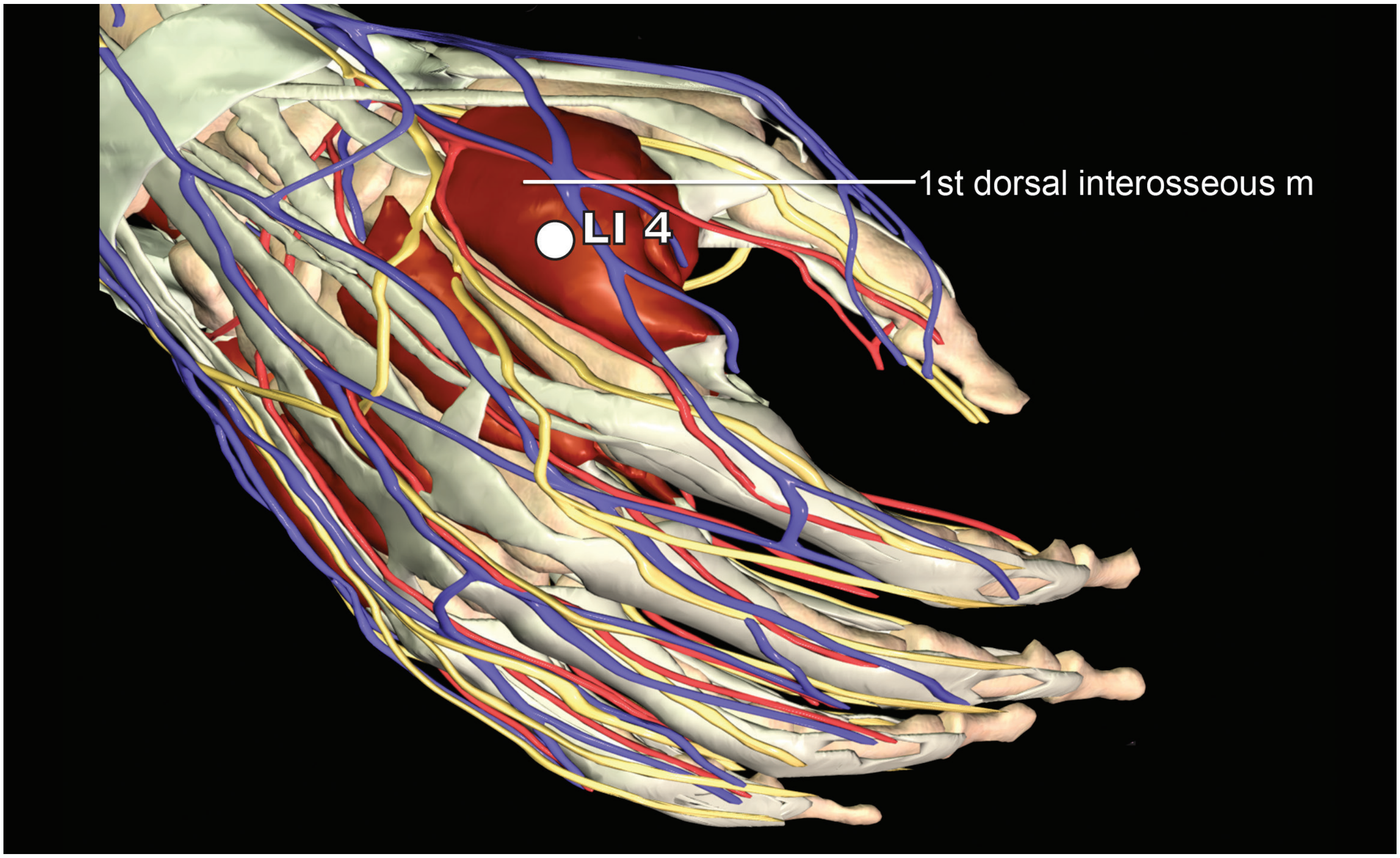


Figure 2-7. The fleshy first dorsal interosseous muscle provides a suitably large target for this highly regarded acupuncture point.

side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle and sensation to the skin of the palmar and distal dorsal aspects of the little finger, the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), along with the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

- **Median nerve (C6-T1):** Innervates all thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Supplies the lumbrical muscles for the 2nd and 3rd digits and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), the radial aspect of the ring finger, and the adjacent palmar areas. Four terminal median nerves include the recurrent (thenar), lateral, medial, and palmar cutaneous branches. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.
- **A note about sympathetic fibers:** The brachial plexus conveys sympathetic and sensory fibers to the lower two-thirds of the brachial artery and all of its branches. Near their destination, these fibers exit the nerve and course through connective tissue to the vessel.
- As described more fully below, distal vessels are more densely innervated than are proximal ones. This, in part, accounts for the stronger autonomic responses associated with distal acupuncture points, especially those at the ends of the channels. Nearly all endpoints land adjacent to the base of the nail of fingers and toes. The Chinese call these"Ting points".
- Specifically, the proximal third of the brachial artery receives its sensory and sympathetic nerves from the radial, median, and musculocutaneous nerves, as does the posterior humeral circumflex artery. The middle third of the brachial artery carries fibers mainly from the medial and musculocutaneous nerves, with some filaments possible from the radial and ulnar nerves. The distal third of the brachial artery is supplied by the median and musculocutaneous nerves, whereas the profunda brachii artery is innervated by fibers from the radial nerve.
- The superior and inferior ulnar collateral arteries receive sensory and sympathetic input from the median nerve.
- As arteries travel toward the fingers, their sympathetic and sensory nerve supply intensifies. That is, more sensory and sympathetic nerve fibers attach to blood vessels per unit area in distal, as opposed to proximal, segments.
- In the forearm, the vasculature's sympathetic and sensory fibers emit from the radial, medial, ulnar nerves, and antebrachial cutaneous nerves.

Specifically:

Radial artery: The proximal third of the radial artery receives input from the median nerve and the lateral antebrachial cutaneous nerves. The radial recurrent artery receives nerve fibers from the deep branch of the radial nerve and the lateral antebrachial cutaneous nerves. Innervation of the mid-portion of the radial artery is thought to be minimal. The distal third of the radial artery receives fibers from the superficial branch of the radial nerve, the lateral antebrachial cutaneous nerves, and possibly the median nerve.

Ulnar artery: The median nerve innervates the upper third of the ulnar artery and the ulnar recurrent artery. The ulnar nerve sends sensory and sympathetic fibers to the mid-portion of the ulnar artery. The ulnar nerve and the medial antebrachial cutaneous nerve supply the distal third of the ulnar artery. The palmar interosseous nerve supplies the palmar interosseous artery. **Arteries of the Hand:** The deep palmar arterial arch is innervated by the deep branch of the ulnar nerve. The superficial palmar arterial arch receives a rich nerve supply from the common digital nerve branches of the ulnar and median nerves. **The proximity of LI 4, HT 8, and PC 8 to the arterial arches of the hand explains, at least in part, their notable autonomic influences.** Each proper digital nerve innervates its accompanying artery comparable to its nerve supply of the skin. **Effects of sympathetic activation:** Sympathetic fibers provide control over both vasoconstriction and vasodilation. The largest arteries of the upper limb (subclavian and axillary) contain few vasomotor fibers. Distal vessels, in contrast, have many vasomotor fibers, as mentioned previously. Increased sympathetic drive from emotions, hemorrhage, or cold provokes vasoconstriction. Sympathetic nerves contain some vasodilator fibers; the fingers carry more vasodilator sympathetic fibers than do the toes. (Parasympathetic cholinergic vasodilator fibers, on the other hand, innervate the arteries of the external genitalia and the pial arteries of the brain.)

- The intimate anatomical relationships between nerves and blood vessels raises the question of which depends on the other during development; i.e., do nerves follow vessels or do vessels follow nerves? A series of experiments reported in 2002 suggested that peripheral nerves secrete vascular endothelial growth factor (VEGF) and thereby outline the pattern of blood vessel branching and arterial differentiation in the skin.[49]

Clinical Relevance: The plurality of nerves congressing near or around LI 4 justify the point's major significance in acupuncture. Every nerve reaching the hand supplies structures located in the vicinity of this point, including the median, radial, ulnar, and sympathetic nerves. This neural diversity reflects the multiplicity of clinical applications, from motor dysfunction to sensory disturbances, as well as from local dysregulation of vasomotor tone to upper body dysautonomia.

Vasoregulation determines how much blood reaches tissues. Periarterial autonomic nervous plexuses alter arterial tone, aided by endothelium-dependent, myogenic, and humoral mechanisms. Defects in hemodynamic homeostasis cause dysfunctional thermoregulation, abnormal blood pressure, and insufficient redirection of flow to the heart and brain under stress states such as hypoxia.[50] VEGF, along with a host of neurotransmitters, neuropeptides, and neurotrophins, orchestrate the regulation of vessel diameter through periarterial nerves.

Vessels

- **Double (superficial and deep) palmar arch:** An arterial and venous network in the palm; each has a superficial and deep loop, formed by the terminating ulnar and radial arteries and veins.
- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Radialis indicis artery:** Arises from the radial artery or the princeps pollicis artery and passes along the radial aspect of the index finger.
- **Dorsalis indicis artery:** Courses along the dorsal radial aspect of the index finger.

Clinical Relevance: Vasculature near LI 4 not only feeds and drains the tissues at the site, but also affects autonomic tone system-wide. Bidirectional signaling between periarterial sympathetic nerve fibers and vascular smooth muscle cells govern local circulation in the hand. Neuromodulation through acupuncture (and activation of a panoply of peripheral, central, and autonomic reflex arcs) thus extends to hemodynamic regulation, opening up an entirely new domain of neuro-effector sites accessible to acupuncture. Disease states characterized by altered neuro-effector function include Raynaud's phenomenon, migraine, orthostatic hypotension, essential hypertension, and congestive heart failure.[51]

Indications and Potential Point Combinations

- **The far-reaching influences of LI 4 on brain function, autonomic activity, cervicothoracic spinal cord reflexes and, secondarily, trigeminal nerve actions create a long list of neuromodulatory changes promoted by this popular acupuncture point, most widely recognized as a treatment for headache.**
- **Headache:** Trigeminal origin (face, teeth, rostral dura) – LI 4, local tender points on the face or scalp, BL 10, GV 20. Cervical origin (occipitofrontalis tension, neck pain in conjunction with head pain): LI 4, BL 10, GB 21, GB 20, GV 20, other tender points in the cervicothoracic region.
- **Dental and oral pain:** LI 4, LU 7, ST 7, CV 24, BL 10.
- **Urticaria and skin problems:** LI 4, LI 11, LI 10, ST 36, GV 14.
- **Nose and throat disorders:** tonsillitis, pharyngitis, epistaxis, rhinitis, sinusitis: LI 4, LU 7, ST 9, CV 23. For frontal sinusitis, add BL 2, GB 14, BL 3. For maxillary sinusitis, add ST 3.
- **Conjunctivitis and eye problems:** LI 4, TH 23, GB 2, BL 2.
- **Delay of menses ("menstrual block"):** LI 4, SP 6, ST 36.
- **Arm and hand pain or restricted movement:** LI4, identify painful or dysfunctional muscles and nerves. Consider Baxie (web spaces between the fingers) to promote nerve communication to the digits. Examine paraspinal points for tenderness or linkage to dysfunction in order to impact relevant spinal cord segments in the cervicothoracic cord. First dorsal interosseous referred pain extends to the radial aspect of the index finger and secondarily the dorsum of the hand and palmar surface of the index finger as well as the palm itself.

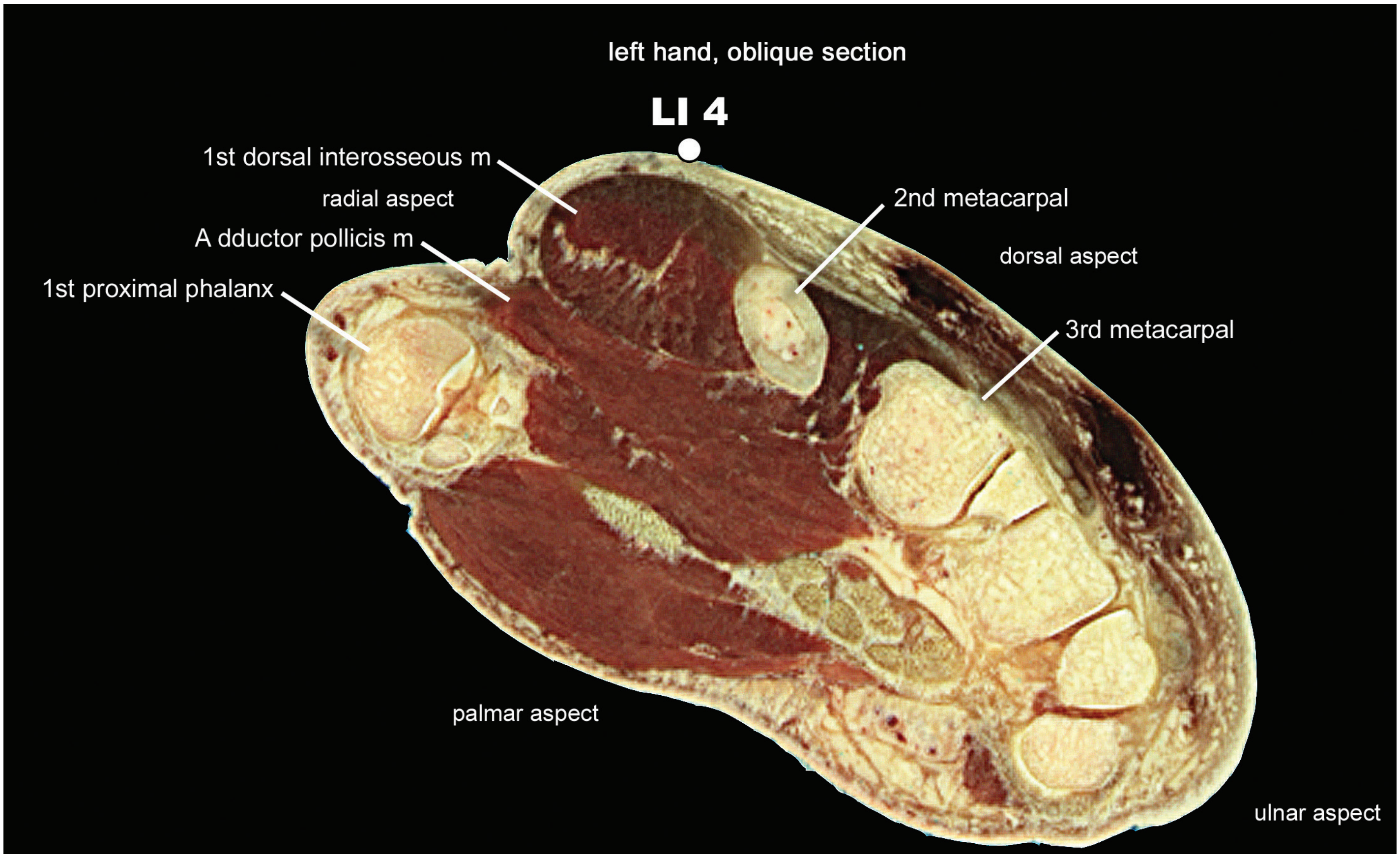


Figure 2-8. This image depicts the roundish nature of the first dorsal interosseous muscle, exhibiting the depth and potential resistance it would deliver to an acupuncture needle.

Evidence-Based Applications

- Both manual acupuncture and low-frequency EA to LI 4, ST 4, ST 7, ST 36, HT 7, SP 6, and KI 5 caused significant increases in local blood flow overlying the parotid gland, suggesting a mechanism for increased salivary flow in **xerostomia** patients.[1]
- Electroacupuncture at LI 4 and SI 3 produce significant **changes in skin temperature** of the hand.[2,3]
- Acupuncture at LI 4 and LI 10 had a **modulatory effect on skin blood flow and heart rate.**[4]
- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **keratoconjunctivitis sicca** (KCS, or dry eye).[5]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an **increase in the local blood flow in the skin over the parotid gland** in patients with Sjögren's syndrome.[6]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **KCS.**[7]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[8]
- Acupuncture at LI 4 and SP 6 can **shorten** the time interval between estimated date of confinement (EDC) and **actual delivery time**. Helps **support cervical ripening.**[9]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[10]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6 plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome)**.[11]
- Acupuncture at SP 6 and LI 4 was shown to **increase cervical dilatation** without causing changes in human chorionic gonadotropin (HCG).[12]
- Acupuncture at LI 4 reduced the level of expression of COX-2 enzyme in uterine endometrium and myometrium in pregnant and nonpregnant rats. Acupuncture at LI 4 also **reduced uterine motility** in pregnant rats, supporting the suggestion that LI 4 acupuncture inhibits the expression of COX-2 enzyme and may be useful in regulating complicated preterm labor.[13]
- Acupressure at LI 4 and BL 67 significantly **decreased labor pain** during the active phase of the first stage of labor.[14]
- Electroacupuncture at LI 4 and LU 6 **normalized the pattern of leukocytes**, and decreased heart rate.[15]
- Case series reported electroacupuncture at GB 14, SI 18, ST 7, GB 20, and LI 4 was effective treatment for peripheral **facial paralysis.**[16]

- Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a reduction of minimum alveolar concentration (MAC) of isoflurane by 16.7% in dogs. Acupuncture-assisted anesthesia thus **potentiated the anesthetic effects of volatile anesthetic agents**.[17]

- LI 4, CV 21, and CV 22 **improved cancer-related breathlessness**.[18]

- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/ LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[19]

- Laser acupuncture significantly outperformed sham laser for the treatment of mild to moderate **depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[20]

- Acupuncture stimulation of LI 4 and PC 6 **modulates heart rate variability** differently under fatigue or non-fatigue states.[21]

- Acupuncture at LI 4 **modulates cortical excitability**.[22]

- Pain relief following acupuncture at LI 4 may relate at least in part to decreased regional cerebral blood flow in the putamen.[23]

- Acupuncture at LI 4, LR 3, and PC 6 inhibited sympathetic activation during mental **stress** in advanced heart failure patients.[24]

- Acupuncture at LI 4 and ST 36 activated the hypothalamus and nucleus accumbens. Both of these brain structures are important in mediating acupuncture analgesia. Acupuncture at LI 4 and ST 36 deactivated areas within the limbic system, including the rostral part of the anterior cingulate cortex, amygdala formation, and hippocampal complex. **Limbic deactivation** may play a role in acupuncture analgesia by affecting pain perception – in particular, its affective-cognitive aspect.[25]

- Acupuncture of LI 4 **activated the hypothalamus** (thought to be a key neural substrate mediating acupuncture analgesia), the insula (a cortical region integrating critical functions including visceral sensory, visceral motor, motor association, vestibular, and language activities), the anterior cingulate cortex (possibly involved in mediating the de qi phenomenon), and the cerebellum (interconnected to the hypothalamus by both direct and indirect pathways).[26]

- LI 4 deactivated the nucleus accumbens, amygdala, hippocampus, parahippocampus, hypothalamus, ventral tegmental area, anterior cingulate gyrus, caudate, putamen, temporal pole, and insula, while it caused activation of the somatosensory cortex. This suggests that the complex mechanisms of acupuncture may involve **modulation of activity of subcortical structures**.[27]

- Acupuncture at LI 4 **modified somatosensory evoked potentials**.[28]

- Acupuncture at LI 4, ST 36, SP 6, and SP 9 **reduced discomfort and anxiety** in patients undergoing **colonoscopy**.[29]

- Acupuncture at LI4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome.**[30]

- Transcutaneous electrical nerve stimulation (TENS) at LI 4, LU 10, BL 57, and ST 36 effectively **reduced rectal hypersensitivity** in diarrhea-predominant irritable bowel syndrome.[31]

- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully **treated sleep-related laryngospasm with gastroesophageal reflux**, refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[32]

- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[33]

- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[34]

- A controlled trial found “aqueous acupuncture” at LI 4 and GB 34 effective for the treatment of **postoperative pain**.[35]

- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders**, prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[36]

- Acupuncture and acupressure may be helpful in reducing **orthodontic post-adjustment pain**. *Journal of Contemporary Dental Practice.* 2005; 6(1):163-167.

- A randomized, placebo-controlled trial suggested that treatment with laser acupuncture at LU 7, LI 4, GB 14, and GB 20 benefits **chronic tension headache**.[37]

- Unilateral acupuncture for advanced **osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[38]

- Acupuncture at LI 4 and PC 6 effectively treated **acute postoperative pain** in a patient with pregnancy-induced thrombocytopenia.[39]

- Acupuncture at LI 4 and PC 6 **increased pain threshold and pain tolerance** in the skin over the thyroid.[40]

- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in **prophylaxis of migraine** compared to flunarizine.[41]

- Acupuncture at LR 3, SP 6, LI 4, GB 20, GV 20, and Taiyang outperformed transcutaneous electrical nerve stimulation and laser therapy in **reducing the frequency of migraine**, although all three treatments were effective.[42]

- Acupuncture at LI 4, ST 6, ST 7, and TH 17 was superior to placebo for the prevention of **postoperative dental pain.**[43]

- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[44]

- Acupuncture at LI 4 provided significant short-term pain reduction in **chronic orofacial pain.**[45]

- Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an effective **analgesic during oocyte aspiration**; these analgesic effects equal those of conventional analgesics.[46] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[47]

- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with chronic **low back pain.**[48]

References

1. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson B. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjogren's syndrome. *Journal of Oral Rehabilitation.* 1993;20:541-54

2. Landry MD and Scudds RA. The cooling effects of electroacupuncture on the skin temperature of the hand. *J Hand Ther.* 1996;9:359-366.

3. Ernst M and Lee MHM. Sympathetic vasomotor changes induced by manual and electrical acupuncture of the Hoku point visualized by thermography. *Pain.* 1985;21:25-33.

4. Ballegaard S, Muteki T, Harada H, Ueda N, Tsuda H, Tayama F, and Ohishi K. Modulatory effect of acupuncture on the cardiovascular system: a crossover study. *Acupuncture & Electrotherapeutics Res., Int J.* 1993;18:103-115.

5. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand.* 2004;82:283-290.

6. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation.* 1993;20:541-548.

7. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2.* New York: Plenum Press, 1998. pp. 1011-1016.

8. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.* 1995;13(2):91-92.

9. Rabl M, Ahner R, Bitschnau M, Zeisler H, and Husslein P. Acupuncture for cervical ripening and induction of labor at term – a randomized controlled trial. *Wiener Klinische Wochenschrift.* 2001;113(23-24):942-946.

10. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.

11. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.

12. Ying Y-K, Lin J-T, and Robins J. Acupuncture for the induction of cervical dilatation in preparation for first-trimester abortion and its influence on HCG. *Journal of Reproductive Medicine.* 1985;30(7):530-534.

13. Kim J-S, Shin KH, Na CS. Effect of acupuncture treatment on uterine motility and cyclooxygenase-2 expression in pregnant rats. *Gynecol Obstet Invest.* 2000;50:225-230.

14. Chung U-L, Hung L-C, Kuo S-C, and Huang C-L. Effects of LI4 and BL 67 acupressure on labor pain and uterine contractions in the first stage of labor. *Journal of Nursing Research.* 2003;11(4):251-259.

15. Mori H, Nishijo K, Kawamura H, and Abo T. Unique immunomodulation by electroacupuncture in humans possibly via stimulation of the autonomic nervous system. *Neuroscience Letters.* 2002;320:21-24.

16. Zhang X. Electric needle therapy for peripheral facial paralysis. *Journal of Traditional Chinese Medicine.* 1997;17(1):47-49.

17. Culp LB, Skarda RT, and Muir WW 3rd. Comparisons of the effects of acupuncture, electroacupuncture, and transcutaneous cranial electrical stimulation on the minimum alveolar concentration of isoflurane in dogs. *Am J Vet Res.* 2005;66(8):1364-1370.

18. Filshie J, Penn K, Ashley S, and Davis CL. Acupuncture for the relief of cancer-related breathlessness. *Palliative Medicine.* 1996;10:145-150.

19. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. *Medical Acupuncture.* 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.

20. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine.* 2005;23(3):103-111.

21. Li Z, Want C, Mak AFT, and Chow DHK. Effects of acupuncture on heart rate variability in normal subjects under fatigue and non-fatigue state. *Eur J Appl Physiol.* 2005;94:633-640.

22. Lo YL and Cui SL. Acupuncture and the modulation of cortical excitability. *NeuroReport.* 2003;14:1229-1231.

23. Schlunzen L, Vafaee MS, and Cold GE. Acupuncture of LI-4 in anesthetized healthy humans decreases cerebral blood flow in the putamen measured with positron emission tomography. *Anesth Analg.* 2007;104:308-311.

24. Middlekauff HR, Hui K, Yu JL, Hamilton MA, Fonarow GC, Moriguchi J, Maclellan WR, and Hage A. Acupuncture inhibits sympathetic activation during mental stress in advanced heart failure patients. *Journal of Cardiac Failure.* 2002;8(6):399-406.

25. Wu M-T, Hsieh J-C, Xiong J, Yang C-F, Pan H-B, Chen Y-CI, Tsai G, Rosen BR, and Kwong KK. Central nervous pathway for acupuncture stimulation: Localization of processing with functional MR imaging of the brain – preliminary experience. *Radiology.* 1999;212:133-141.

26. Hsieh J-C, Tu C-H, Chen F-P, Chen M-C, Yeh T-C, Cheng H-C, Wu Y-T, Liu R-S, and Ho L-T. Activation of the hypothalamus characterizes the acupuncture stimulation at the analgesic point in human: a positron emission tomography study. *Neuroscience Letters.* 2001;105-105.

27. Hui KKS, Liu J, Makris N, Gollub RL, Chen AJW, Moore CI, Kennedy DN, Rosen BR, and Kwong KK. Acupuncture modulates the limbic system and subcortical gray structures of the human brain: evidence from fMRI studies in normal subjects. *Human Brain Mapping.* 2000;9:13-25.

28. Abad-Alegria F, Adelantado S, and Martinez T. The role of the cerebral cortex in acupuncture modulation of the somesthetic afferent. *Am J Chin Med.* 1995;23(1):11-14.

29. Fanti L, Gemma M, Passaretti S, Guslandi M, Testoni PA, Casati A, and Torri G. Electroacupuncture analgesia for colonoscopy: a prospective, randomized, placebo-controlled study. *American Journal of Gastroenterology.* 2003;98(2):312-316.

30. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.

31. Xiao W-B and Liu Y-L. Rectal hypersensitivity reduced by acupoint TENS in patients with diarrhea-predominant irritable bowel syndrome: a pilot study. *Digestive Diseases and Sciences.* 2004;49(2):312-319.

32. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci.* 2003;326(2):107-109.

33. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate bronchodilating response in asthma patients. *J Chin Med Assoc.* 2005;68(12):591-594.

34. Fink M, Wolkenstein E, Karst M, and Gehrke A. Acupuncture in chronic epicondylitis: a randomized controlled trial. *Rheumatology.* 2002;41:205-209.

35. Chen S-C, Lu S-N, Lai C-T, Jean J-Y, Hsiao C-L, and Hsu P-T. Aqueous acupuncture for postoperative pain – a matched controlled trial. *Kaohsiung J Med Sci.* 1991;7:466-470.

36. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases.* 2001;7:109-115.

37. Ebneshahidi NS, Heshmatipour M, Moghaddami A, Eghtesadi-Araghi P. The effects of laser acupuncture on chronic tension headache – a randomised controlled trial. *Acupuncture in Medicine.* 2005;23(1):13-18.

38. Tillu A, Roberts C, and Tillu S. Unilateral versus bilateral acupuncture on knee function in advanced osteoarthritis of the knee – a prospective randomized trial. *Acupuncture in Medicine.* 2001;19(1):15-18.

39. Oomman S, Liu D, and Cummings M. Acupuncture for acute postoperative pain relief in a patient with pregnancy-induced thrombocytopenia – a case report. A*cupuncture in Medicine.* 2005;23(2):83-85.

40. Stacher G, Wancura I, Bauer P, Lahoda R, and Schulze D. Effect of acupuncture on pain threshold and pain tolerance determined by electrical stimulation of the skin: a controlled study. *American Journal of Chinese Medicine.* 1975;3(2):143-149.

41. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache.* 2002;42:855-861.

42. Allais G, De Lorenzo C, Quirico PE, Lupi G, Airola G, Mana O, and Benedetto C. Non-pharmacological approaches to chronic headaches: transcutaneous electrical nerve stimulation, lasertherapy, and acupuncture in transformed migraine treatment. *Neurol Sci.* 2003;24:S138-S142.

43. Lao L, Bergman S, Hamilton GR, Langenberg P, and Berman B. Evaluation of acupuncture for pain control after oral surgery: a placebo-controlled trial. *Arch Otolaryngol Head Neck Surg.* 1999; 125(5):567-572.

44. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine.* 2003;21(4):138-149.

45. Goddard G. Short term pain reduction with acupuncture treatment for chronic orofacial pain patients. *Med Sci Monit.* 2005;11(2):CR71-74.

46. Stener-Victorin E, Waldenström U, Nilsson L, Wikland M, Janson PO. A prospective randomized study of electro-acupuncture versus alfentanil as anaesthesia during oocyte aspiration in in-vitro fertilization. *Human Reproduction.* 1999;14(10):2480-2484.

47. Stener-Victorin E, Waldenström U, Wikland M, Nilsson L, Hägglund L, and Lundeberg T. Electro-acupuncture as a preoperative analgesic method and its effects on implantation rate and neuropeptide Y concentrations in follicular fluid. *Human Reproduction.* 2003;18(7):1454-1460.

48. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.

49. Mukouyama Y-Sm Shin D, Britsch S, et al Sensory nerves determine the pattern of arterial differentiation and blood vessel branching in the skin. *Skin.* 2002;109:693-705.

50. Storkebaum E and Carmeliet P. Review. Paracrine control of vascular innervation in health and disease. *Acta Physiologica.* 2011;203:61-86.

51. Storkebaum E and Carmeliet P. Review. Paracrine control of vascular innervation in health and disease. *Acta Physiologica.* 2011;203:61-86.

LI 5

Yang Xi "Yang Ravine"

On the radial side of the wrist, distal to the tip of the styloid process of the radius, in a depression that appears between the tendons of the extensor pollicis longus and brevis muscles, when the thumb is extended, in the anatomical snuff box. Avoid needling the radial artery and the cephalic vein.

Anatomical Snuff Box (Tabatière Anatomique)[1]

- A narrow triangular area associated with the following geometry and structures:
  - Radial side: Extensor pollicis brevis tendon
  - Ulnar side: Extensor pollicis longus tendon
  - Base: Distal edge of the extensor retinaculum
  - Bony floor: Distal radius, scaphoid, trapezium, and proximal end of the first metacarpal bone.
  - Neurovascular contents: Superficial radial nerve branches. Radial artery with a dorsal carpal branch and venae comitantes. Tributaries of the cephalic vein. Connections between the cephalic vein and the venae comitantes of the radial artery may exist within the anatomical snuff box.

Clinical Relevance: Structures inhabiting the anatomical snuff box may suffer iatrogenic injury following surgery (e.g., distal radius fixation) or intravenous catheterization of the distal cephalic vein.[2] Resultant morbidity may respond to acupuncture and related techniques implemented with the goal of reducing inflammation, scarring, and pain while normalizing circulation.

Tendons

- **Extensor pollicis brevis tendon:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.
- **Extensor pollicis longus tendon:** Extends the distal phalanx of the thumb at the metacarpophalangeal joint and the interphalangeal joint.
- **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.

Clinical Relevance: Iatrogenic injury, overuse syndrome, wrist sprain, tendinitis, weakness in the wrist.

Nerves

- **Posterior interosseous nerve (C7, C8):** The terminal branch of the deep branch of the radial nerve, the posterior interosseous nerve supplies the extensor digitorum, extensor digiti minimi, extensor carpi ulnaris, abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis muscles.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm

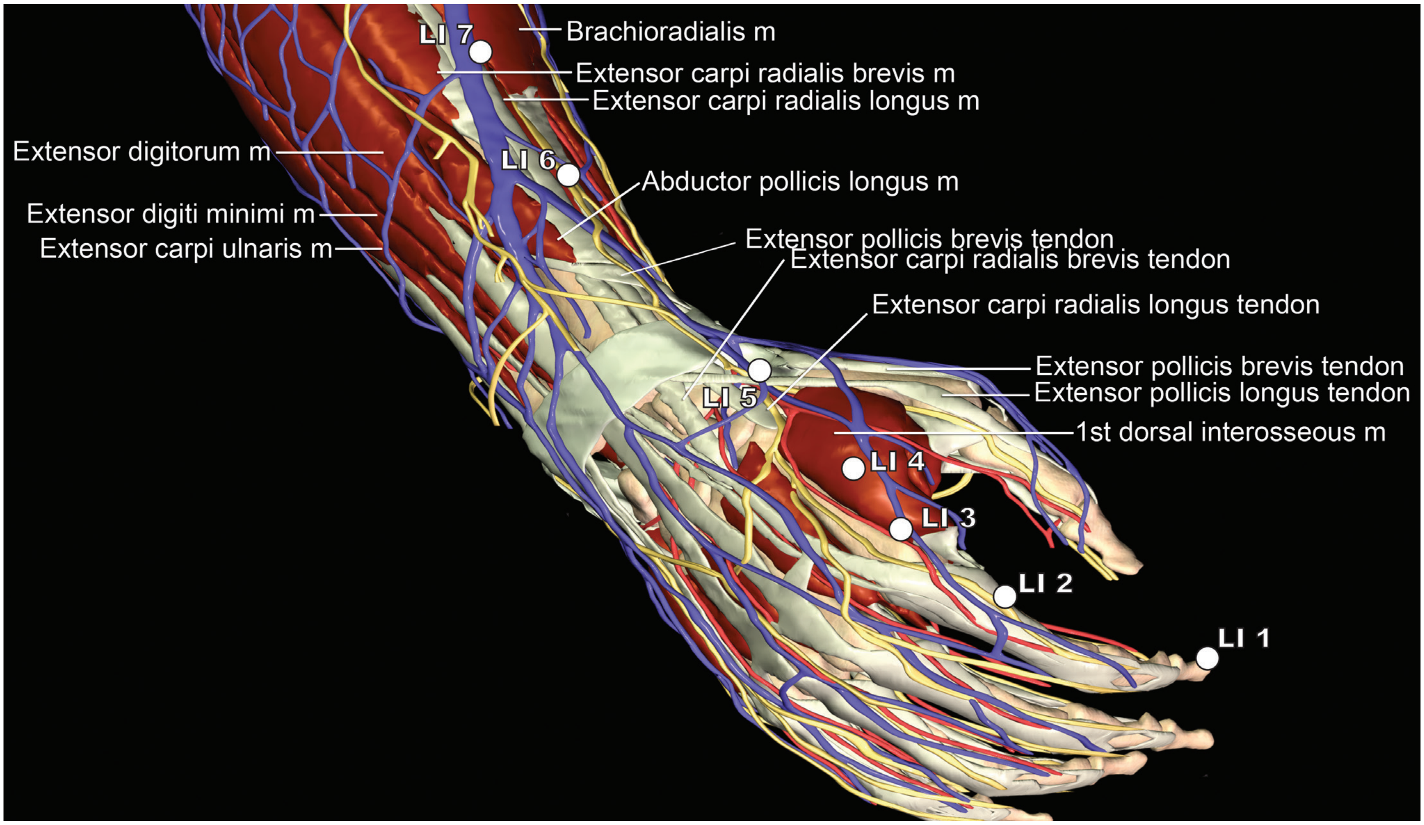

LI 7
Brachioradialis m
Extensor carpi radialis brevis m
Extensor carpi radialis longus m
Extensor digitorum m
LI 6
Abductor pollicis longus m
Extensor digiti minimi m
Extensor carpi ulnaris m
Extensor pollicis brevis tendon
Extensor carpi radialis brevis tendon
Extensor carpi radialis longus tendon
Extensor pollicis brevis tendon
Extensor pollicis longus tendon
LI 5
1st dorsal interosseous m
LI 4
LI 3
LI 2
LI 1

Figure 2-9. This image shows the tendinous borders (the extensor pollicis brevis and longus tendons) of the anatomical snuff box, between which LI 5 nestles. This alley on the dorsal (Yang) surface connotes a stream, hence the name "Yang Ravine".

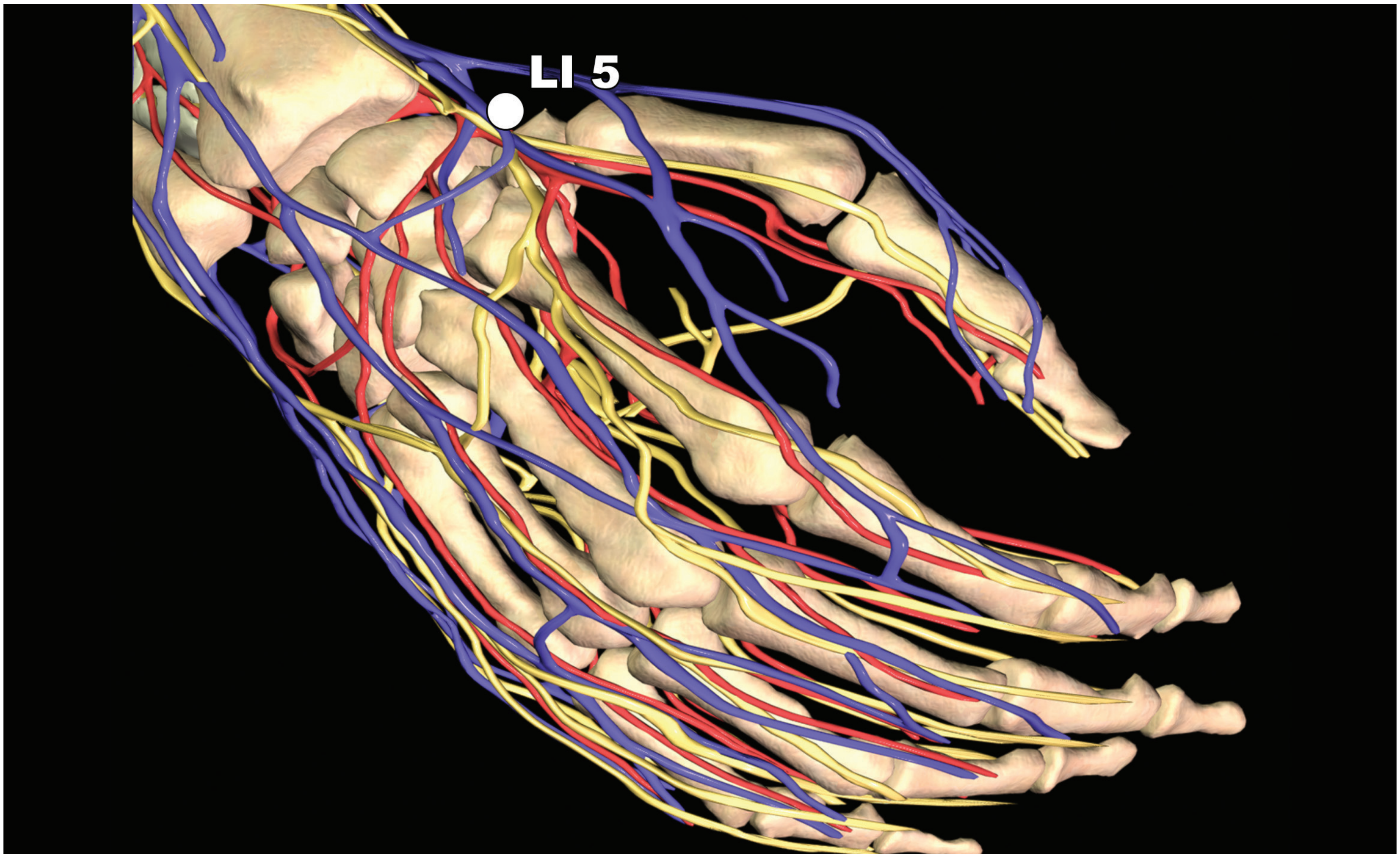


Figure 2-10. The "anatomical snuff box" or "tabatière anatomique" provides a basin that coddles the radial artery and its dorsal carpal branch, tributaries of the cephalic vein, and branches of the superficial radial nerve.

and posterior forearm and wrist.

Clinical Relevance: Iatrogenic injury, neuropathic pain, sensory loss, compressive neuropathy of the superficial branch of the radial nerve by dorsal wrist ganglion or other structures.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

Clinical Relevance: Trauma to the radial artery may produce an aneurysm in the anatomical snuff box.[3] Injury to the distal radial artery at this site may lead to digital emboli to the thumb and forefinger.[4]

Indications and Potential Point Combinations

- Extensor pollicis brevis or longus tendinitis, deQuervain's tenosynovitis: LI 5, LI 6, LI 10, LU 7, LU 10.

Evidence-Based Applications

Acupuncture at LI 5 in dogs produced a sympathomimetic effect similar to atropine in dogs with sinus arrhythmia and pulsus alternans.[5]

References

1. Tubbs RS, Salter EG, and Oakes WJ. The tabatoère anatomique. *Clin Anat.* 2006;19:299-303.
2. Tubbs RS, Salter EG, and Oakes WJ. The tabatoère anatomique. *Clin Anat.* 2006;19:299-303.
3. Walton NP, Shoudhary F. Idiopathic radial artery aneurysm in the anatomical snuff box. *Acta Orthop Belg.* 2002; 68(3):292-294.
4. Longo GM, Friedman AC, Hollins RR, et al. Distal radial artery lesion as a source of digital emboli. *J Vasc Surg.* 1998;28(4):710-714.
5. Lee DC, Lee MO, and Clifford DH. Modification of cardiovascular function in dogs by acupuncture: a review. *Am J Chin Med.* 1976;4(4):333-346.

LI 6

Pian Li "Veering Passageway"

On the radial side of the dorsal antebrachial region, 3 cun proximal to the dorsal wrist crease, or one-fourth the distance from LI 5 to LI 11, along the line that connects them. Divide the distance between LI 5 and LI 11 in half, and then halve the distance between LI 5 and the midpoint.

Muscles and Tendons

- **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis tendon:** Extends and abducts the hand at the wrist.
- **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Trigger points referring to the wrist, thumb, or hand; local discomfort.

Nerves

- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.
- **Local pain or neuralgia:** LI 6, LI 4, LI 10, other local points that

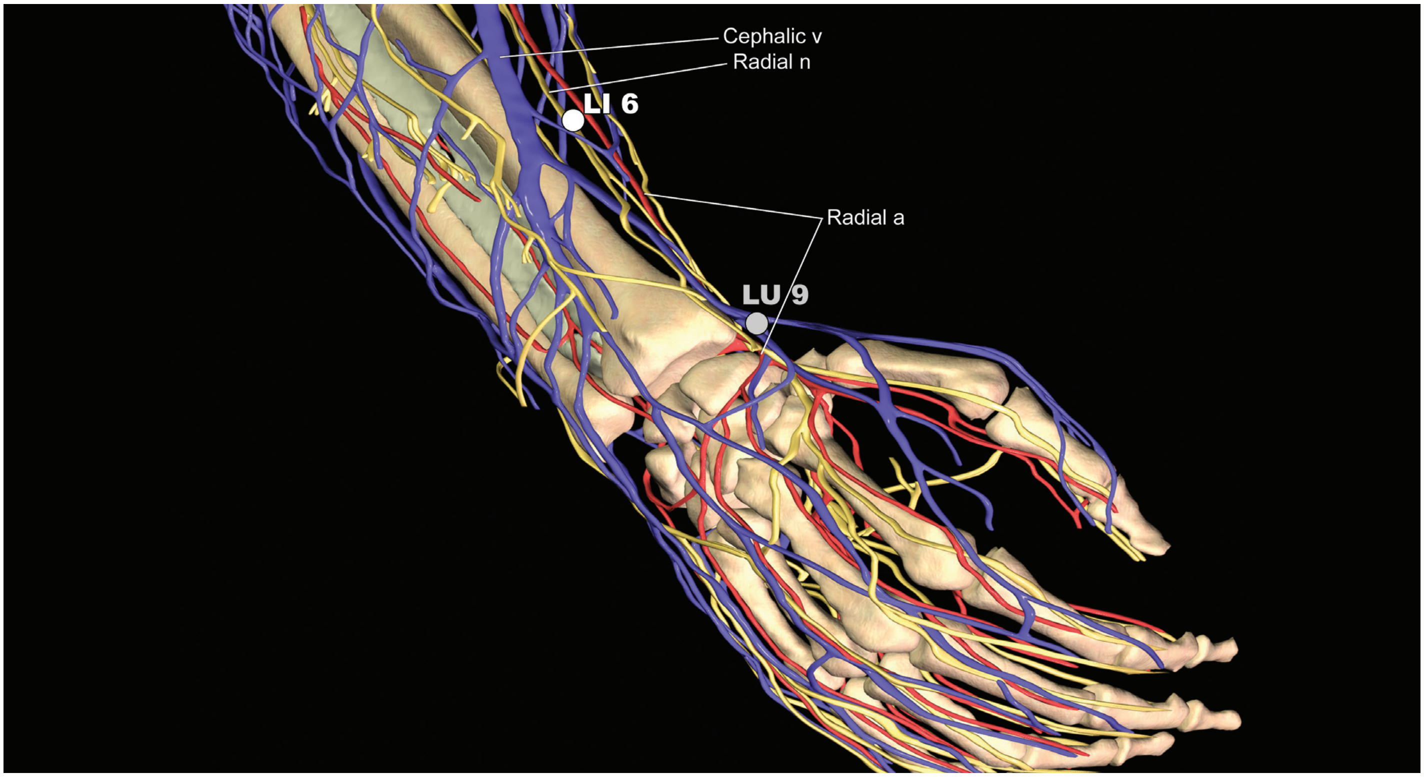


Figure 2-11. This neurovascular view of LI 6 reveals the anatomic underpinning of the Chinese medicine "Luo-Yuan" connection. That is, the Traditional Chinese Medical (TCM) approach to acupuncture asserts that connections exist between certain points on coupled channels. TCM practitioners classify these shunting points as "Luo" and "Yuan" and describe their job as one of shifting "energy" between Yang and Yin "meridians" (a term employed to describe energy pathways) or vice versa. Scientifically based medical acupuncturists, on the other hand, acknowledge the anatomic and neurovascular foundations of acupuncture, in keeping with the original viewpoint by the Chinese that acupuncture pathways constituted blood vessels and associated neural elements. As such, this beautifully portrayed neurovascular connection between LU 9 and LI 6 serves as an example of the anatomical basis of acupuncture. The Chinese name for LI 6 means "Veering Passageway" and refers to the detour taken by these structures toward the thumb.

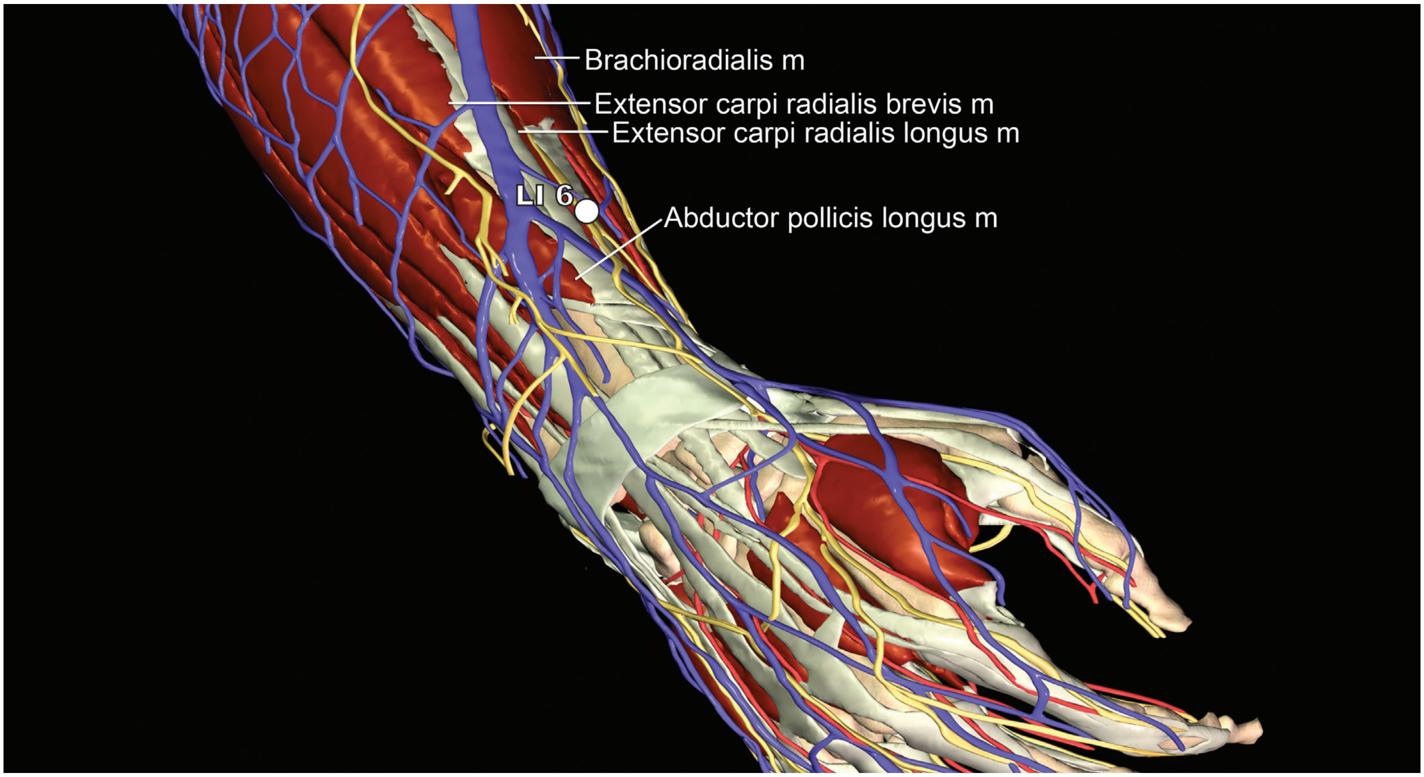

Brachioradialis m
Extensor carpi radialis brevis m
Extensor carpi radialis longus m
LI 6
Abductor pollicis longus m

Figure 2-12. This image depicts the muscles local to LI 6 and highlights the indications of LI 6 for myofascial dysfunction affecting the elbow, antebrachium, and wrist.

exhibit tenderness to palpation or relate neuroanatomically to a neuropathic nerve branch.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

- **Local pain or neuralgia:** LI 6, LI 4, LI 10, other local points that exhibit tenderness to palpation or relate neuroanatomically to a neuropathic nerve branch.

LI 7

Wen Liu "Warm Flow"

On the radial side of the posterior antebrachial region, 5 cun proximal to the dorsal wrist crease, on the line connecting LI 5 and LI 11. Locate by dividing the distance between LI 5 and LI 11 in half; take LI 7 one cun distal to this midpoint.

Muscles and Tendons

- **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

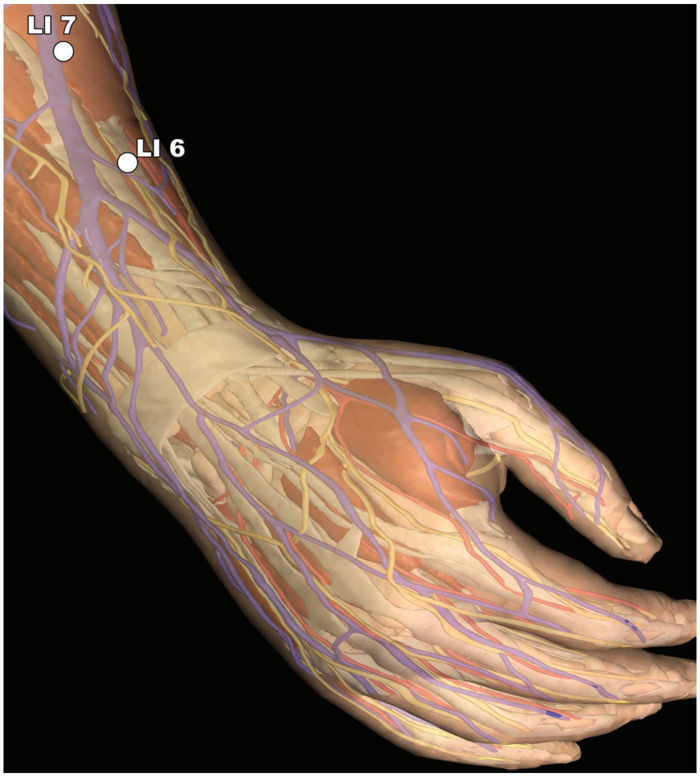


Figure 2-13. The LI 7 point designation as the "Xi-Cleft" point indicates its indications for pain and blockage along the channel. Trigger points located at myotendinous junctions may exhibit tenderness to palpation; these sections of muscles thus serve as fertile territory for myofascial palpation examination.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.
- **Forearm pain:** LI 7 if tender, palpate for trigger points in the proximal extensor carpi radialis longus and brevis muscles, as well as the abductor pollicis longus muscle.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

- **Forearm pain:** LI 7 if tender, palpate for trigger points in the proximal extensor carpi radialis longus and brevis muscles, as well as the abductor pollicis longus muscle.

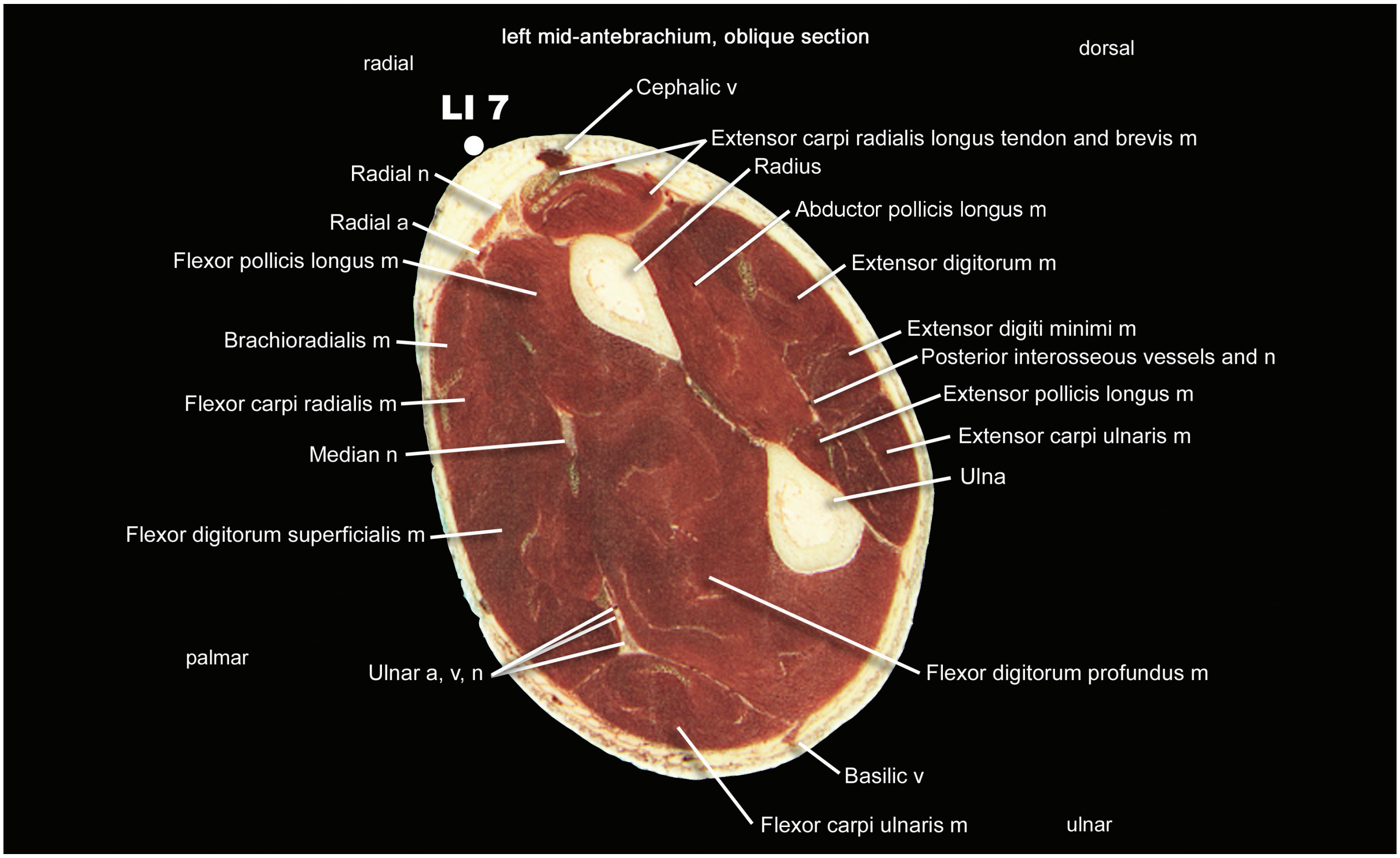

left mid-antebrachium, oblique section
radial
dorsal
LI 7
Cephalic v
Extensor carpi radialis longus tendon and brevis m
Radius
Radial n
Radial a
Abductor pollicis longus m
Flexor pollicis longus m
Extensor digitorum m
Brachioradialis m
Extensor digiti minimi m
Posterior interosseous vessels and n
Extensor pollicis longus m
Flexor carpi radialis m
Extensor carpi ulnaris m
Median n
Ulna
Flexor digitorum superficialis m
palmar
Ulnar a, v, n
Flexor digitorum profundus m
Basilic v
Flexor carpi ulnaris m
ulnar

Figure 2-14. LI 7 sits atop several antebrachial structures that accompany the LI channel and produce the expected physiologic results from acupuncture stimulation. These include the radial nerve and artery, the cephalic vein, and the extensor carpi radialis (ECR) longus tendon and ECR brevis muscle. The cephalic vein ushers through the "Warm Flow" associated with LI 7.

LI 8

Xia Lian "Lower Ridge"

On the radial side of the dorsal antebrachial region, 4 cun distal to LI 11 at the cubital crease, on the line connecting LI 5 and LI 11. Divide the distance between LI 5 and LI 11 into thirds. LI 8 is located between the junction of the middle and proximal thirds.

Muscles and Tendons

- **Extensor carpi radialis longus tendon:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Supinator muscle:** Supinates the forearm as it rotates the radius.
- **Brachioradialis muscle:** Flexes the forearm.
- **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.
- **Extensor carpi radialis brevis myofascial trigger point (with radiating pain to the dorsal wrist and hand):** LI 8, TH 4, TH 3.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

- Extensor carpi radialis brevis myofascial trigger point (with radiating pain to the dorsal wrist and hand): LI 8, TH 4, TH 3.

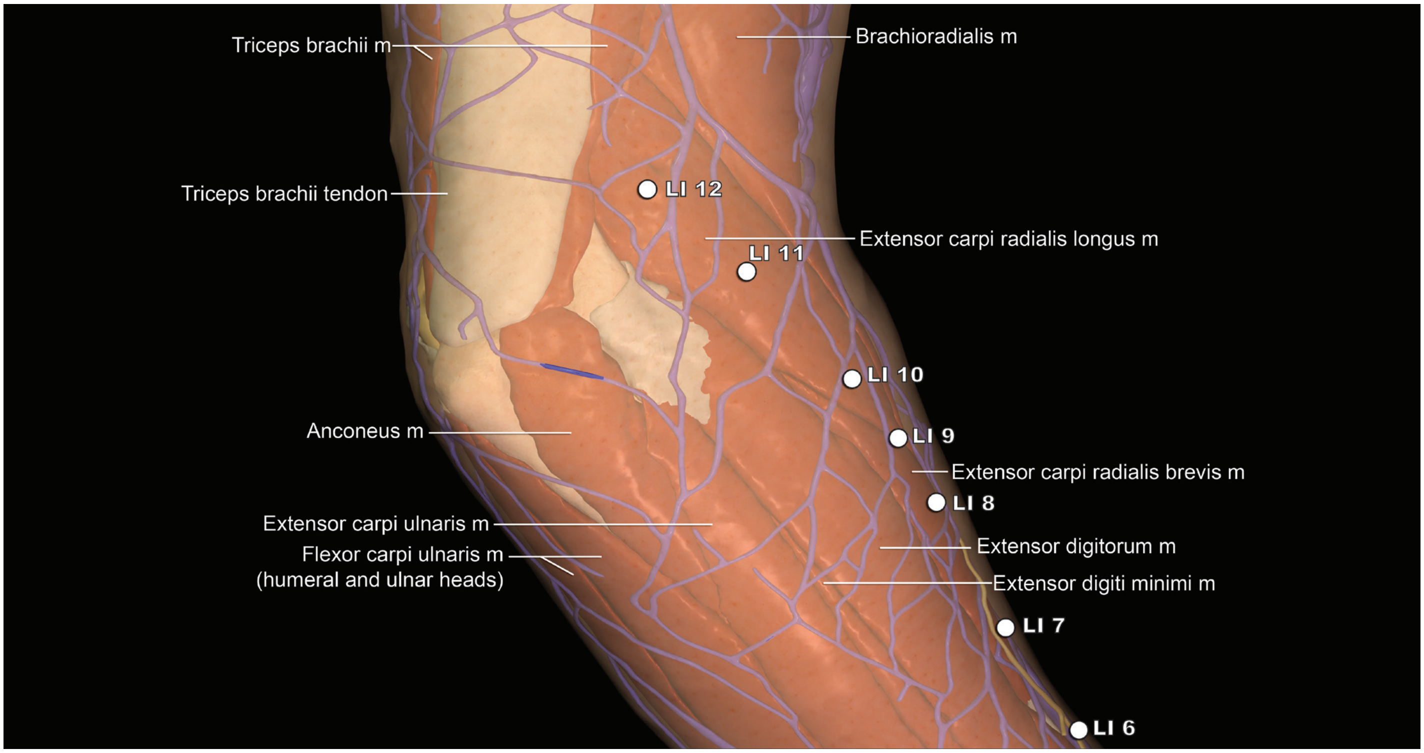


Figure 2-15. The lineup of LI points along the brachioradialis and antebrachial extensors exposes their indications for pain or discomfort involved with actions requiring these muscles' effort. LI 8 huddles on the lower ridge of the extensor bulge over the belly of the extensor carpi radialis brevis muscle.

LI 9

Shang Lian “Upper Ridge”

On the radial side of the dorsal antebrachial region, 3 cun distal to LI 11 at the cubital crease, on the line connecting LI 5 and LI 11. One way to find the point is to divide the distance between LI 5 and LI 11 in half, then bisect the distance between this midpoint and LI 11.

Muscles

- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Extensor digitorum muscle:** Extends digits II-V at the metacarpophalangeal joints and extends the hand at the wrist.
- **Brachioradialis muscle:** Flexes the forearm.
- **Supinator muscle:** Supinates the forearm as it rotates the radius.
- **Abductor pollicis longus muscle:** Extends the thumb at the carpometacarpal joint and abducts the thumb.

Clinical Relevance: Myofascial dysfunction affecting wrist, hand, and/or thumb function, mobility, and/or strength. Pain, weakness, or restriction with antebrachial supination.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation, loss of extensor function due to radial or other nerve injury or entrapment.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.
- **Tension or pain in the extensor carpi radialis longus or brevis:** LI 9, LI 8, LI 10, LI 11, and/or LI 6.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

Tension or pain in the extensor carpi radialis longus or brevis: LI 9, LI 8, LI 10, LI 11, and/or LI 6.

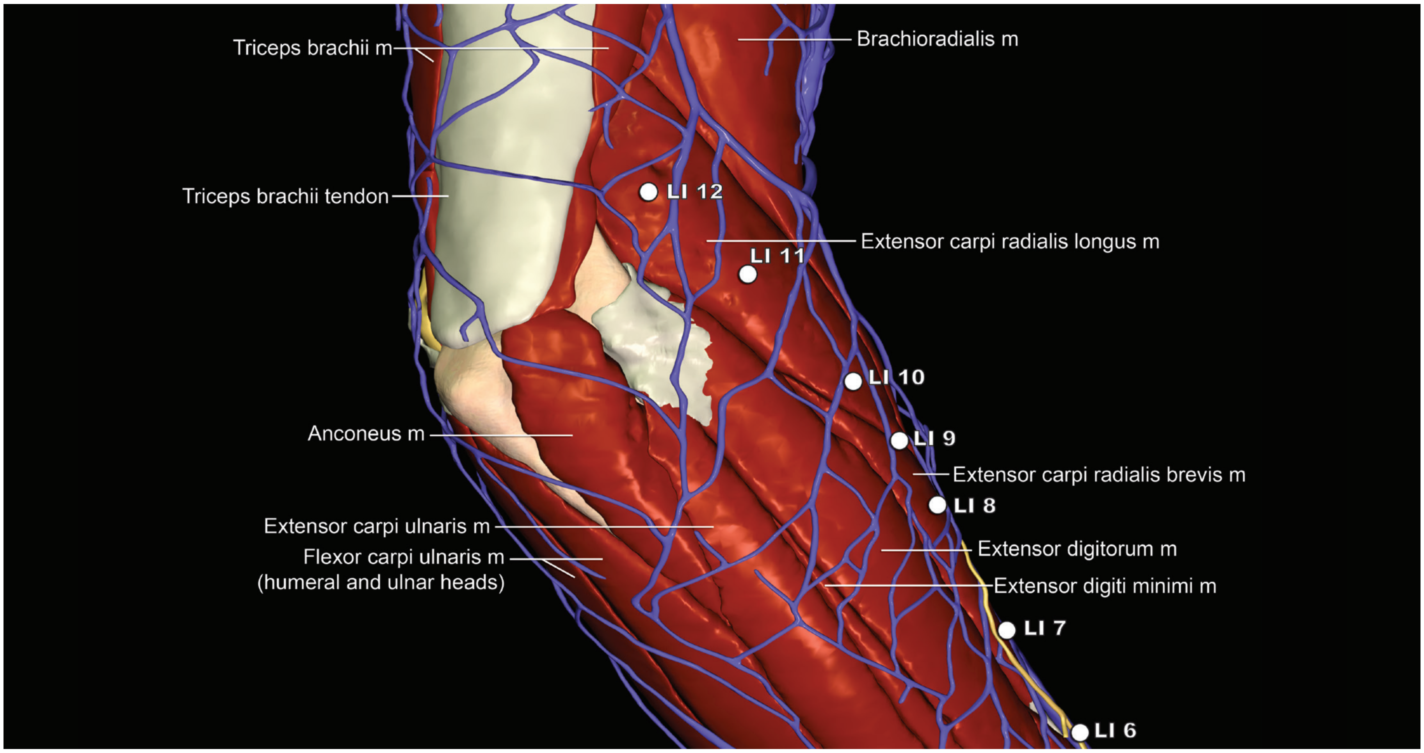


Figure 2-16. LI 9, “Upper Ridge” resides on the ridge of the radius and LI line from hand to elbow. To compare, LI 8, the “Lower Ridge”, lurked below this bony ledge..

LI 10

Shou San Li "Arm Three Li"

On the radial side of the dorsal antebrachial region, 2 cun distal to LI 11, at the cubital crease, on the line connecting LI 5 and LI 11. Usually tender to palpation for its location near the trigger point of the extensor carpi radialis longus muscle.

Muscles

- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Extensor carpi radialis brevis muscle:** Extends and abducts the hand at the wrist.
- **Extensor digitorum muscle:** Extends digits II-V at the metacarpophalangeal joints and extends the hand at the wrist.
- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Brachialis muscle:** Flexes the forearm at the elbow.
- **Supinator muscle:** Supinates the forearm as it rotates the radius.

Clinical Relevance: Myofascial dysfunction affecting elbow, wrist, and/or hand, function, mobility, and/or strength. Pain, weakness, or restriction with antebrachial supination, wrist motion, and elbow movement. Lateral epicondylitis, lateral epicondylalgia.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist. Radial nerve compression can produce motor impairments and pain.[1] The signs and symptoms associated with radial tunnel syndrome can produce pain in the lateral elbow and antebrachium, producing symptoms that overlap with lateral epicondylitis. Posterior interosseous nerve compression may additionally cause weakness in the hand.

Clinical Relevance: Altered sensation on the forearm; loss of extensor function due to radial nerve injury or entrapment. Sympathetic neuromodulation in the head, neck, and cranial thorax, pertaining mainly to respiratory conditions and immunologic dysregulation.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist

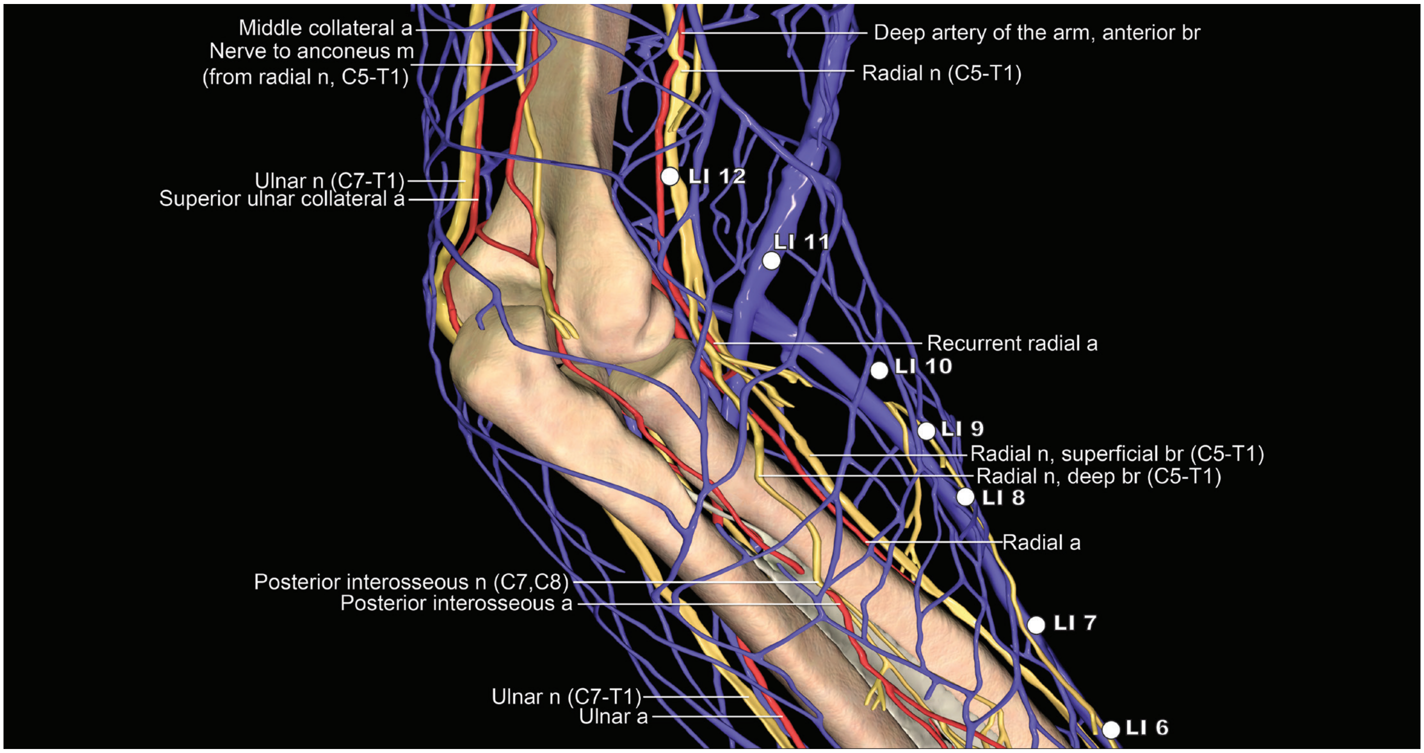

Middle collateral a
Nerve to anconeus m (from radial n, C5-T1)
Ulnar n (C7-T1)
Superior ulnar collateral a
Deep artery of the arm, anterior br
Radial n (C5-T1)
LI 12
LI 11
Recurrent radial a
LI 10
LI 9
Radial n, superficial br (C5-T1)
Radial n, deep br (C5-T1)
LI 8
Radial a
Posterior interosseous n (C7,C8)
Posterior interosseous a
LI 7
Ulnar n (C7-T1)
Ulnar a
LI 6

Figure 2-17. LI 10, "Arm Three Li" resembles ST 36, "Leg Three Li" by occupying a relatively similar position on the extensor surface of the limb amid prominent extensor muscles. This image shows LI 10 in relation to the underlying superficial and deep branches of the radial nerve. It also depicts the continuation of the radial nerve as the posterior interosseous nerve. Compression of these structures generates look-alike nerve compression syndromes (e.g., radial tunnel and posterior interosseous nerve syndrome) with overlapping symptoms that clinicians may confuse with lateral epicondylitis. Accurate diagnosis requires careful palpation, serial examination, and determination of which nerves couple with specific pain and motor impairment.

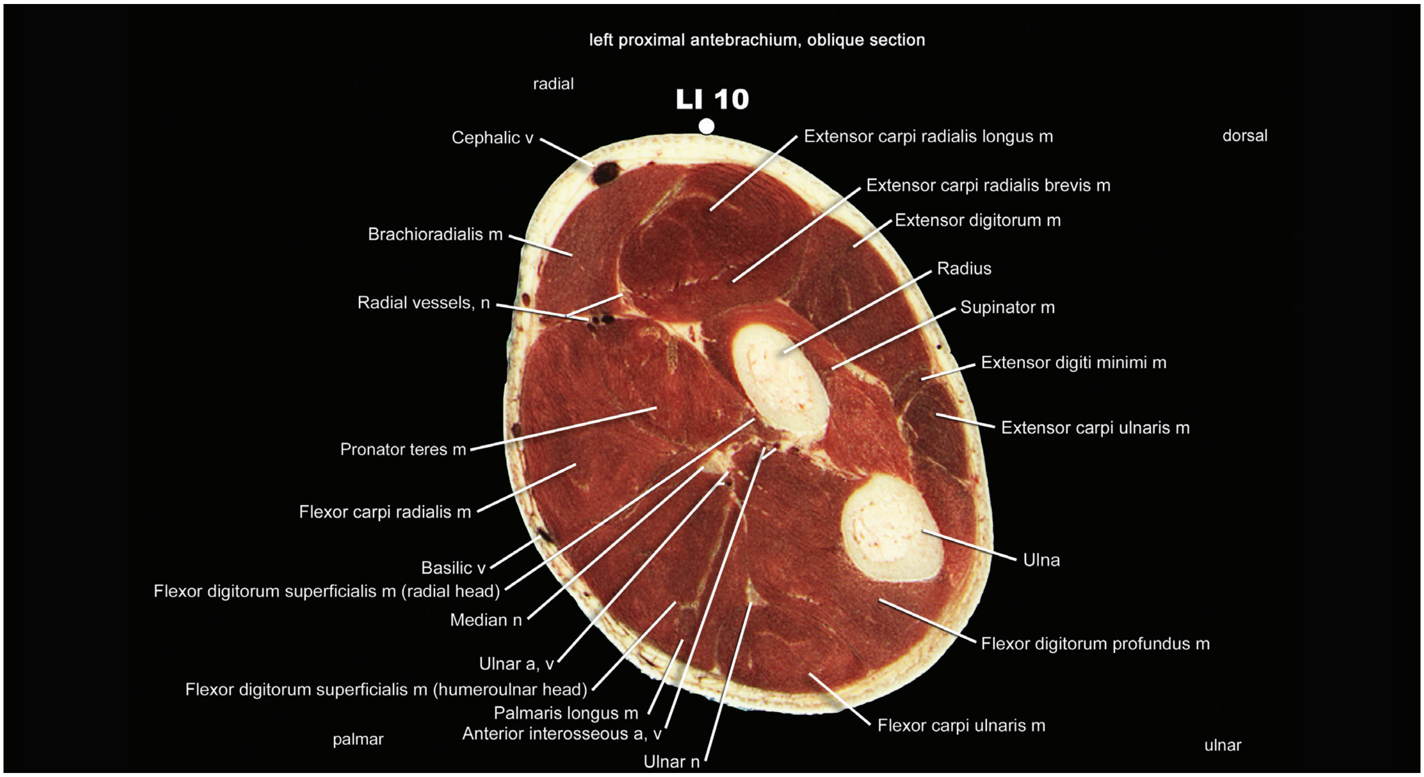

left proximal antebrachium, oblique section
radial
LI 10
dorsal
Cephalic v
Extensor carpi radialis longus m
Extensor carpi radialis brevis m
Brachioradialis m
Extensor digitorum m
Radius
Radial vessels, n
Supinator m
Extensor digiti minimi m
Extensor carpi ulnaris m
Pronator teres m
Flexor carpi radialis m
Ulna
Basilic v
Flexor digitorum superficialis m (radial head)
Median n
Ulnar a, v
Flexor digitorum profundus m
Flexor digitorum superficialis m (humeroulnar head)
Palmaris longus m
Flexor carpi ulnaris m
palmar
Anterior interosseous a, v
ulnar
Ulnar n

Figure 2-18. Tension in the forearm extensors, as well as in the supinator muscle, may contribute to chronic lateral elbow pain. This cross section at the level of LI 10 demonstrates the relationship of the point to these structures, as well as the compressible radial nerve, illustrating the value of LI 10 in addressing myofascial restriction for the alleviation of chronic lateral elbow pain.

and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

- **Radial recurrent artery:** Arises from the radial artery and supplies the brachioradialis and brachialis muscles and the elbow joint. Anastomoses with the radial collateral artery from the profunda brachii artery.
- **Radial artery:** Begins distal to the elbow and ends by forming the deep palmar arch with the deep branch of the ulnar artery.

Clinical Relevance: Iatrogenic or traumatic vessel injury, bruising.

Indications and Potential Point Combinations

- **Gastrointestinal problems:** abdominal pain, dyspepsia, vomiting, diarrhea: LI 10, PC 6, ST 36, CV 12.
- **Thoracic limb pain and weakness:** LI 10, LI 11, LI 4, other points as they relate to neuroanatomically relevant painful or dysfunctional structures in the patient.
- **Tennis elbow (lateral epicondylitis):** LI 10, LI 11, local tender points.

Evidence-Based Applications

- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[2]
- Causes a transitory reduction in heart rate, possibly by **reducing sympathetic drive** to the heart.[3]
- Acupuncture at LI 4 and LI 10 had a modulatory effect on skin blood flow and heart rate.[4]
- Moxibustion and point injection at LI 10 and LI 11 helped relieve **lateral epicondylitis** discomfort according to a case series.[5]
- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma** patients.[6]
- Electroacupuncture at LI 10-LI 11, TH 5-LI 4, and direct moxa to each point significantly reduced **spasticity due to stroke**; when applied repeatedly, effects became longer lasting.[7]
- Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[8]

References

1. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect.* 2008;57:177-185.
2. Fink M, Wolkenstein E, Karst M, and Gehrke A. Acupuncture in chronic epicondylitis: a randomized controlled trial. *Rheumatology.* 2002;41:205-209.
3. Imai K and Kitakoji H. Comparison of transient heart rate reduction associated with acupuncture stimulation in supine and sitting subjects. *Acupuncture in Medicine.* 2003;21(4):133-137.
4. Ballegaard S, Muteki T, Harada H, Ueda N, Tsuda H, Tayama F, and Ohishi K. Modulatory effect of acupuncture on the cardiovascular system: a crossover study. *Acupuncture & Electrotherapeutics Res., Int J.* 1993;18:103-115.
5. Song L. Fifty cases of external humeral epicondylitis treated by moxibustion and point-injection. *Journal of Traditional Chinese Medicine.* 2004;24(3):194-195.
6. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate broncho-dilating response in asthma patients. *J Chin Med Assoc.* 2005;68(12):591-594.
7. Moon SK, Whang Y-K, Partk S-U, et al. Antispastic effect of electroacupuncture and moxibustion in stroke patients. *Am J Chin Med.* 2003;31(3):467-474.
8. Haker E and Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. *Clin J Pain.* 1990;6(3):221-226.

LI 11

Qu Chi "Pool at the Bend"

On the lateral side of the elbow, in a depression at the end of the cubital crease when the elbow is close to full flexion, approximately midway between the tendon of the biceps brachii and the lateral epicondyle of the humerus.

Muscles

- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Extensor carpi radialis longus muscle:** Extends and abducts the hand at the wrist.
- **Brachialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Lateral elbow pain, restricted movement, tension.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Lateral antebrachial cutaneous nerve (C5, C6):** A continuation of the musculocutaneous nerve, the lateral antebrachial cutaneous nerve supplies a large portion of the skin of the forearm.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.

Clinical Relevance: Altered sensation on the forearm; loss of extensor function due to radial nerve injury or entrapment. Radial nerve injury affecting wrist and hand sensation. Sympathetic neuromodulation in the head, neck, and cranial thorax, pertaining mainly to respiratory conditions and immunologic dysregulation.

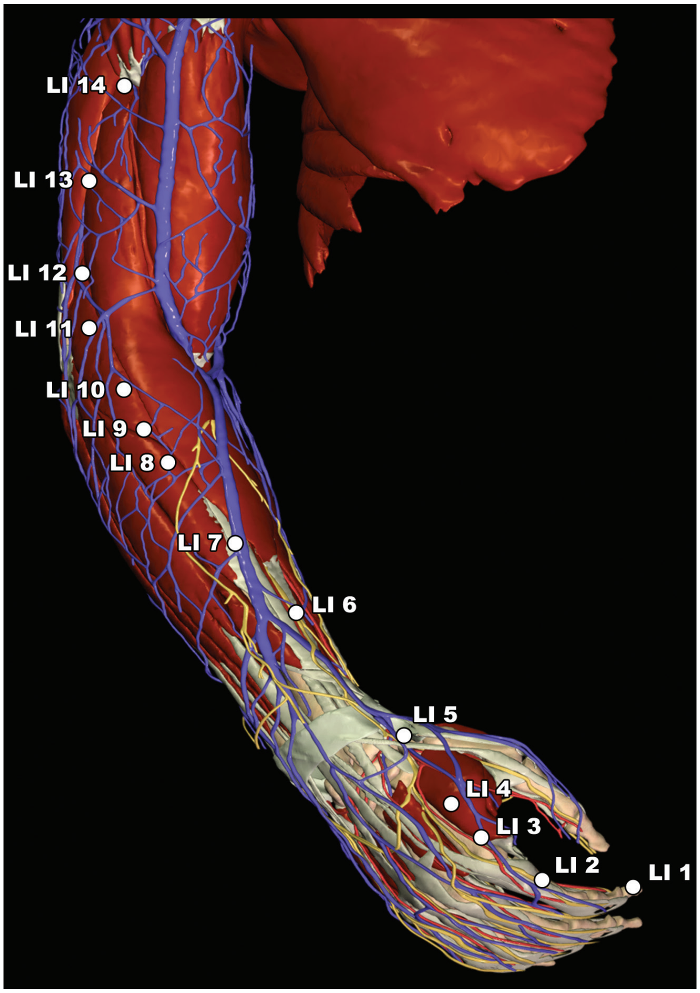


Figure 2-19. The meaty muscle beneath LI 11 beckons dry needling, massage, and laser therapy for lateral elbow pain.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.
- **Radial recurrent artery:** Arises from the radial artery and supplies the brachioradialis and brachialis muscles and the elbow joint. Anastomoses with the radial collateral artery from the profunda brachii artery.

Clinical Relevance: Deep needling of LI 11 accesses the radial nerve as well as the profunda brachii artery. Activation of the nervi vasorum associated with branches of these neurovascular structures would influence autonomic function near and far through sympathetic connections. The proximity of LI 11 to the cephalic vein suggests an application to enhance drainage of an edematous elbow.

Indications and Potential Point Combinations

- **Febrile and viral illnesses:** LI 11, LI 4, GV 14, ST 36, BL 13.
- **Throat problems, tonsillitis, pharyngitis:** LI 11, LI 10, CV 22, ST 36.
- **Radial nerve injury:** LI 11; isolate injury location if possible, needle proximal and distal, as well as cervicothoracic spinal nerves, LI 4, GV 14.
- **Lateral elbow pain:** LI 11, LI 10, trigger points related to elbow pain. Check for trigger points in the triceps brachii.

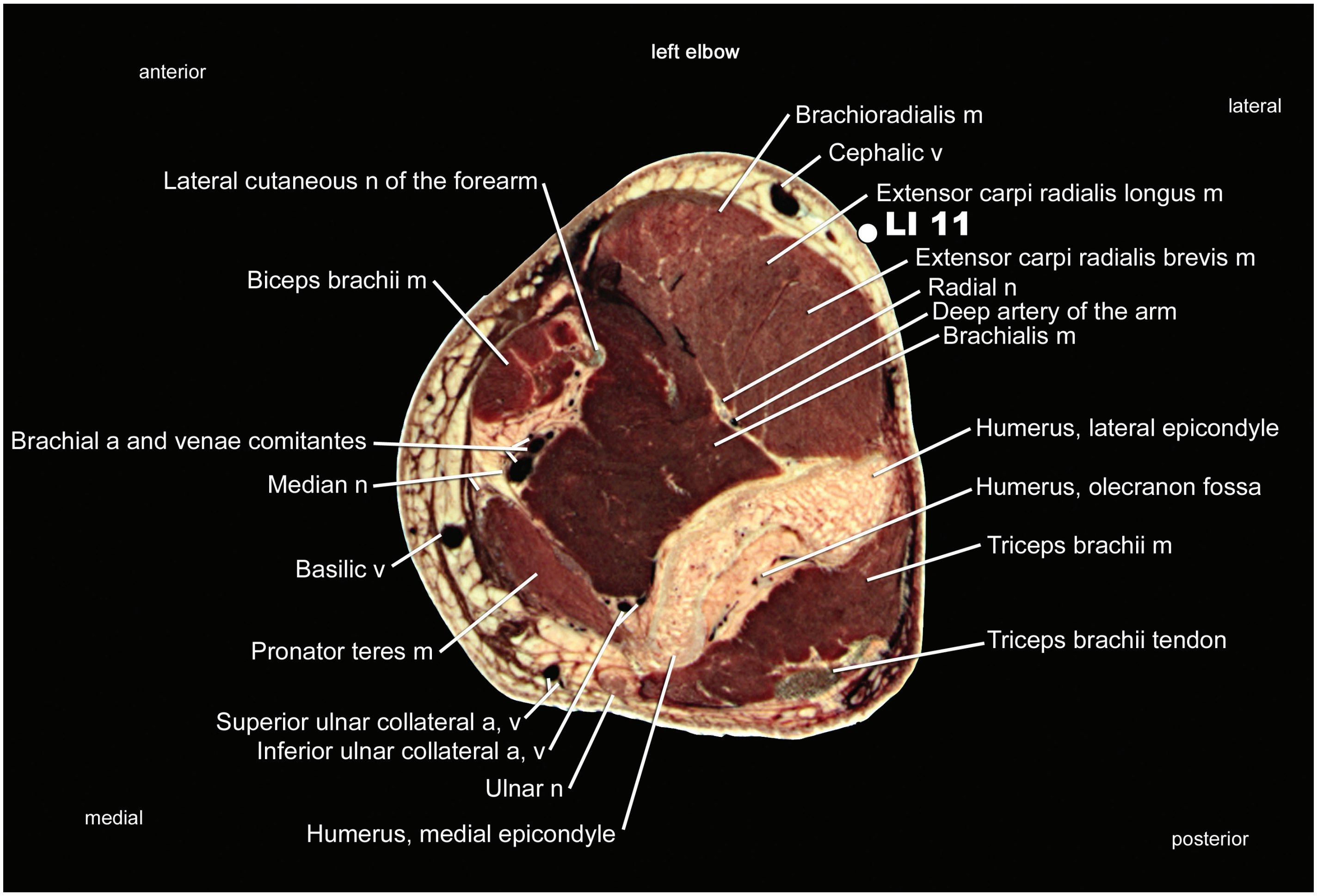

left elbow
anterior
lateral
Brachioradialis m
Cephalic v
Lateral cutaneous n of the forearm
Extensor carpi radialis longus m
LI 11
Extensor carpi radialis brevis m
Biceps brachii m
Radial n
Deep artery of the arm
Brachialis m
Brachial a and venae comitantes
Humerus, lateral epicondyle
Median n
Humerus, olecranon fossa
Triceps brachii m
Basilic v
Pronator teres m
Triceps brachii tendon
Superior ulnar collateral a, v
Inferior ulnar collateral a, v
Ulnar n
medial
Humerus, medial epicondyle
posterior

Figure 2-20. LI 11, "Pool at the Bend", occupies a palpable depression, or pool, at the bend, or elbow. The sink in the tissue appears when the elbow flexes. Notably, the median cubital vein (unlabeled) shows in this cross section as a broad venous ditch just lateral to the biceps brachii muscle, superficial to the bicipital aponeurosis, in the cubital fossa. It connects the basilic and cephalic veins distal to this site.

Evidence-Based Applications

- Acupuncture using magnetic needles at LI 11, ST 40, and LR 3 **lowered endothelin-1**, a potent vasoconstrictive peptide.[1]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an **immunomodulatory** effect for patients with **lichen ruber planus**.[2]
- A case series evaluating acupuncture for **poison ivy contact dermatitis** reported effectiveness with the acupuncture points SP 10, LI 11, and ST 36.[3] These points were also effective in reducing the severity and **preventing recurrences of herpes simplex infections**[4] and in **clearing psoriasis lesions.**[5]
- Treatment for fever using GV 14, GB 20, and LI 11 in patients with **common cold, influenza, acute tonsillitis, or acute bronchitis** helped normalize vital signs and increased T-lymphocytes.[6]
- The four points LI 11, SP 10, SP 6, and ST 36 treat **acute urticaria.**[7]
- Pre-treatment with acupuncture at LI 11 provided a **significant reduction in experimentally-induced (i.e., application of histamine) itch and wheal formation,** compared to acupuncture within the same (C6) dermatome but at a non-acupuncture point, and also to no pre-treatment.[8]
- Effectively relieves **refractory uremic pruritus** in hemodialysis patients.[9,10]
- Repeated acupuncture at ST 36, LI 11, SP 10, and GV 14 significantly decreased leukocyte and lymphocyte values in healthy humans, although cortisol and norepinephrine plasma levels remained unchanged. The mechanism whereby acupuncture affected **leukocyte circulation** was unknown.[11]
- Acupuncture at SP 6 produced a strong vasoconstriction in the ipsilateral leg and a slight vasoconstriction in the contralateral leg with no change in the arms Stimulation of ST 36 produced a superficial vasoconstriction in the skin of both legs but no change in the arms. Stimulation of PC 6 or LI 11 caused **ipsilateral vasoconstriction** in the arms only. This information suggests a topographical representation in the neural segments responsible for the change in sympathetic activity.[12]
- Electroacupuncture (EA) at LI 11 is **antipyretic**, possibly through inhibiting the action of prostaglandin E_2.[13]
- Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome.**[14]
- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[15]
- Following a series of acupuncture treatments, men with **poor sperm quality** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile

spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[16]

- Electroacupuncture of SI 19 and LI 11 was more effective in **lowering blood pressure** than were other points paired with LI 11.[17] This effect appeared to be related to central opioid and/or noradrenergic mechanisms.[18]
- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[19]
- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis** (tennis elbow).[20]
- Moxibustion and point injection at LI 10 and LI 11 helped relieve **lateral epicondylitis** discomfort according to a case series.[21]
- Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[22]

References

1. Jiang X. Effects of magnetic needle acupuncture on blood pressure and plasma ET-1 level in the patient of hypertension. *Journal of Traditional Chinese Medicine.* 2003;23(4):290-291.
2. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.* 1995;13(2):91-92.
3. Lioa SJ. Acupuncture for poison ivy contact dermatitis. *Acupuncture & Electrotherapeutics Res., Int J.* 1988;13:31-39.
4. Liao SJ. Acupuncture treatment for herpes simplex infections. *Acupuncture & Electrotherapeutics Res., Int J.* 1991;16:135-142.
5. Liao SJ and Liao TA. Acupuncture treatment for psoriasis: a retrospective case report. *Acupuncture & Electrotherapeutics Res., Int J.* 1992;17:195-208.
6. Tan D. Treatment of fever due to exopathic Wind-Cold by rapid acupuncture. *Journal of Traditional Chinese Medicine.* 1992;12(4):267-271.
7. Chen C-J and Yu H-S. Acupuncture treatment of urticaria. *Arch Dermatol.* 1998;134:1397-1399.
8. Pfab F, Hammes M, Backer M, Huss-Marp J, Athanasiadis GI, Tolle TR, Behrendt H, Ring J, and Darsow U. Preventive effect of acupuncture on histamine-induced itch: A blinded, randomized, placebo-controlled crossover trial. *J Allergy Clin Immunol.* 2005; 116(6):1386-1388.
9. Chou C-Y, Cheng YW, Kao M-T, and Huang C-C. Acupuncture in haemodialysis patients at the Quchi (LI11) acupoint for refractory uraemic pruritus. *Nephrol Dial Transplant.* 2005;20:1912-1915.
10. Duo LJ. Electrical needle therapy of uremic pruritus. *Nephron.* 1987;179-183.
11. Kou W, Bell JD, Gareus I, Pacheco-Lopez G, Goebel MU, Spahn G, Stratmann M, Janssen OE, Schedlowski M, and Dobos GJ. Repeated acupuncture treatment affects leukocyte circulation in healthy young male subjects: a randomized single-blind two-period crossover study. *Brain, Behavior, and Immunity.* 2005;19:318-324.
12. Lin M-T, Chandra A, and Chen-Yen S-M. Effects of needle stimulation of acupuncture loci Nei-Kuan (EH-6), Tsu-San-Li (St-36), San-Yin-Chiao (Sp-6) and Chu-Chih (LI-11) on cutaneous temperature and pain threshold in normal adults. *Am J Chin Med.* 1982;9(4):305-314.
13. Fang J-Q, Guo S-Y, Asano K, Yu Y, Kasahara T, and Hisamitsu T. *In vivo.* 1998;12:503-510.
14. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.
15. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System.* 2000;79:173-180.
16. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
17. Ku Y-H and Zou C-J. Tinggong (SI 19), a novel acupoint for 2Hz electroacupuncture-induced depressor response. *Acupuncture & Electrotherapeutics Res., Int J.* 1993;18:89-96.
18. Zou C-J, Wang H, and Ge L. The central mechanism of the depressor-bradycardia effect of "Tinggong(SI 19)-Quchi(LI 11)" 2Hz electroacupuncture. *Acupuncture & Electro-therapeutics Res., Int J.* 2000;25:145-153.
19. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.
20. Fink M, Wolkenstein E, Karst M, and Gehrke A. Acupuncture in chronic epicondylitis: a randomized controlled trial. *Rheumatology.* 2002;41:205-209.
21. Song L. Fifty cases of external humeral epicondylitis treated by moxibustion and point-injection. *Journal of Traditional Chinese Medicine.* 2004;24(3):194-195.
22. Haker E and Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. *Clin J Pain.* 1990;6(3):221-226.

LI 12

Zhou Liao "Elbow Bone Hole"

With the elbow flexed, LI 12 is one cun proximal to LI 11, at the junction of the lateral supracondylar ridge of the humerus with the lateral epicondyle.

Muscles

- **Triceps brachii muscle:** Extends the forearm at the elbow. Steadies the head of an abducted humerus with the long head.
- **Brachioradialis muscle:** Flexes the forearm at the elbow.
- **Brachialis muscle:** Flexes the forearm at the elbow.

Clinical Relevance: Painful or difficult elbow extension. Tender myofascial trigger points. Lateral arm pain.

Nerves

- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.
- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

Clinical Relevance: Radial nerve injury, entrapment, or neuropathy, leading to pain, myofascial dysfunction, and possibly neurogenic inflammation in the lateral elbow region.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes across the anterior elbow to join with the basilic vein. Empties into the axillary vein.
- **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.

Clinical Relevance: Local circulatory compromise or altered vasoregulation.

Indications and Potential Point Combinations

- **Pain in the lateral elbow or arm:** Check for brachialis trigger

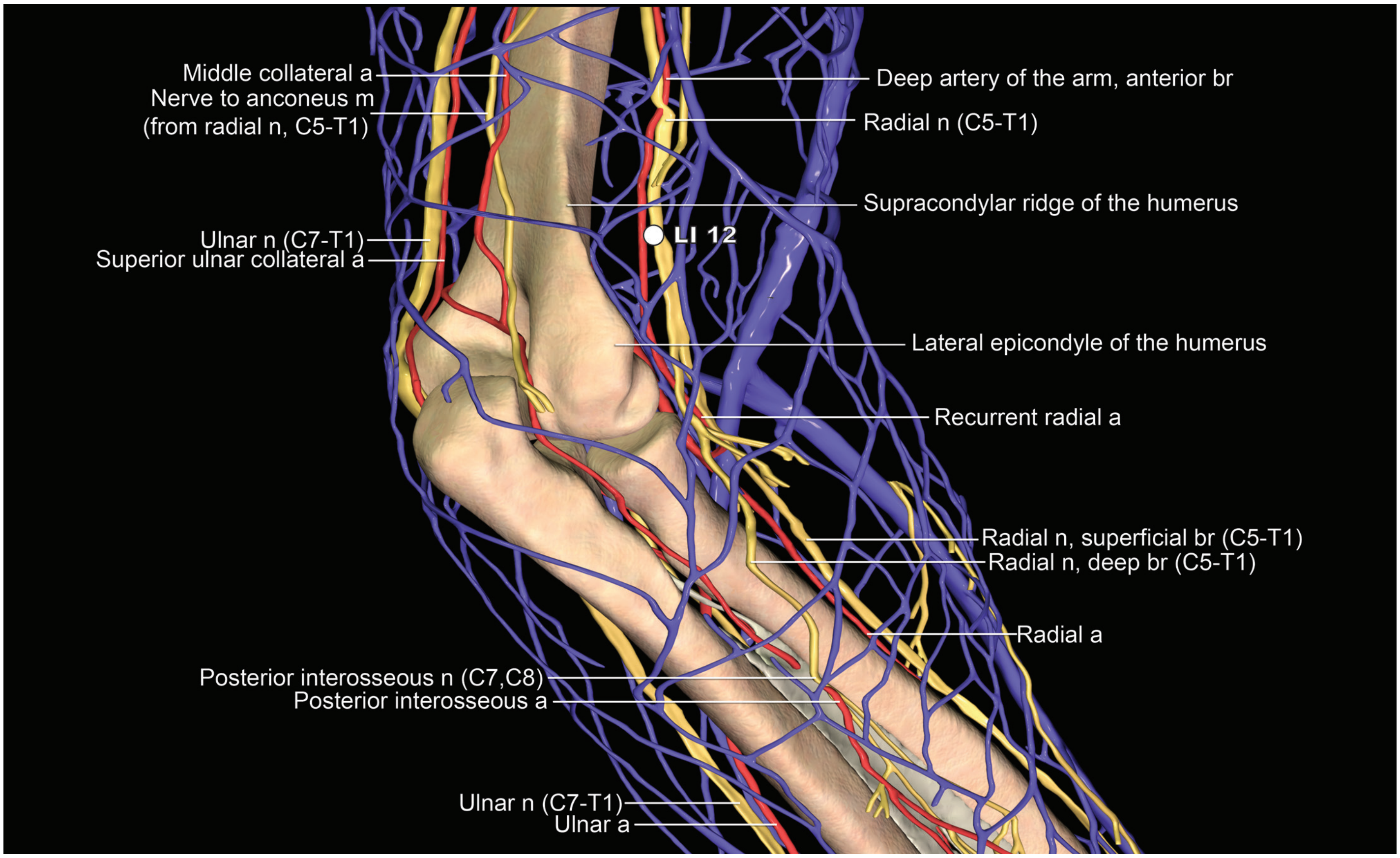

Middle collateral a
Nerve to anconeus m (from radial n, C5-T1)
Ulnar n (C7-T1)
Superior ulnar collateral a
LI 12
Deep artery of the arm, anterior br
Radial n (C5-T1)
Supracondylar ridge of the humerus
Lateral epicondyle of the humerus
Recurrent radial a
Radial n, superficial br (C5-T1)
Radial n, deep br (C5-T1)
Radial a
Posterior interosseous n (C7,C8)
Posterior interosseous a
Ulnar n (C7-T1)
Ulnar a

Figure 2-21. The name for LI 12 of "Elbow Bone-Hole" refers to the palpable depression just proximal to the lateral epicondyle of the humerus, atop the supracondylar ridge.

points,or the lateral portion of the medial head of the triceps brachii muscle. Select LI 12 if tender. Consider adding LI 11, LI 10, PC 3.

- **Radial nerve injury:** Locate site of injury if possible; stimulate proximal and distal to injury; treat myofascial compression associated with injured nerve and neuromodulate locus of impact. Consider LI 12, LI 11, LI 10, LI 4, GV 14, spinal nerve points for lower cervical spinal nerves.

Evidence-Based Applications

- Deep acupuncture at LU 5, TH 5, LI 10, LI 11, and LI 12 produced superior analgesia to superficial needling at these locations for the treatment of lateral epicondylalgia.[1]
- Electroacupuncture at LI 12, TH 5, GB 30, and ST 36 in patients with acute ischemic cerebrovascular disease was associated with significantly increased somatostatin levels in the cerebrospinal fluid and blood and no significant change in pancreatic polypeptide amounts.[2]

References

1. Haker E and Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. *Clin J Pain*. 1990;6(3):221-226.

2. Zhang X, Yuan Y, Kuang P, et al. Effects of electro-acupuncture on somatostatin and pancreatic polypeptide in ischemic cerebrovascular diseases. *J Tradit Chin Med*. 1999;19(1):54-58.\

LI 13

Shou Wu Liu "Arm Five Li"

On the lateral brachium, 3 cun proximal to LI 11, on the line connecting LI 11 to LI 15, approximately level with where the radial nerve sulcus crosses the lateral margin of the humerus.

Muscles

- **Brachialis muscle:** Flexes the antebrachium at the elbow.

Clinical Relevance: Local trigger point pathology or myofascial dysfunction.

Nerves

- **Inferior lateral brachial cutaneous nerve (C5, C6):** A branch of the radial nerve, this nerve supplies the skin over the inferolateral brachium. It may appear as a branch of the posterior cutaneous nerve of the forearm, also a branch of the radial nerve.
- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium. The radial nerve divides into superficial and deep branches near the elbow. The deep branch only supplies muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.
- **Musculocutaneous nerve (C5, C6):** Supplies all of the muscles in the anterior, or flexor, compartment of the brachium: the biceps brachii, brachialis, and coracobrachialis muscles. Becomes the lateral cutaneous nerve of the forearm, supplying a large portion of the skin of the antebrachium.

Clinical Relevance: Stiff elbow flexion and/or extension from neuropathic nerves or their spinal nerve roots. Radial nerve injury.

Vessels

- **Cephalic vein:** Ascends from the lateral portion of the dorsal venous network. Courses along the lateral aspect of the wrist and anterolateral forearm and arm. Communicates with the median cubital vein in the anterior elbow, and then passes

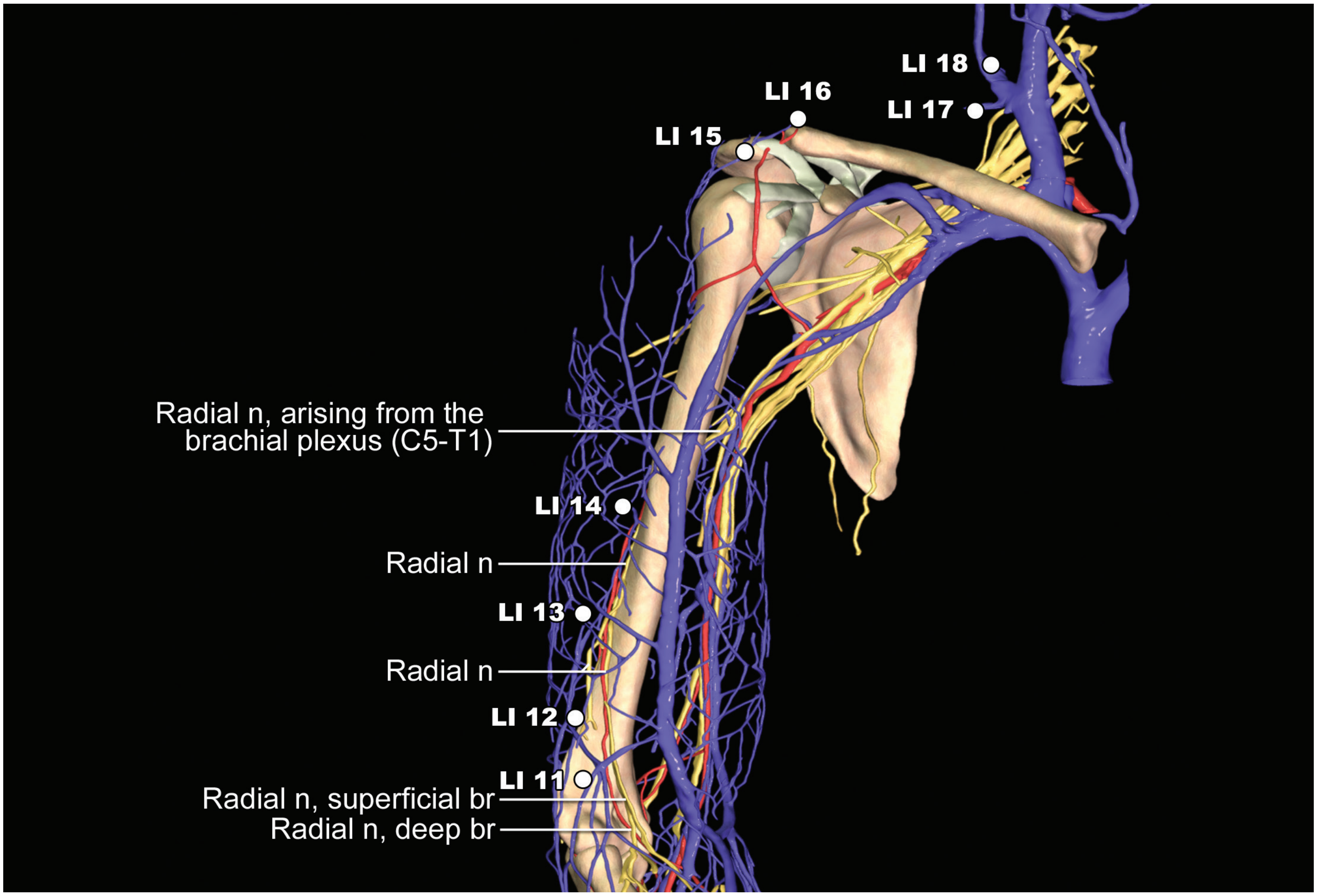


Figure 2-22. LI 13, "Arm Five Li" lands 5 cun proximal to the lateral epicondyle. In this instance, "li" refers to "cun". Note the radial nerve winding around the humerus.

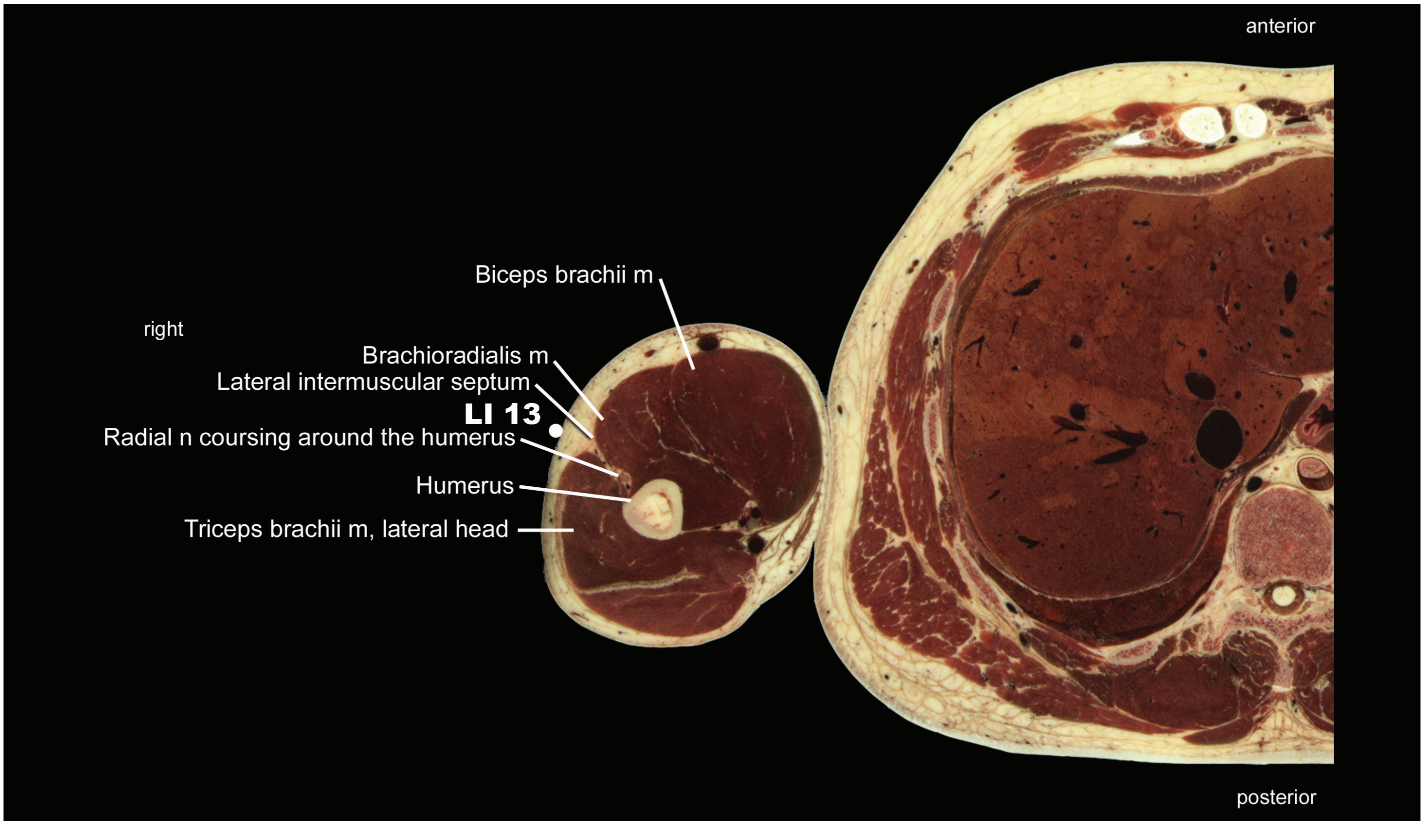

anterior
Biceps brachii m
right
Brachioradialis m
Lateral intermuscular septum
LI 13
Radial n coursing around the humerus
Humerus
Triceps brachii m, lateral head
posterior

Figure 2-23. Deep to LI 13, the radial nerve sits nests amid the lateral intermuscular septum.

across the anterior elbow to join with the basilic vein. Empties into the axillary vein.

- **Anterior descending branch of the profunda brachii artery (also known as the radial collateral artery):** Anastomoses with the radial recurrent branch of the radial artery to participate in the arterial anastomoses of the elbow.

Clinical Relevance: Supports circulatory supply and drainage to and from the elbow, respectively.

Indications and Potential Point Combinations

- **Lateral arm pain:** Check for trigger points in the brachioradialis, triceps brachii, and brachialis muscles. LI 13 for local pain. Consider LI 12, LI 11.

LI 14

Bi Nao "Upper Arm"

On the lateral brachium, on the anterior margin of the insertion of the deltoid muscle, on the line connecting LI 11 with LI 15. Puncture obliquely upward for deltoid and shoulder problems.

Muscles

- **Deltoid muscle:** Anterior part medially rotates and flexes the arm at the shoulder; middle part abducts the arm; posterior part laterally rotates the arm and extends it.

Clinical Relevance: Deltoid insertion pain, shoulder restriction, local tissue inflammation and trigger points.

Nerves

- **Superior lateral brachial cutaneous nerve (from the axillary nerve):** Supplies the skin over the inferior portion of the deltoid muscle.
- **Axillary nerve (C5, C6):** Supplies the teres minor and deltoid muscles, the skin over the inferior portion of the deltoid (via the superior lateral brachial cutaneous nerve), and the shoulder joint.

Clinical Relevance: Neuropathic nerves due to compression, trauma, or surgery.

Vessels

- **Profunda brachii artery (Deep brachial artery):** This is the largest branch of the brachial artery and accompanies the radial nerve through the radial groove. It divides into anterior and posterior descending branches which take part in the elbow arterial anastomoses.

Clinical Relevance: Consider role of local vasculature (including nervi vasorum) in shoulder recovery from trauma, surgery, adhesive capsulitis, and dislocation.

Indications and Potential Point Combinations

- **Arm pain:** Check for trigger points in the deltoid muscle insertion as well as the lateral border of the lateral head of the triceps brachii muscle.

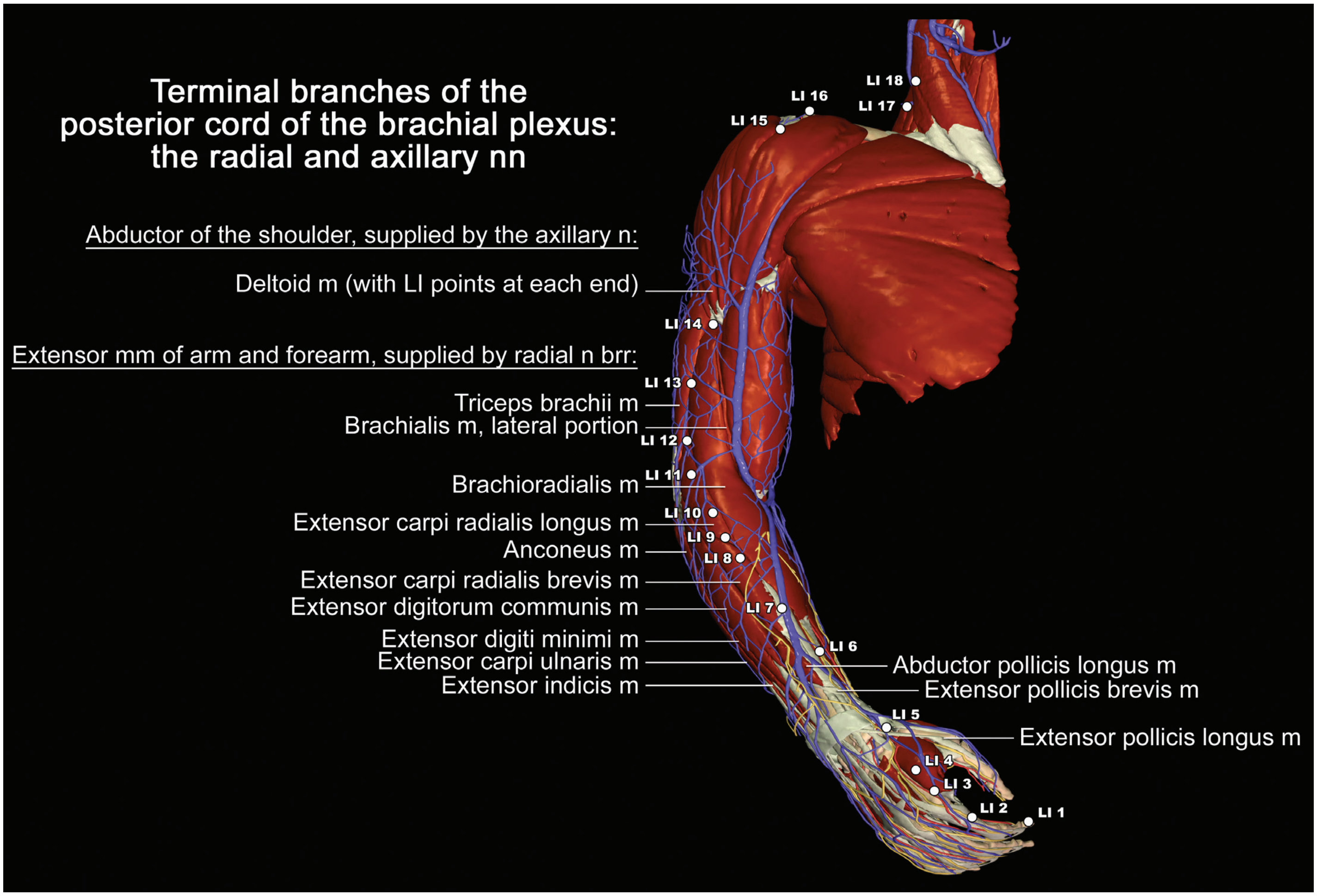

Terminal branches of the posterior cord of the brachial plexus: the radial and axillary nn
Abductor of the shoulder, supplied by the axillary n:
Deltoid m (with LI points at each end)
Extensor mm of arm and forearm, supplied by radial n brr:
Triceps brachii m
Brachialis m, lateral portion
Brachioradialis m
Extensor carpi radialis longus m
Anconeus m
Extensor carpi radialis brevis m
Extensor digitorum communis m
Extensor digiti minimi m
Extensor carpi ulnaris m
Extensor indicis m
Abductor pollicis longus m
Extensor pollicis brevis m
Extensor pollicis longus m
LI 18
LI 17
LI 16
LI 15
LI 14
LI 13
LI 12
LI 11
LI 10
LI 9
LI 8
LI 7
LI 6
LI 5
LI 4
LI 3
LI 2
LI 1

Figure 2-24. LI 14, "Muscle of the Arm", tucks into the anterior margin of the deltoid muscle insertion. The deltoid attachment incorporates three tendons that form an arch. Fascia investing the deltoid blends with the brachial fascia by way of its confluence with the medial and lateral intermuscular septi. As such, this "delta" joins not only three muscle parts but also three fascial components. (Rispoli DM, Athwal GS, Sperling JW, et al. The anatomy of the deltoid insertion. J Shoulder Elbow Surg. 2009;18:386-390.)

LI 15

Jian Yu "Shoulder Bone"

Inferior to the acromion, on the anterior border of the acromial part of the deltoid muscle, in the anterior of two depressions appearing on either side of the acromion when the arm is abducted 90°.

Bursa

- **Subacromial bursa:** Lies between the coracoacromial arch, the supraspinatus tendon, and the greater tubercle of the humerus.

Clinical Relevance: Subacromial impingement syndrome (a spectrum of pathology that includes subacromial bursitis, rotator cuff tendinopathy, and full-thickness tears of the rotator cuff; may involve features of extrinsic compression and intrinsic degeneration);[3] consider acupuncture and laser therapy for rotator cuff lesions with shoulder stiffness that may arise from local alterations in inflammatory cytokines, leading to myofibroblast recruitment in the subacromial bursa.[4]

Muscles and Tendons

- **Deltoid muscle:** Anterior part medially rotates and flexes the arm; middle part abducts the arm; posterior part laterally rotates the arm and extends it.
- **Supraspinatus tendon:** A rotator cuff muscle, the supraspinatus assists the infraspinatus, teres minor, and subscapularis muscles to hold the head of the humerus in the glenoid cavity of the scapula. Also, assists the deltoid muscle in arm abduction.

Clinical Relevance: Shoulder pain and dysfunction; shoulder joint pathology. Consider acupuncture and related techniques (laser therapy, most notably) for tendon pathology, in light of evidence maintaining the importance of nitric oxide in tendon health and recovery from injury.[5]

Nerves

- **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.
- **Superior lateral brachial cutaneous nerve (from the axillary nerve):** Supplies the skin over the inferior portion of the deltoid muscle.
- **Axillary nerve (C5, C6):** Supplies the teres minor and deltoid muscles, the skin over the inferior portion of the deltoid (via the superior lateral brachial cutaneous nerve), and the shoulder joint.

Clinical Relevance: Supraclavicular or other nerve entrapment, whether by fibrous bands, muscles, or tendons.[6] Painful musculoskeletal conditions lead to central sensitization; this includes patients with shoulder impingement syndrome.[7]

Vessels

- **Thoracoacromial artery:** A short arterial trunk that divides into four branches: the acromial, deltoid, pectoral, and clavicular arteries.

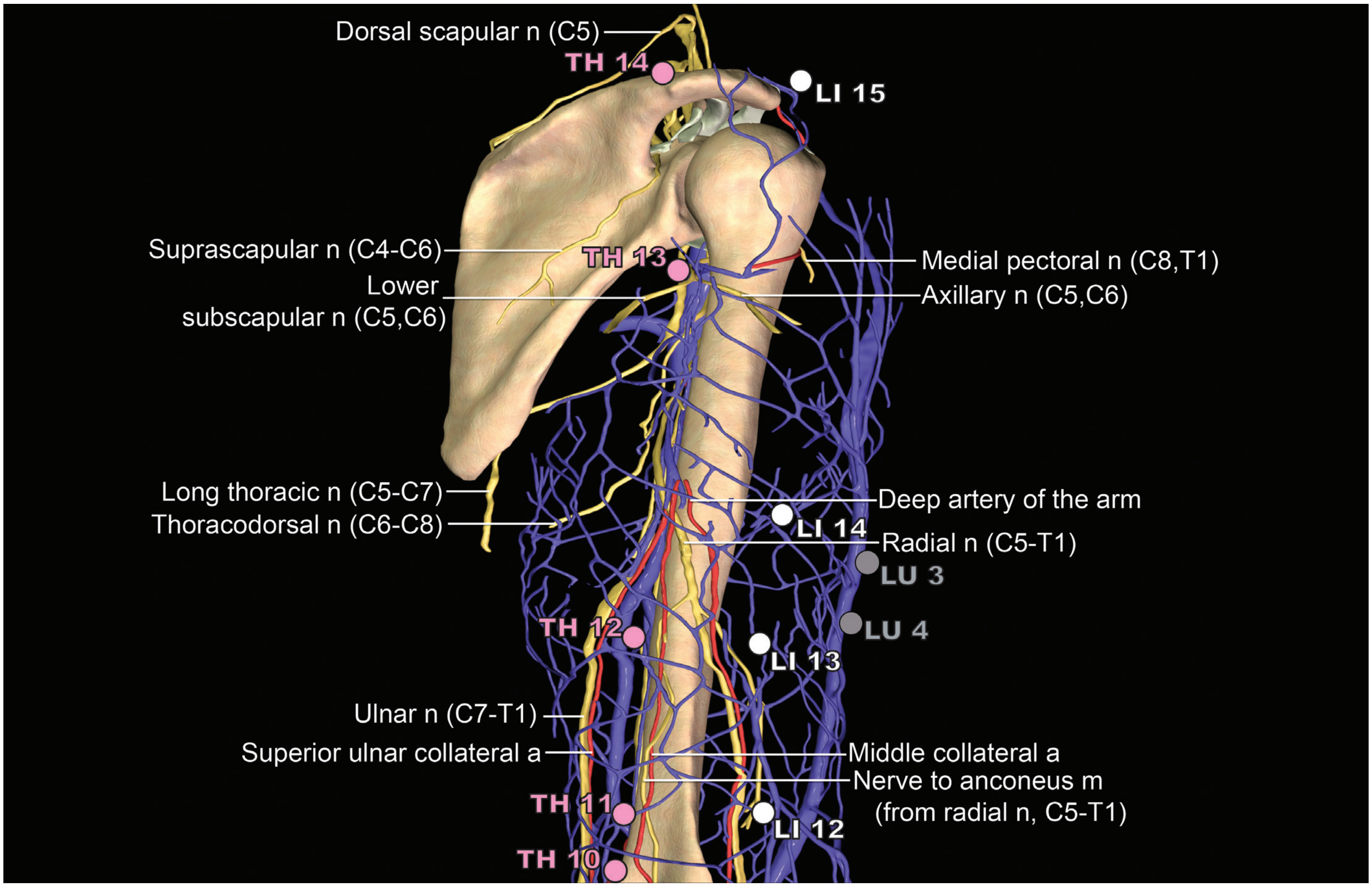

Dorsal scapular n (C5)
TH 14
LI 15
Suprascapular n (C4-C6)
TH 13
Lower subscapular n (C5,C6)
Medial pectoral n (C8,T1)
Axillary n (C5,C6)
Long thoracic n (C5-C7)
Thoracodorsal n (C6-C8)
Deep artery of the arm
LI 14
Radial n (C5-T1)
LU 3
LU 4
TH 12
LI 13
Ulnar n (C7-T1)
Superior ulnar collateral a
Middle collateral a
Nerve to anconeus m (from radial n, C5-T1)
TH 11
LI 12
TH 10

Figure 2-25. LI 15, "Shoulder Bone" often appears with TH 14, "Shoulder Bone Hole" in treatment protocols addressing shoulder joint pain.

Clinical Relevance: Hypovascular zones may promote susceptibility to rupture susceptibility in tendons such as that belonging to the long head of the biceps muscle.[8] Possibly, by supporting circulation through medical acupuncture and related techniques, improved blood flow to tendons will support tissue integrity and strength.

Indications and Potential Point Combinations

- **Anterior shoulder pain:** LI 15 (trigger point in the anterior deltoid region. Palpate for other local trigger points; including the infraspinatus muscle, at or around SI 11 and supraspinatus muscle (SI 12, SI 13) that may refer pain to the anterior shoulder. Coracobrachialis restriction should also be considered and palpated.
- **Shoulder joint pain:** LI 15, TH 14, contributing trigger points.
- **Torticollis:** LI 15, LI 16, LI 18, GB 12, GB 20, SI 17.

Evidence-Based Applications

- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis (tennis elbow)**.[1]
- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/ LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[2]

References

1. Fink M, Wolkenstein E, Karst M, and Gehrke A. Acupuncture in chronic epicondylitis: a randomized controlled trial. *Rheumatology*. 2002;41:205-209.

2. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. *Medical Acupuncture*. 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.

3. Harrison AK and Flatow EL. Subacromial impingement syndrome. *J Am Acad Orthop Surg*. 2011;19(11):701-708.

4. Ko J. Rotator cuff lesions with shoulder stiffness: updated pathomechanisms and management. *Chang Gung Medical Journal*. 2011;34(4):331-340.

5. Bokhari AR and Murrell GAC. The role of nitric oxide in tendon healing. *J Shoulder Elbow Surg*. 2012;21:238-244.

6. Douchamps F, Courtois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome *Joint Bone Spine*. 2012;79:88-89.

7. Gwilym SE, Oag HCL, Tracey I, et al. Evidence that central sensitization is present in patients with shoulder impingement syndrome and influences the outcome after surgery. *J Bone Joint Surg*. 2011;93-B:498-502.

8. Cheng NM, Pan W-R, Vally F, et al. The arterial supply of the long head of biceps tendon: anatomical study with implications for tendon rupture. *Clin Anat*. 2010;683-692.

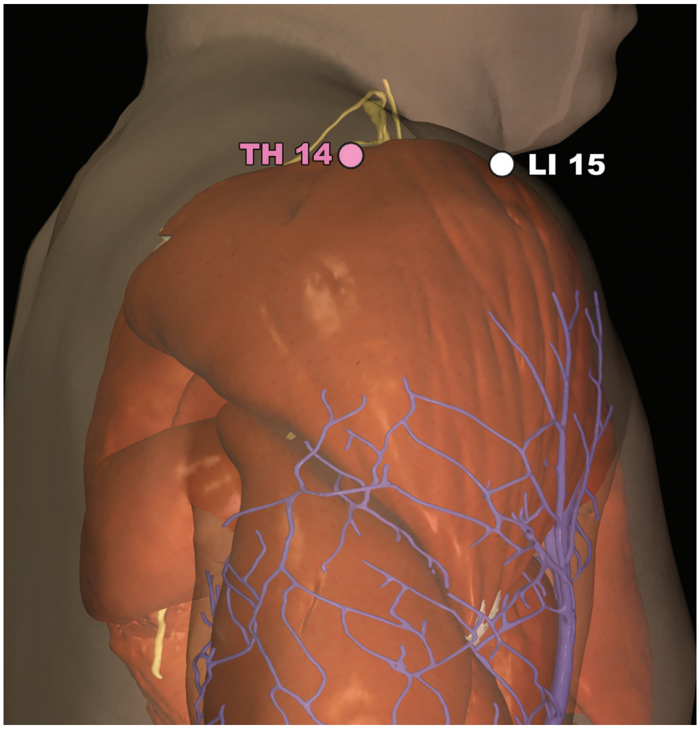


Figure 2-26. LI 15, "Shoulder Bone" and TH 14, "Shoulder Bone Hole" both inhabit depressions on either side of the acromion process. One can best visualize them with the thoracic limb abducted 90°. The depressions denote separations in the fiber bundles between the anterior,middle, and posterior portions of the deltoid muscle.

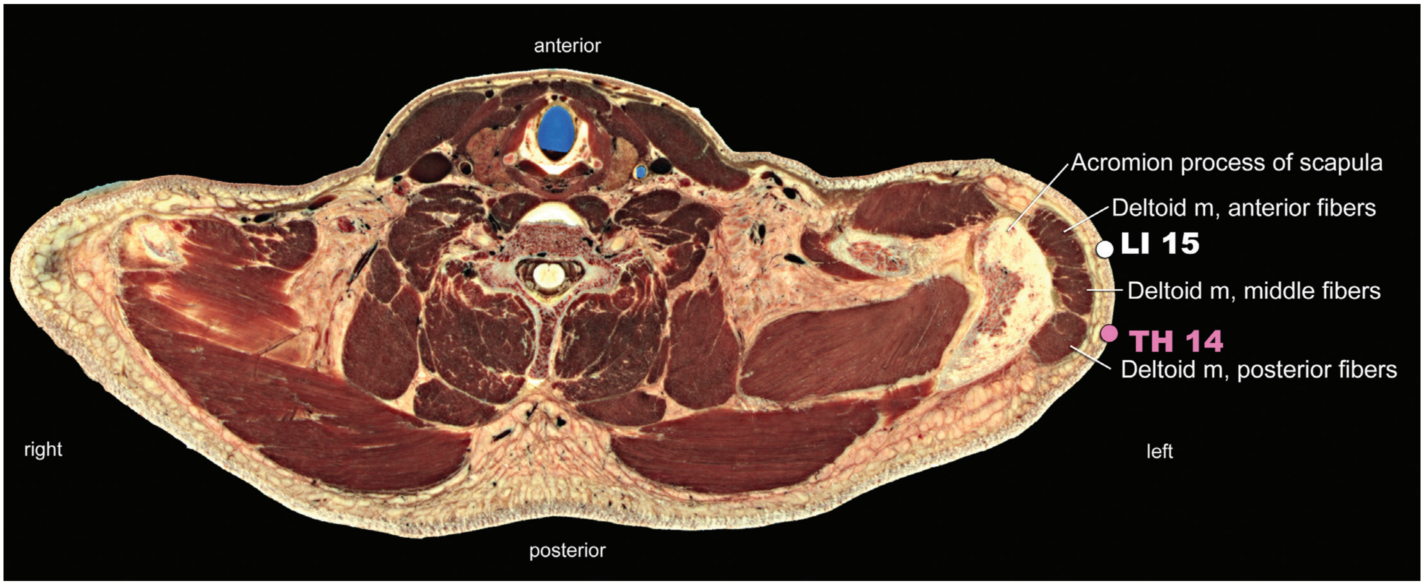

anterior
Acromion process of scapula
Deltoid m, anterior fibers
LI 15
Deltoid m, middle fibers
TH 14
Deltoid m, posterior fibers
right
left
posterior

Figure 2-27. The crooks between the anterior, middle, and posterior fibers of the deltoid muscle appear here where they house LI 15 and TH 14.

LI 16

Ju Gu "Great Bone"

On the superior aspect of the shoulder, in the depression that appears between the acromial extremity of the clavicle and the spine of the scapula.

Muscles

- **Trapezius muscle:** The trapezius muscle's superior fibers elevate, middle fibers retract, and inferior fibers depress the scapula.
- **Supraspinatus muscle:** As a rotator cuff muscle, the supraspinatus assists the infraspinatus, teres minor, and subscapularis muscles to hold the head of the humerus in the glenoid cavity of the scapula. Also, assists the deltoid muscle in arm abduction.

Clinical Relevance: Shoulder pain and dysfunction; shoulder joint pathology. Consider acupuncture and related techniques (laser therapy, most notably) for tendon pathology, in light of evidence maintaining the importance of nitric oxide in tendon health and recovery from injury.[1]

Nerves

- **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.
- **Spinal accessory nerve (CN XI):** Motor fibers innervate the sternocleidomastoid and trapezius muscles as well as the soft palate and pharynx.
- **Suprascapular nerve (C4, C5, C6):** Arises from the brachial (not the cervical) plexus to supply the supraspinatus and infraspinatus muscles. It also sends branches to the shoulder, or glenohumeral joint.

Clinical Relevance: Supraclavicular or other nerve entrapment, whether by fibrous bands, muscles, or tendons.[2] Painful musculoskeletal conditions lead to central sensitization; this includes patients with shoulder impingement syndrome.[3]

Vessels

- **Suprascapular artery:** Branches off of the thyrocervical trunk to supply the muscles on the posterior aspect of the scapula.

Clinical Relevance: Hypovascular zones may promote

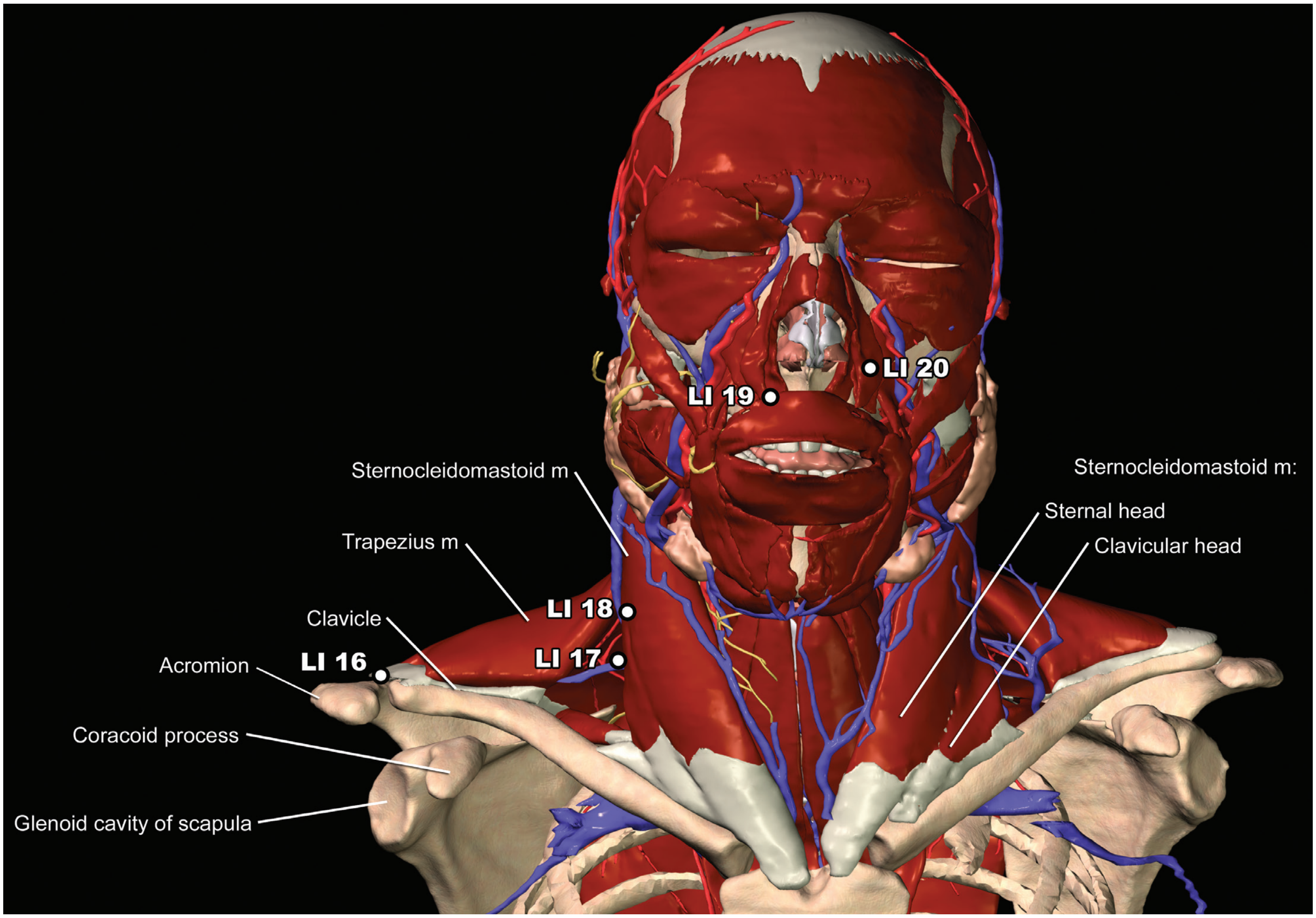


Figure 2-28. The Chinese term for LI 16, "Great Bone" alludes to the acromioclavicular joint as well as the clavicle itself. LI 16 resides in the nook created at the acromial end of the clavicle and the scapular spine, as shown in this image. LI 16 overlooks the supraspinatus outlet, denoted by a space surrounded by the acromoclavicular joint and the acromion along with the coracoacromial arch serving as the roof while the humeral head and glenoid become the floor. Narrowing of the supraspinatus outlet or dysfunction resulting from bearing increased loads can lead to impingement of the supraspinatus tendon. Tendinopathy or tendinitis may ensue

susceptibility to rupture susceptibility in tendons such as that belonging to the long head of the biceps muscle.[4] Possibly, by supporting circulation through medical acupuncture and related techniques, improved blood flow to tendons will support tissue integrity and strength.

Indications and Potential Point Combinations

- **Shoulder pain:** LI 16, isolate trigger points in nearby muscles contributing to the pain (deltoid, trapezius, pectoralis, etc.). Also palpate more distal potential sources of referred pain, including the subscapularis and teres major muscles for trigger points near HT 1. Check latissimus dorsi for trigger points referring to the shoulder.
- **Supraspinatus tendinitis:** LI 16, LI 15, LI 14, SI 12.

References

1. Bokhari AR and Murrell GAC. The role of nitric oxide in tendon healing. *J Shoulder Elbow Surg*. 2012;21:238-244.
2. Douchamps F, Courtois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome *Joint Bone Spine*. 2012;79:88-89.
3. Gwilym SE, Oag HCL, Tracey I, et al. Evidence that central sensitization is present in patients with shoulder impingement syndrome and influences the outcome after surgery. *J Bone Joint Surg.* 2011;93-B:498-502.
4. Cheng NM, Pan W-R, Vally F, et al. The arterial supply of the long head of biceps tendon: anatomical study with implications for tendon rupture. *Clin Anat.* 2010;683-692.

LI 17

Tian Ding "Celestial Tripod"

On the anterior margin of the posterior triangle of the neck, on the posterior margin of the sternocleidomastoid muscle, at the midpoint of the line connecting LI 18 to ST 12.

Muscles

- **Platysma muscle:** The platysma muscle moves the corners of the mouth inferiorly, as in expressions of sadness or fright.
- **Sternocleidomastoid (SCM) muscle:** Tilts the head to one side.
- Flexes and rotates the neck to turn the face superiorly to the opposite side.
- **Anterior scalene muscle:** The anterior scalene muscle rotates the neck and flexes it laterally; it also elevates the first rib.
- **Middle scalene muscle:** The middle scalene flexes the neck laterally and raises the first rib during forced inspiration.

Clinical Relevance: Neck pain, restriction, torticollis, vestibular dysfunction, whiplash-associated disorders following motor vehicle accidents.[2]

Nerves

- **Transverse cervical nerve (C2, C3):** Provides sensation to the skin over the anterior triangle of the neck.
- **Cervical branch of the facial nerve (CN VII):** Provides motor innervation to the platysma muscle.
- **Phrenic nerve (C4, with C3 and C5):** Provides sensation to the central part of the diaphragm, as well as the mediastinal pleura and pericardium. Also receives communicating branches from the cervical sympathetic ganglia. Provides sole motor supply to the diaphragm.
- **Brachial plexus (C5-T1):** Superior trunk of the brachial plexus formed by the union of the C5 and C6 roots.
- **Supraclavicular nerves (C3, C4):** Supply portions of the skin of the neck and shoulder.
- **Spinal accessory nerve (CN XI):** Motor fibers innervate the sternocleidomastoid and trapezius muscles as well as the soft palate and pharynx.
- **C2, C3 spinal nerves:** Provides pain sensation and proprioceptive function to the SCM.
- **C5-C8 spinal nerves:** Innervate the middle scalene muscle.
- **Great auricular nerve (C2, C3):** Supplies the skin over the parotid gland, the posterior aspect of the pinna, and a patch of skin spanning from the angle of the mandible to the mastoid process.

Clinical Relevance: Pain, motor disturbances, sensory loss, myofascial restriction, autonomic dysfunction, phrenic nerve injury.

Vessels

- **External jugular vein (EJV):** Most of the blood drained by the EJV arises from the scalp and face.
- **Ascending cervical artery:** Supplies the lateral muscles of the upper neck; is one of the two terminal branches of the thyrocervical trunk (with the inferior thyroid artery).

Clinical Relevance: Caution needling in this highly vascularized zone, rich with autonomic investment. Note the proximity of this point to the external jugular vein.

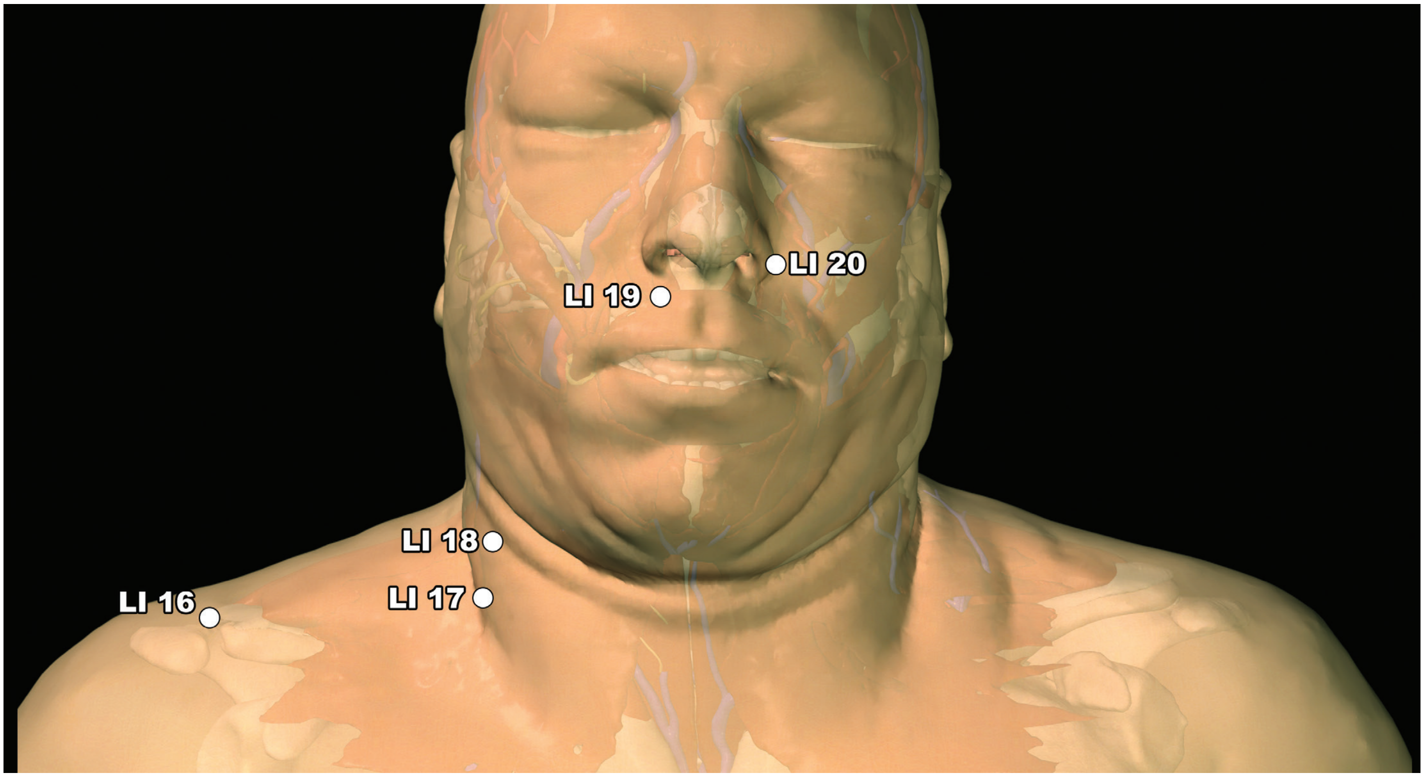


Figure 2-29. The "Celestial Tripod", LI 17, alludes to the location of LI 17 at the base of a cervical triangle that, like the feet of a tripod, support the head, a heavenly structure in Chinese allegory

Indications and Potential Point Combinations

- Neck pain related to trigger points in the scalene and sternocleidomastoid muscles: LI 17.

Evidence-Based Applications

- Point injection of LI 17 was shown in a case series to effectively relieve "obstinate hiccup".[1]

References

1. Ju L. Twenty-five cases of obstinate hiccup treated by point injection at Tianding. *Journal of Traditional Chinese Medicine.* 2003;23(2):117-118.

2. Bexander CS, Hodges PW. Cervico-ocular coordination during neck rotation is distorted in people with whiplash-associated disorders. *Exp Brain Re.* 2012;217(1):67-77.

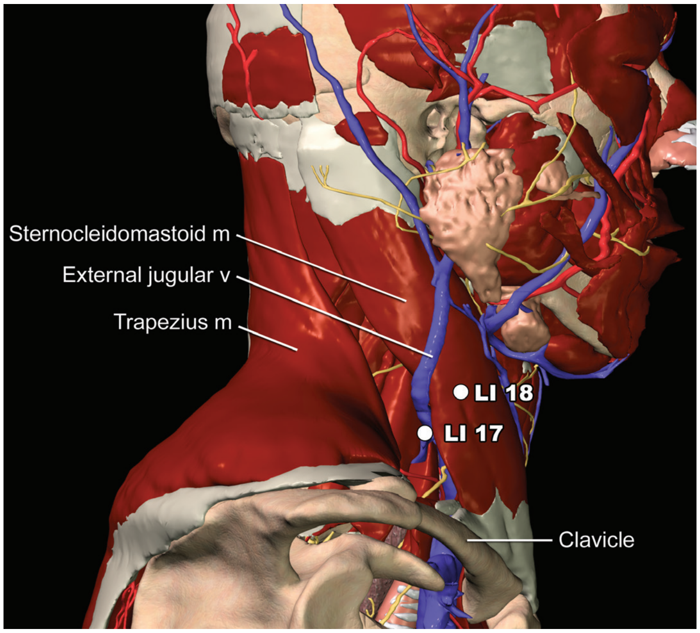

Sternocleidomastoid m
External jugular v
Trapezius m
LI 18
LI 17
Clavicle

Figure 2-30. This image depicts the close association between LI 17 and the external jugular vein (EJV). The EJV crosses the SCM obliquely to dive into the anteroinferior part of the posterior triangle of the neck to ultimately empty into the subclavian vein. Prior to terminating at the subclavian, the EJV receives the transverse cervical, the anterior jugular, and the suprascapular veins. Although not visible in this view, the great auricular nerve (from C2, C3 ventral rami) ascends diagonally over the SCM as the EJV descends.

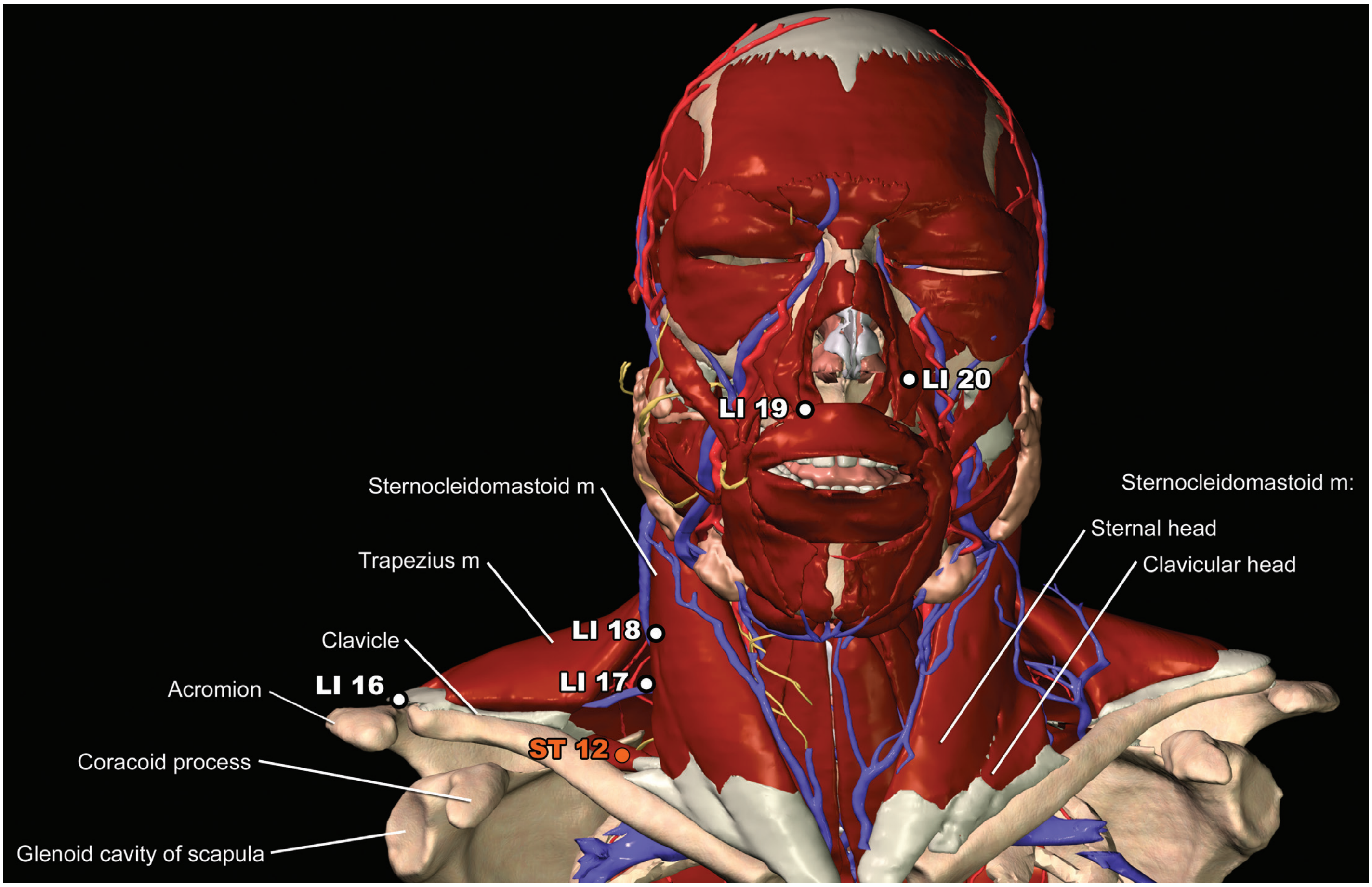

LI 20
LI 19
Sternocleidomastoid m
Sternocleidomastoid m:
Sternal head
Clavicular head
Trapezius m
LI 18
Clavicle
Acromion
LI 16
LI 17
ST 12
Coracoid process
Glenoid cavity of scapula

Figure 2-31. This image provides perspective on the relationship between LI 17 and the two points on either side, LI 18 and ST 12. LI 17 occupies the location halfway between the two. Here, too, the anatomic boundaries of the posterior triangle of the neck appear clearly, defined by the sternocleidomastoid (SCM) muscle, the trapezius muscle, and the clavicle.

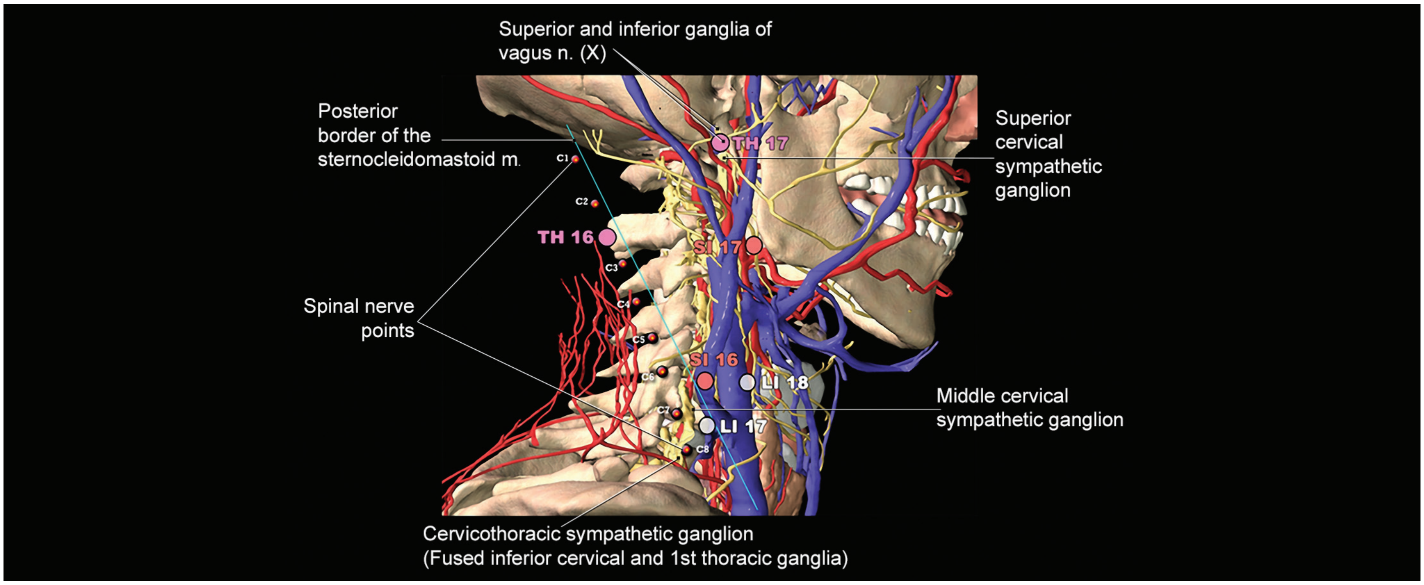

Superior and inferior ganglia of vagus n. (X)
Posterior border of the sternocleidomastoid m.
TH 17
Superior cervical sympathetic ganglion
C1
C2
TH 16
SI 17
C3
Spinal nerve points
C4
C5
SI 16
C6
LI 18
Middle cervical sympathetic ganglion
C7
LI 17
C8
Cervicothoracic sympathetic ganglion (Fused inferior cervical and 1st thoracic ganglia)

Figure 2-32. Acupuncture points on the lateral neck often occur adjacent to autonomic locales capable of widespread physiologic effects. This view illustrates the proximity of LI 17 to the middle cervical and cervicothoracic sympathetic ganglia.

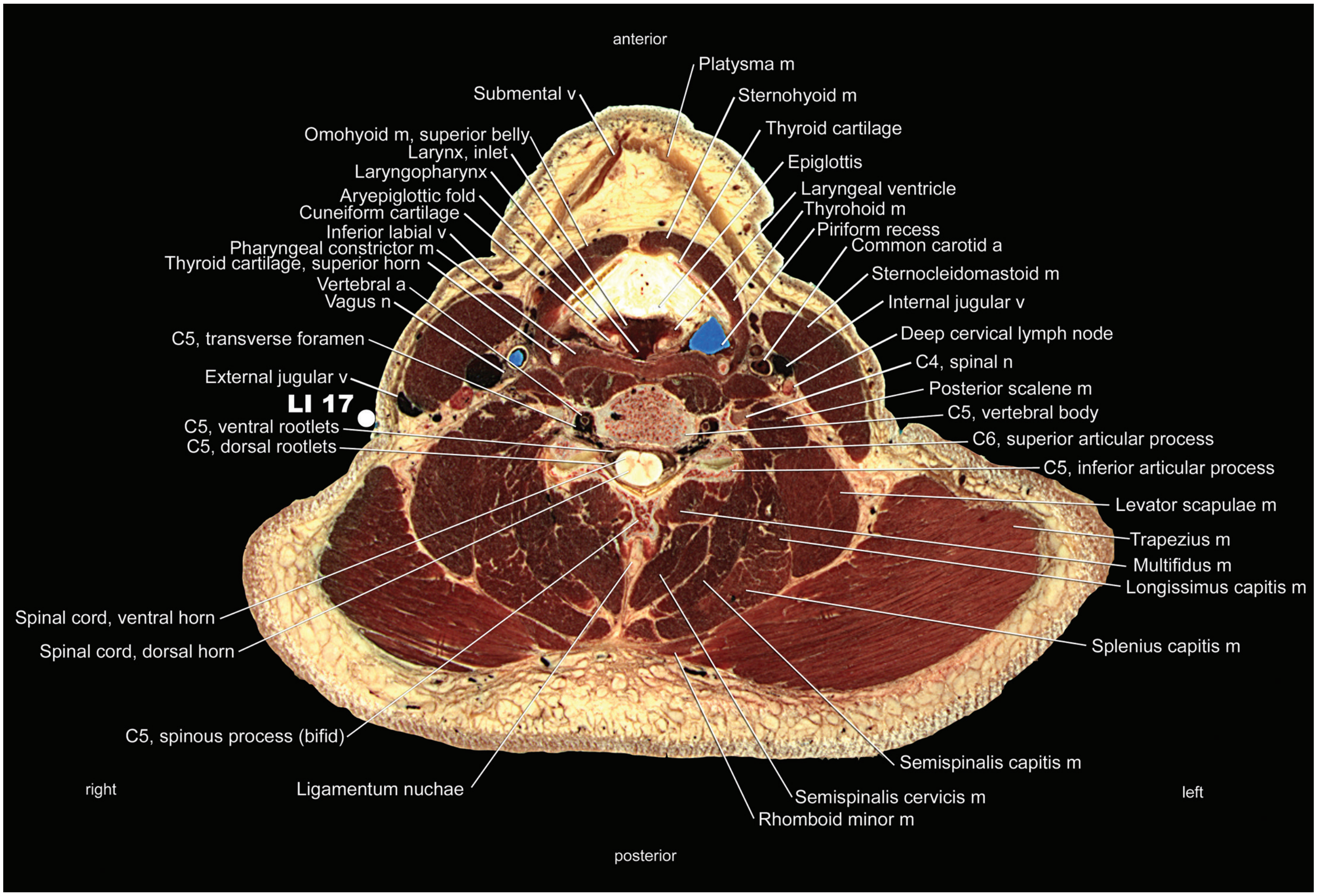

anterior
Platysma m
Submental v
Sternohyoid m
Omohyoid m, superior belly
Thyroid cartilage
Larynx, inlet
Laryngopharynx
Epiglottis
Aryepiglottic fold
Laryngeal ventricle
Cuneiform cartilage
Thyrohoid m
Inferior labial v
Piriform recess
Pharyngeal constrictor m
Common carotid a
Thyroid cartilage, superior horn
Sternocleidomastoid m
Vertebral a
Internal jugular v
Vagus n
Deep cervical lymph node
C5, transverse foramen
C4, spinal n
External jugular v
Posterior scalene m
LI 17
C5, vertebral body
C5, ventral rootlets
C6, superior articular process
C5, dorsal rootlets
C5, inferior articular process
Levator scapulae m
Trapezius m
Multifidus m
Longissimus capitis m
Spinal cord, ventral horn
Splenius capitis m
Spinal cord, dorsal horn
C5, spinous process (bifid)
Semispinalis capitis m
right
Ligamentum nuchae
Semispinalis cervicis m
left
Rhomboid minor m
posterior

Figure 2-33. The cross-section at LI 17 exposes the densely packed neural, vascular, and myofascial structures within reach of an acupuncture needle. While acupuncture needling can influence nociceptive transmission as well as glandular, circulatory, and/or neural control of the head and neck, injudicious needling can cause serious injury.

LI 18

Fu Tu "Protuberance Assistant"

Between the sternal and clavicular heads of the sternocleidomastoid muscle, level with the laryngeal prominence.

Note: Some authors locate the point at the posterior margin of the sternocleidomastoid muscle.

Fascia

- **Carotid sheath:** A facial, tubular structure that contains the internal and common carotid arteries, the internal jugular vein, the vagus nerve, the carotid sinus nerve, sympathetic nerve fibers (i.e., the carotid periarterial plexuses), and deep cervical lymph nodes.

Muscles

- **Platysma muscle:** The platysma muscle moves the corners of the mouth inferiorly, as in expressions of sadness or fright.
- **Sternocleidomastoid (SCM) muscle:** Tilts the head to one side. Flexes and rotates the neck to turn the face superiorly to the opposite side. The SCM participates in the trigemino-cervical reflex, and reflex abnormalities in the trigemino-cervical reflex via brainstem mechanisms appear to participate in the pathogenesis of migraine.[1]

Clinical Relevance: LI 18 lies close to the motor point of the SCM.[6] Thus, while one should always employ caution when stimulating points on the neck, activating LI 18 will likely produce greater contraction strength due to the fact that motor points serve as the locus over the skin where electrical current elicits maximal muscular contraction. Vestibular dysfunction; tinnitus, temporomandibular dysfunction. Neck pain, restriction, torticollis, vestibular dysfunction, whiplash-associated disorders following motor vehicle accidents.[7]

Nerves

- **Transverse cervical nerve (C2, C3):** Provides sensation to the skin over the anterior triangle of the neck.
- **Cervical branch of the facial nerve (CN VII):** Provides motor innervation to the platysma muscle.
- **Supraclavicular nerve (C3, C4):** Supply portions of the skin of the neck and shoulder.
- **Great auricular nerve (C2, C3):** Supplies the skin over the parotid gland, the posterior part of the auricle, and the skin between the mandible and the mastoid process.
- **Spinal accessory nerve (CN XI):** Motor fibers innervate the sternocleidomastoid and trapezius muscles as well as the soft palate and pharynx.
- **Ansa cervicalis (C1-C3; possibly also the vagus nerve (CN X) in some cases):**[2] Supplies the infrahyoid muscles of the anterior cervical triangle.
- **Carotid sinus nerve (CN IX):** Provides sensation to the carotid sinus and carotid body.
- **Vagus nerve (CN X):** Sensation from the inferior pharynx, the larynx, and thoracoabdominal viscera; taste from the root of the tongue and epiglottis; motor and proprioception to the soft palate, pharynx, intrinsic laryngeal muscles, and the palatoglossus; parasympathetic function to the thoracoabdominal organs.

Clinical Relevance: Laryngeal dysfunction; autonomic dysregulation or deafferentation; dysphagia; hemodynamic instability (caution: could cause by stimulating this site); local pain,

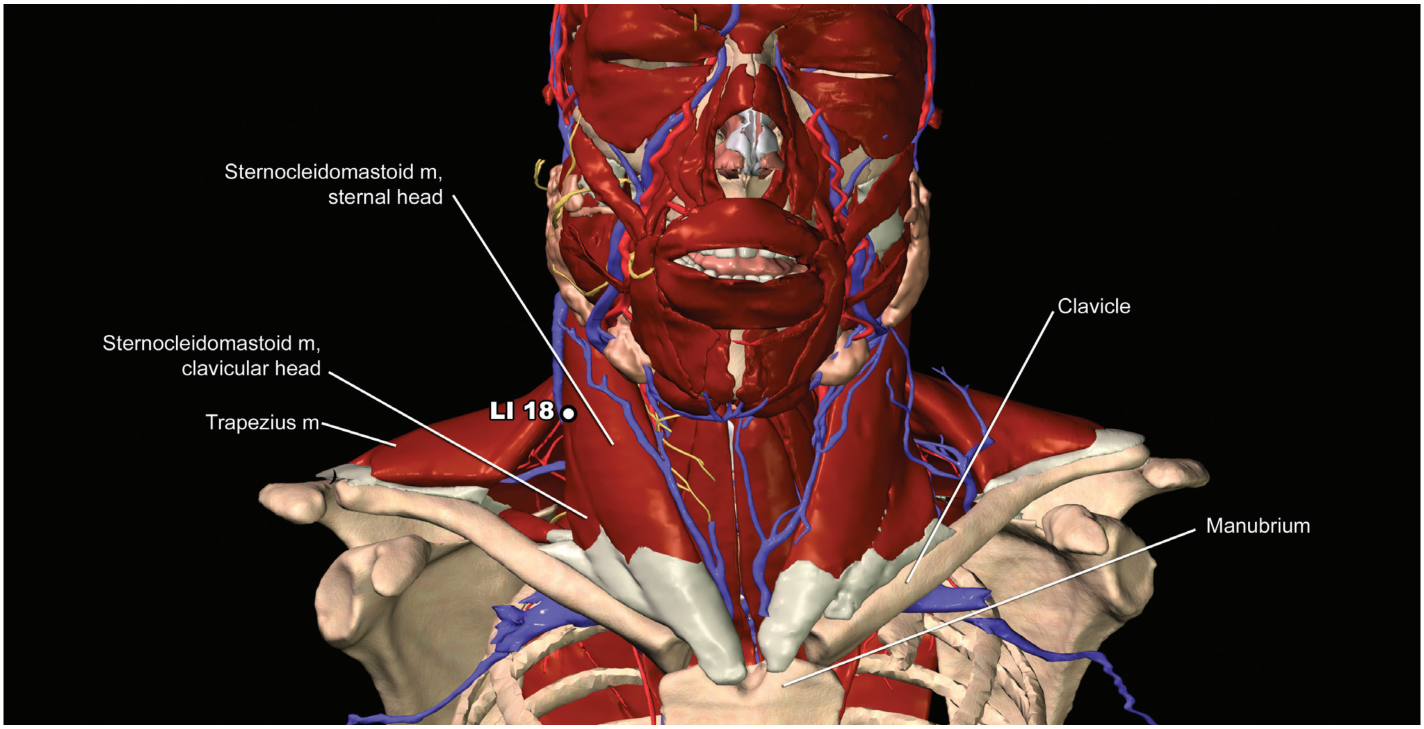

Sternocleidomastoid m, sternal head
Sternocleidomastoid m, clavicular head
Trapezius m
LI 18
Clavicle
Manubrium

Figure 2-34. The obliquely oriented sternocleidomastoid (SCM) muscle separates each half of the neck into two triangles, one anterior and one posterior. The SCM serves as a landmark for topographically locating several acupuncture points in addition to LI 18. Find LI 18 where the SCM cleaves into two parts, the sternal and clavicular heads, as shown here.

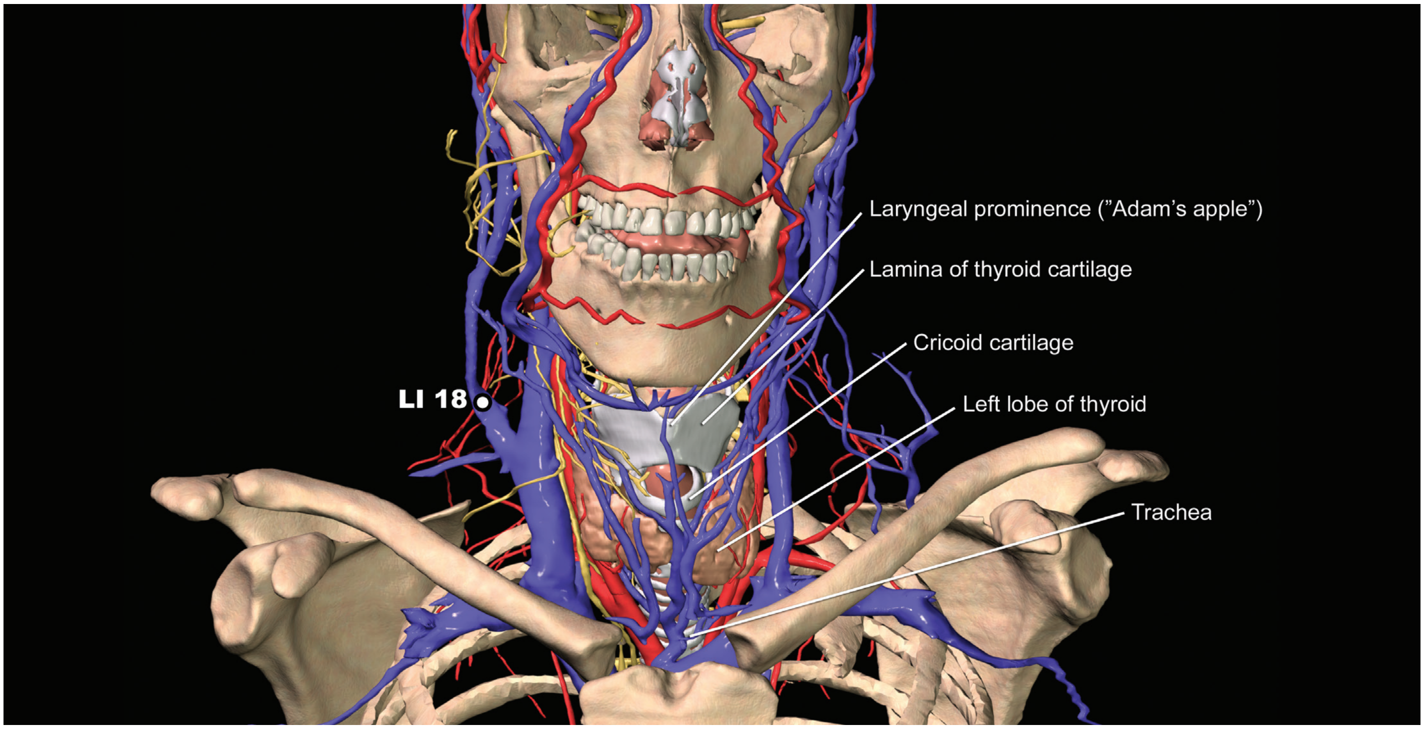

Laryngeal prominence ("Adam's apple")
Lamina of thyroid cartilage
Cricoid cartilage
LI 18
Left lobe of thyroid
Trachea

Figure 2-35. LI 18, the "Protuberance Assistant" resides lateral to the main protuberance of the neck, the laryngeal prominence or "Adam's apple".

myofascial restriction, or sensory disturbances. Vestibular dysfunction; tinnitus, temporomandibular dysfunction.

Vessels

- **External jugular vein (EJV):** Most of the blood drained by the EJV arises from the scalp and face.
- **Internal jugular vein (IJV):** The main venous structure of the neck. Originates from the sigmoid (dural venous) sinus and travels in the carotid sheath as it descends through the neck region. It unites with the subclavian vein at the level of T1 to form the brachiocephalic vein.
- **Common carotid artery:** Divides into the internal and external carotid arteries. The internal carotid artery has no branches in the neck and provides the main blood supply to the brain and structures within the orbits. The external carotid artery supplies structures mainly external to the skull, except for the middle meningeal artery.
- **Ascending cervical artery:** Supplies the lateral muscles of the upper neck; is one of the two terminal branches of the thyrocervical trunk (with the inferior thyroid artery).

Clinical Relevance: Caution needling in this highly vascularized zone, rich with autonomic investment. Note the proximity of this point to the major vessels of the neck.

Indications and Potential Point Combinations

- **Inflammation, edema, or nodules on vocal cords:** LI 18, CV 23, CV 22, ST 36, LI 4.
- **Laryngitis, and post-extubation inflammation and edema of larynx:** LI 18, CV 22.
- **Sore throat, tonsillitis, cough, sputum in the throat:** LI 18, LI 11, LI 4, LU 7.
- **Restricted range of motion of the neck based on local trigger points (scalenes, sternocleidomastoid muscle):** LI 18, LI 17, BL 10, GB 20, GB 21.

Evidence-Based Applications

- Case series illustrated applications for **shoulder and back pain, arm pain, and pharyngitis/laryngitis.**[3]
- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary • Sjögren's syndrome, irradiation, or other causes.[4]
- Patients suffering from **dysphagia** following stroke who received electroacupuncture from LU 7 to LI 4, and from LU 1/ LI 15 to LI 18 demonstrated significantly greater swallowing function than did patients in the control group.[5]

References

1. Nardone R, Ausserer H, Bratti A, et al. Trigemino-cervical reflex abnormalities in patients with migraine and cluster headache. *Headache.* 2008;48:578-585.
2. Vollala VR, Bhat SM, Nayak S, Raghunathan D, Samuel VP, Rodrigues V, and Mathew JG. A rare origin of upper root of ansa cervicalis from vagus nerve: a case report. *Neuroanatomy.* 2005;4:8-9.
3. Sun G. Clinical experience in application of the acupoint Futu. *Journal of Traditional Chinese Medicine.* 2002;22(2):132-133.
4. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases.* 2000;6:15-24.
5. Nowicki NC and Averill A. Acupuncture for dysphagia following stroke. *Medical Acupuncture.* 14(3). Obtained at http://medicalacupuncture.org/aama_marf/journal/vol14_3/article3.html on 01-10-06.
6. Liu YK, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med.* 1975;3(4):347-358.
7. Bexander CS, Hodges PW. Cervico-ocular coordination during neck rotation is distorted in people with whiplash-associated disorders. *Exp Brain Re.* 2011;Dec 17 –Epub ahead of print.

LI 19

He Liao "Grain Bone Hole"

On the upper lip, directly below the lateral margin of the nostril, level with GV 26. (GV 26 lives at the junction of the upper third with the lower two-thirds of the philtrum, along the midline.)

Muscles

- **Levator labii superioris muscle:** Elevates the upper lip and dilates the naris.[1]
- **Orbicularis oris muscle:** Oral sphincter.

Clinical Relevance: Muscles that move the mouth (and eyes) receive much attention from plastic surgeons for cosmetic procedures. Acupressure, acupuncture, and laser therapy "face lifts" might include focus on LI 19 to address the linear folds in the midfacial region and nasolabial crease, common signs of aging. Researchers in Asia have considered local points around the mouth for the treatment of "gummy smile", i.e., excessive display of gingival tissue on smiling, with relaxation of the levator labii superioris muscle with relaxing neuromodulatory input, given that botulinum toxin has shown improvements when injected into this region.[2]

Nerves

- **Infraorbital nerve (CN V$_2$):** Provides sensation to the skin of the cheek and lower lid, the side of the nose, inferior septum, and upper lip. Also provides sensation to the upper premolar incisors and canine teeth as well as the mucosae of the maxillary sinus and upper lip.
- **Buccal branches of facial nerve (CN VII):** Supplies the buccinator muscle, upper parts of the orbicularis oris, and inferior fibers of the levator labii superioris muscles.

Clinical Relevance: Facial nerve injury, local sensory loss, dental pain of the upper arcade.

Vessels

- **Infraorbital artery:** Arises from the maxillary artery to supply the face and part of the orbit.
- **Superior labial artery:** Arises from the facial artery and runs medially in the upper lip.

Clinical Relevance: Richly supplied with sympathetic and sensory fibers, locales such as LI 19, LI 20, and nearby GV 26 confer local and generalized sympathomimetic effects on the individual. Results include clearing of the nasal passages and cardiopulmonary arousal.

Indications and Potential Point Combinations

- **Facial paralysis affecting the buccal branch of the facial nerve:** LI 19, ST 4, TH 17.
- **Toothache, upper arcade:** LI 19, ST 2, LI 4, LU 7.

References

1. Hur MS, Youn KH, Hu KS, et al. New anatomic considerations on the levator labii superioris related with the nasal ala. *J Craniofac Surg.* 2010;21(1):258-260.

2. Hwang W-S, Hur M-S, Hu K-S, et al. Surface anatomy of the lip elevator muscles for the treatment of gummy smile using Botulinum toxin. *Angle Orthod.* 2009;79(1):70-77.

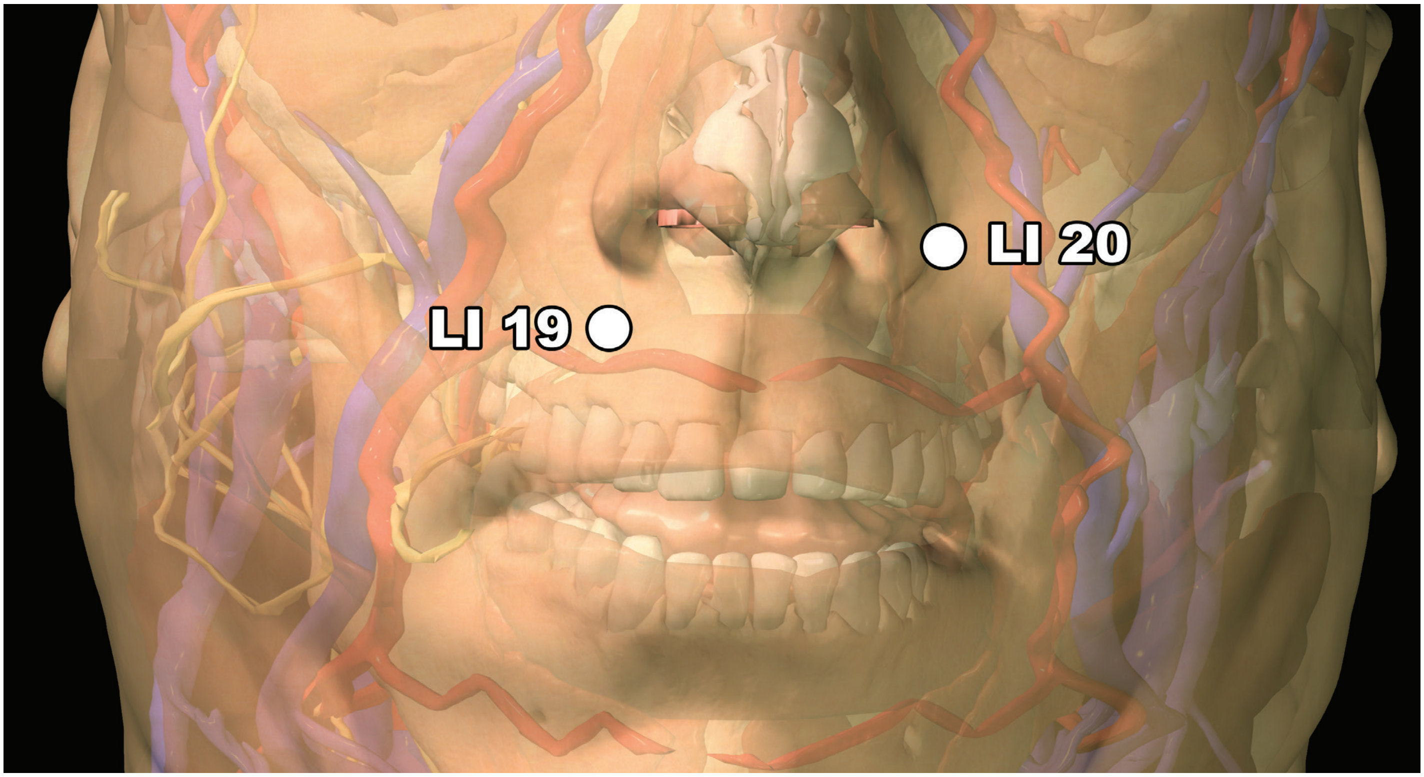


Figure 2-36. LI 19, "Grain Bone-Hole" lines up with the space behind the canine tooth where a space exists, about the size of a grain of rice. The infraorbital nerve (a branch of the trigeminal nerve) and the buccal branch of the facial nerve supply this area with sensory and motor functions, respectively. This justifies the indications of LI 19 for pain in local structures including the teeth, facial nerve injury, and nasal congestion.

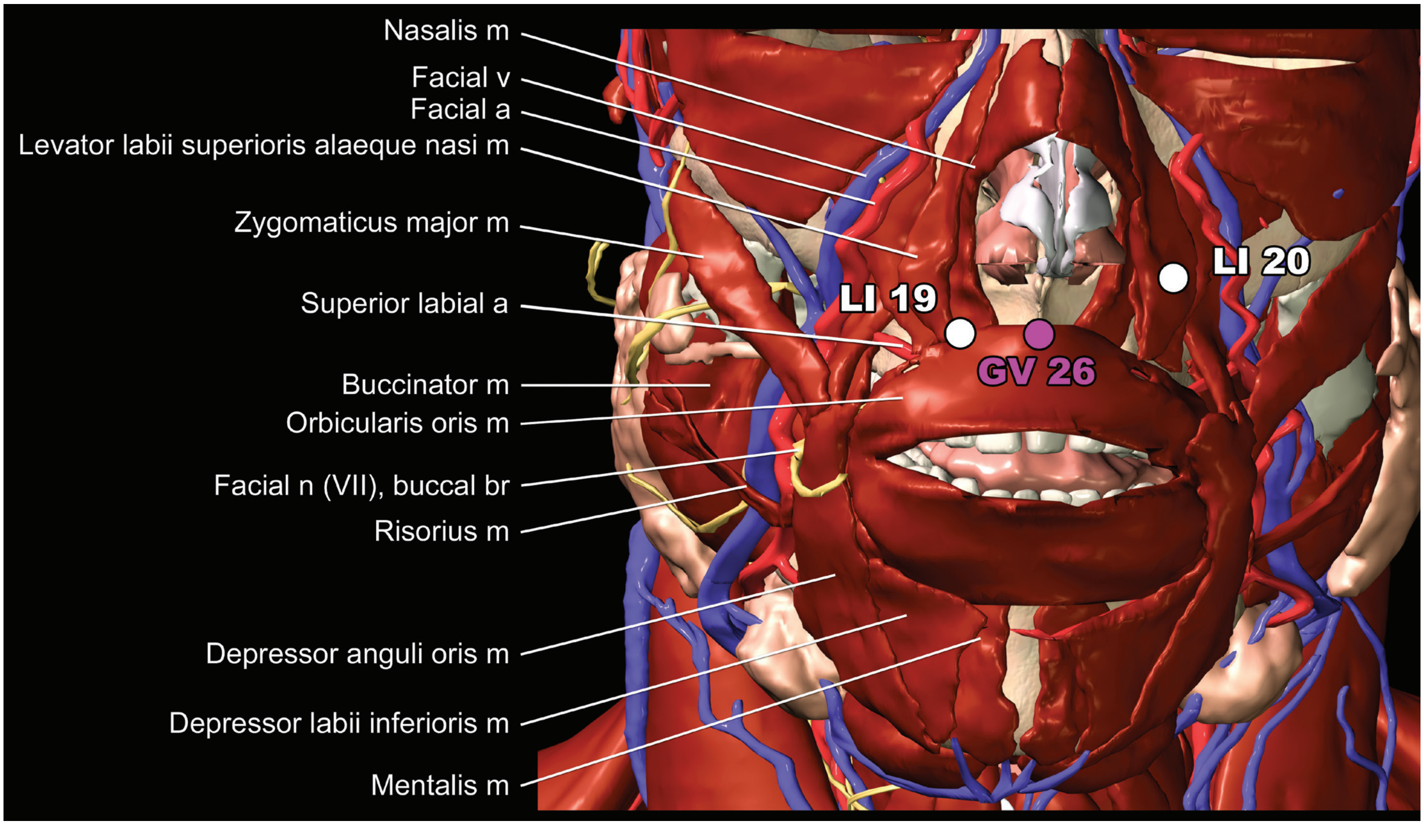

Nasalis m
Facial v
Facial a
Levator labii superioris alaeque nasi m
Zygomaticus major m
Superior labial a
Buccinator m
Orbicularis oris m
Facial n (VII), buccal br
Risorius m
Depressor anguli oris m
Depressor labii inferioris m
Mentalis m
LI 19
LI 20
GV 26

Figure 2-37. LI 19, like GV 26, lies at the junction of the upper third and the lower two thirds of the philtrum, interacting with several muscles of facial expression. Note the muscle medial to the levator labii superioris alaeque nasi, just lateral to LI 19. This unlabeled structure is the levator labii superioris muscle.

LI 20

Ying Xiang "Welcome Fragrance"

In the nasolabial groove, at the level of the midpoint of the lateral border of the ala nasi.

Note: This is the only channel that crosses the midline. Here, LI decussates under the nose between LI 19 and LI 20. As such, LI 20 ends on the side of the body opposite from where it began at LI 1.

Muscles

- **Levator labii superioris muscle:** Elevates the upper lip and dilates the naris.
- **Levator labii superioris alaeque nasi (LLSAN) muscle:** Elevates the upper lip and dilates the naris.

Clinical Relevance: One can classify the muscles of facial expression according to which orifices of the face they close (as sphincters) or open (as dilators); in this case, the LLSAN is a naris dilator. Whether the muscles' role in opening and shutting entryways to the eye and tongue outweighs their value in conveying facial expression remains a matter of debate.[2] Certain primate species possess a "highly graded and intricate facial expression repertoire" that depends heavily on facial muscle movement.[3] Comparisons of human with other primate anatomy yield insights into the form and function of facial musculature from a phylogenetic perspective.[4]

Nerves

- **Infraorbital nerve (CN V$_2$):** Provides sensation to the skin of the cheek and lower lid, the side of the nose, inferior septum, and upper lip. Also provides sensation to the upper premolar incisors and canine teeth as well as the mucosae of the maxillary sinus and upper lip.
- **Buccal branches of facial nerve (CN VII):** Supplies the buccinator muscle, upper parts of the orbicularis oris, and inferior fibers of the levator labii superioris muscles.

Clinical Relevance: Nasal congestion, sinusitis.

Vessels

- **Infraorbital artery:** Arises from the maxillary artery to supply the face and part of the orbit.
- **Superior labial artery:** Arises from the facial artery and runs medially in the upper lip.

Clinical Relevance: Richly supplied with sympathetic and sensory fibers, locales such as LI 19, LI 20, and nearby GV 26 confer local and generalized sympathomimetic effects on the individual. Results include clearing of the nasal passages and sinuses; dental pain.

Indications and Potential Point Combinations

- **Rhinitis, maxillary sinusitis:** LI 20, ST 3, Yintang (GV 24.5).
- **Epistaxis:** LI 20, LI 19, GV 23.
- **Anosmia:** LI 20, GV 23, GV 24.5, GV 20.

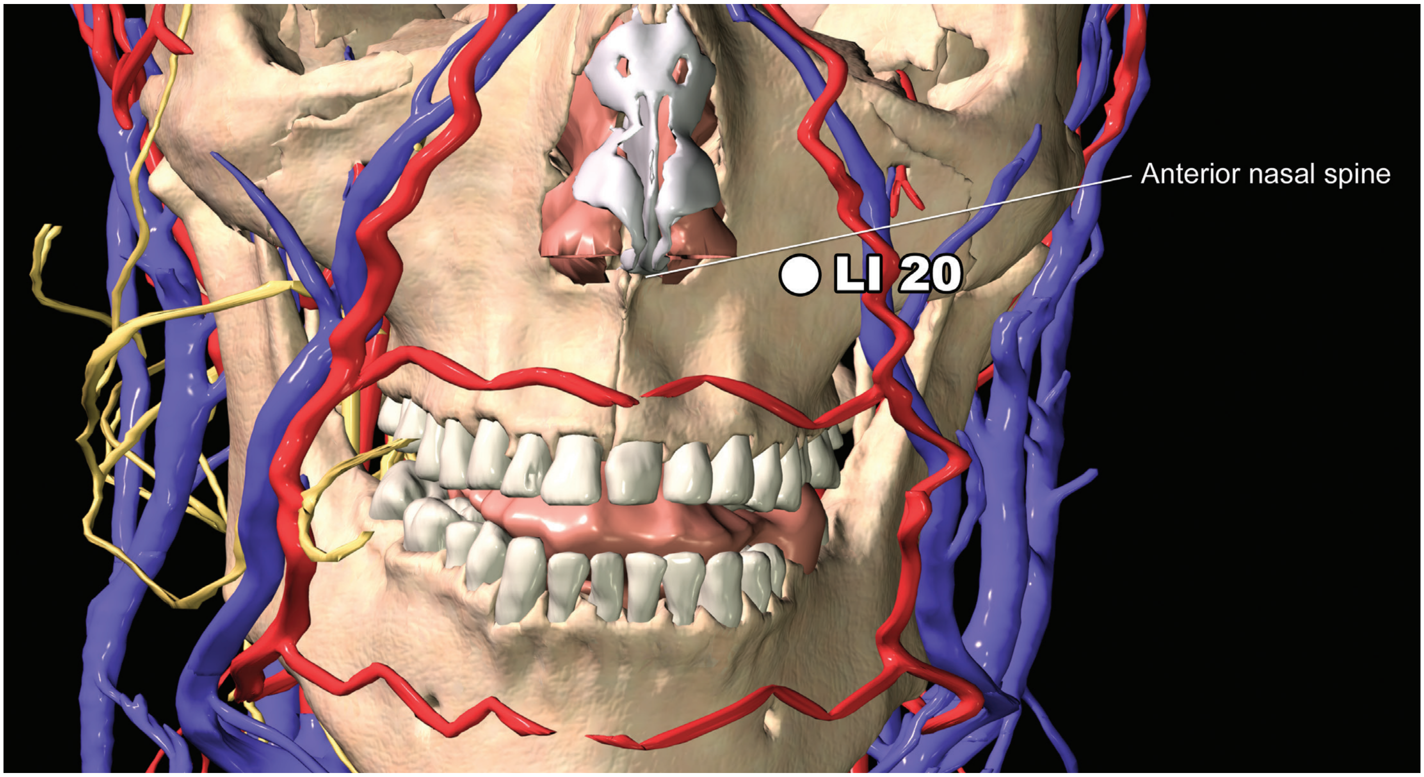


Figure 2-38. LI 20, "Welcome Fragrance", improves the sense of smell by clearing nasal passages, presumably through activation of trigeminal nerve sensory reflexes and local autonomic neuromodulation.

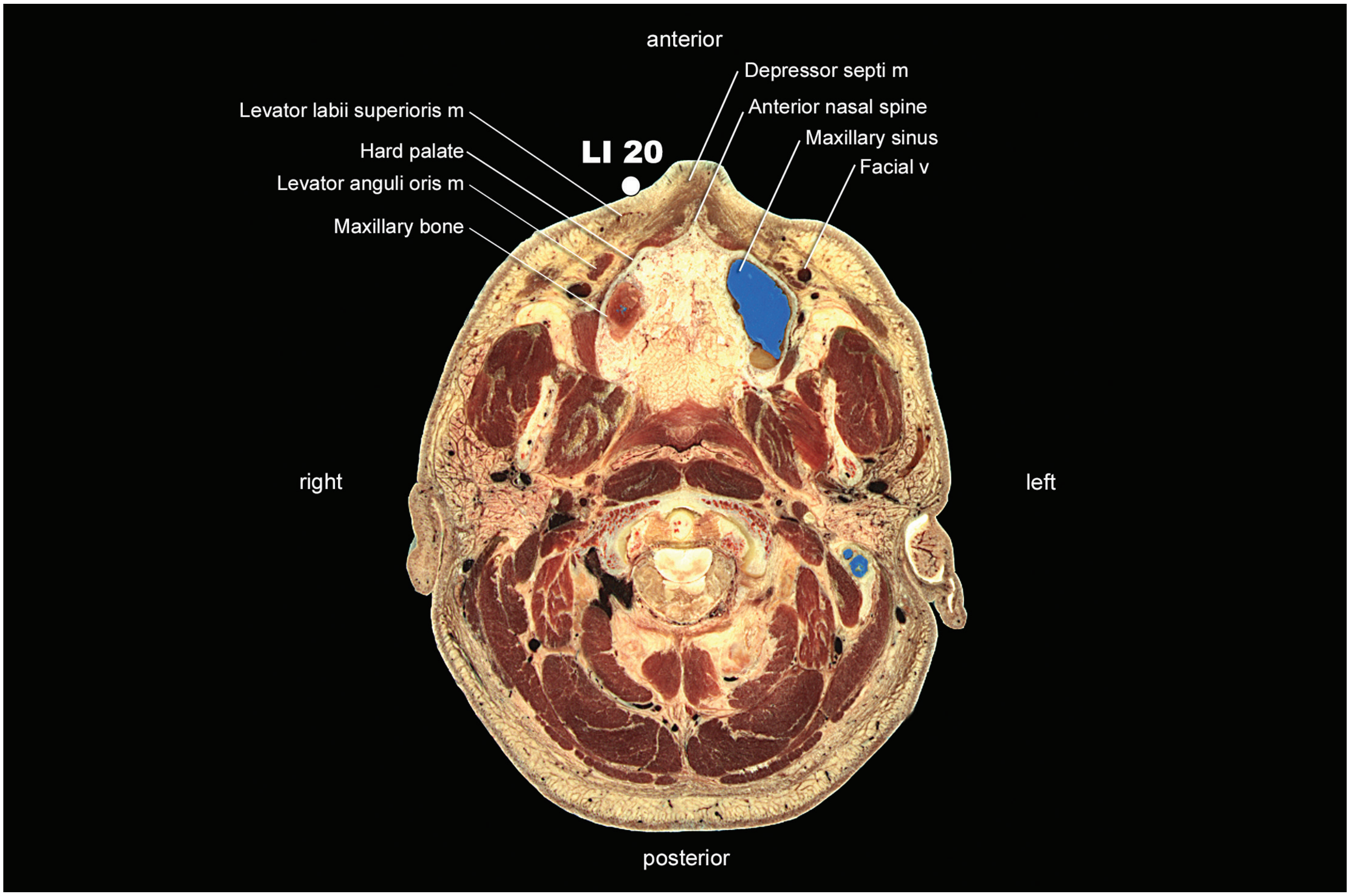

anterior
Depressor septi m
Levator labii superioris m
Anterior nasal spine
Maxillary sinus
Hard palate
LI 20
Facial v
Levator anguli oris m
Maxillary bone
right
left
posterior

Figure 2-39. The anterior nasal spine serves as a landmark to identify the location of LI 20, depicted in this cross section.

Evidence-Based Applications

- Nasal massage at LI 20 may provide relief from **nasal congestion.**[1]

References

1. Takeuchi H, Jawad M, and Eccles R. The effects of nasal massage of the "Yingxiang" acupuncture point on nasal airway resistance and sensation of nasal airflow in patients with nasal congestion associated with acute upper respiratory tract infection. *American Journal of Rhinology*. 1999;13:77-79.

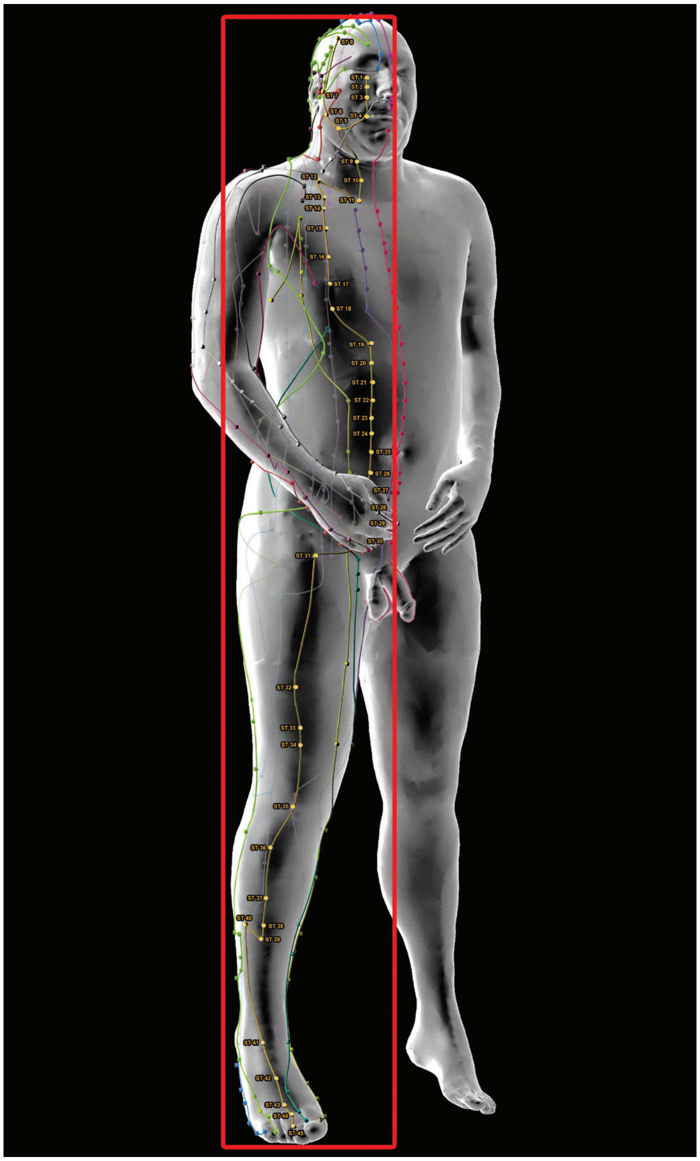
2. Hur MS, Hu KS, Park JT, et al. New anatomical insight of the levator labii superioris alaeque nasi and the transverse part of the nasalis. *Surg Radiol Anat*. 2010;32:753-756.

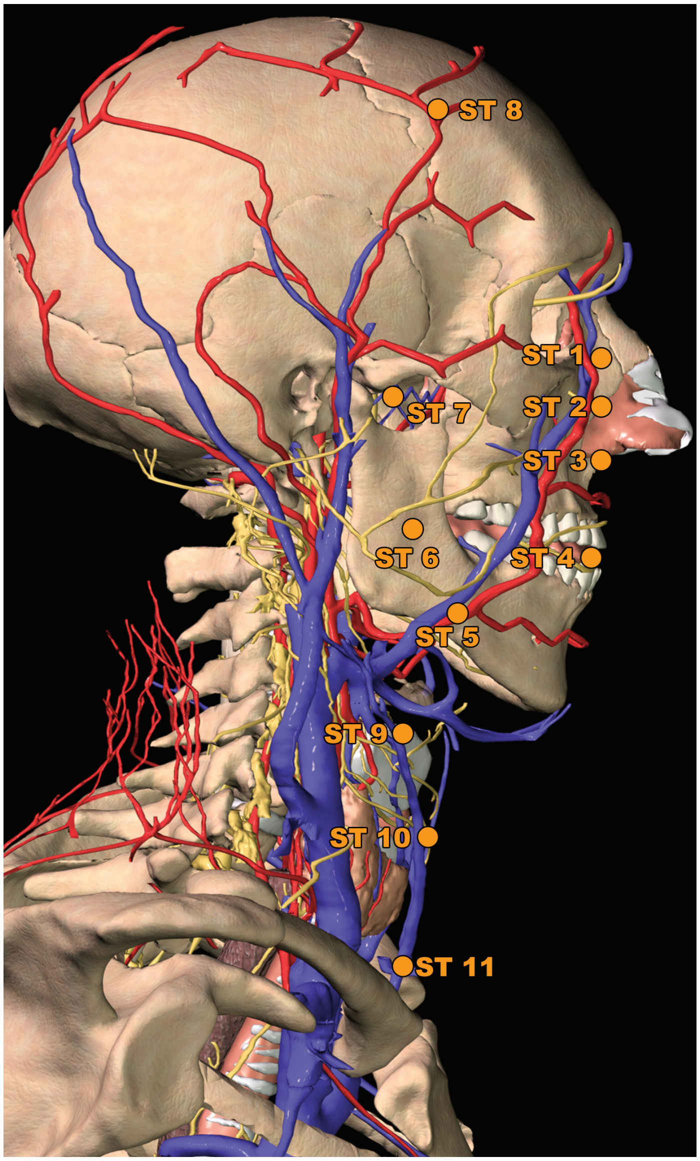
3. Burrows AM, Waller BM, and Parr LA. Facial musculature in the rhesus macaque *(Macaca mulatta)*: evolutionary and functional contexts with comparisons to chimpanzees and humans. *J Anat*. 2009;215:320-334.

4. Diogo R, Wood BA, Aziz MA, et al. On the origin, homologies and evolution of primate facial muscles, with a particular focus on hominoids and a suggested unifying nomenclature for the facial muscles of the Mammalia. *J Anat*. 2009;215:300-319.

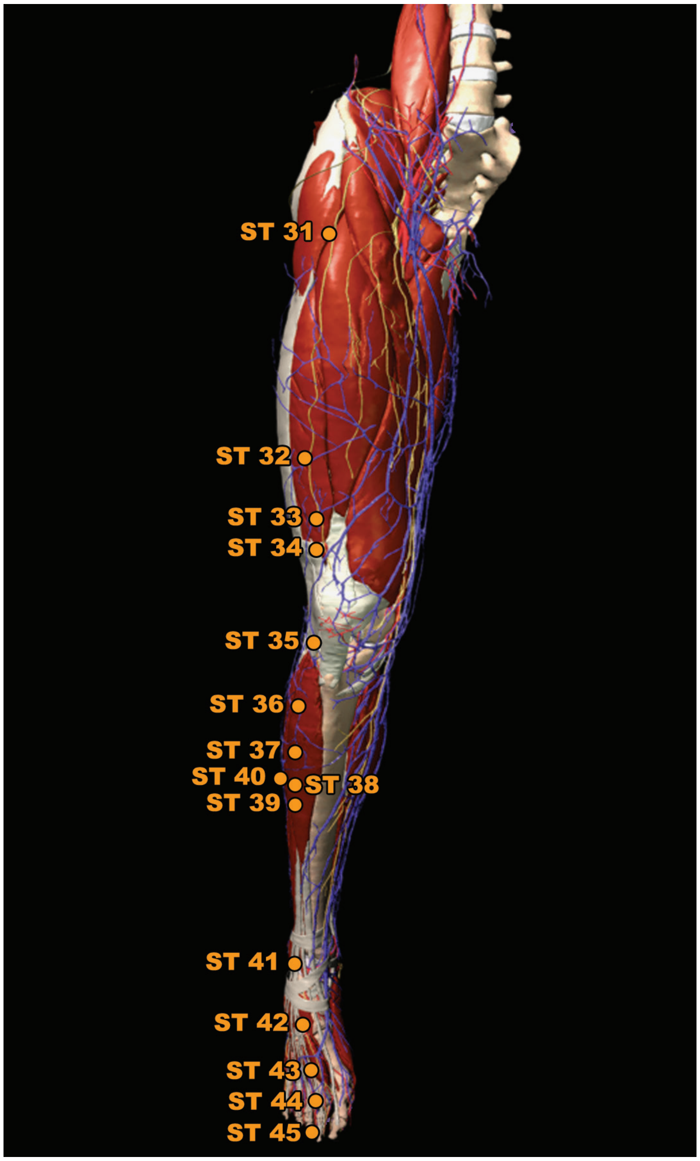
Channel 3:: The Stomach (ST)

The Stomach (ST) channel comprises two branches. The shorter one drops down below the pupil, then swoops around the masseter muscle and swings up the temple. The longer branch descends from neck to clavicle, and straight down the thorax and abdomen, paralleling the Spleen, Kidney, and Conception Vessel lines. From groin to foot, the ST channel covers the anterolateral pelvic limb to end at ST 45 on the lateral aspect of toe number two.


ST 8
ST 1
ST 2
ST 3
ST 7
ST 6
ST 4
ST 5
ST 9
ST 12
ST 10
ST 13
ST 11
ST 14
ST 15
ST 16
ST 17
ST 18
ST 19
ST 20
ST 21
ST 22
ST 23
ST 24
ST 25
ST 26
ST 27
ST 28
ST 29
ST 30
ST 31
ST 32
ST 33
ST 34
ST 35
ST 36
ST 37
ST 40
ST 38
ST 39
ST 41
ST 42
ST 43
ST 44
ST 45



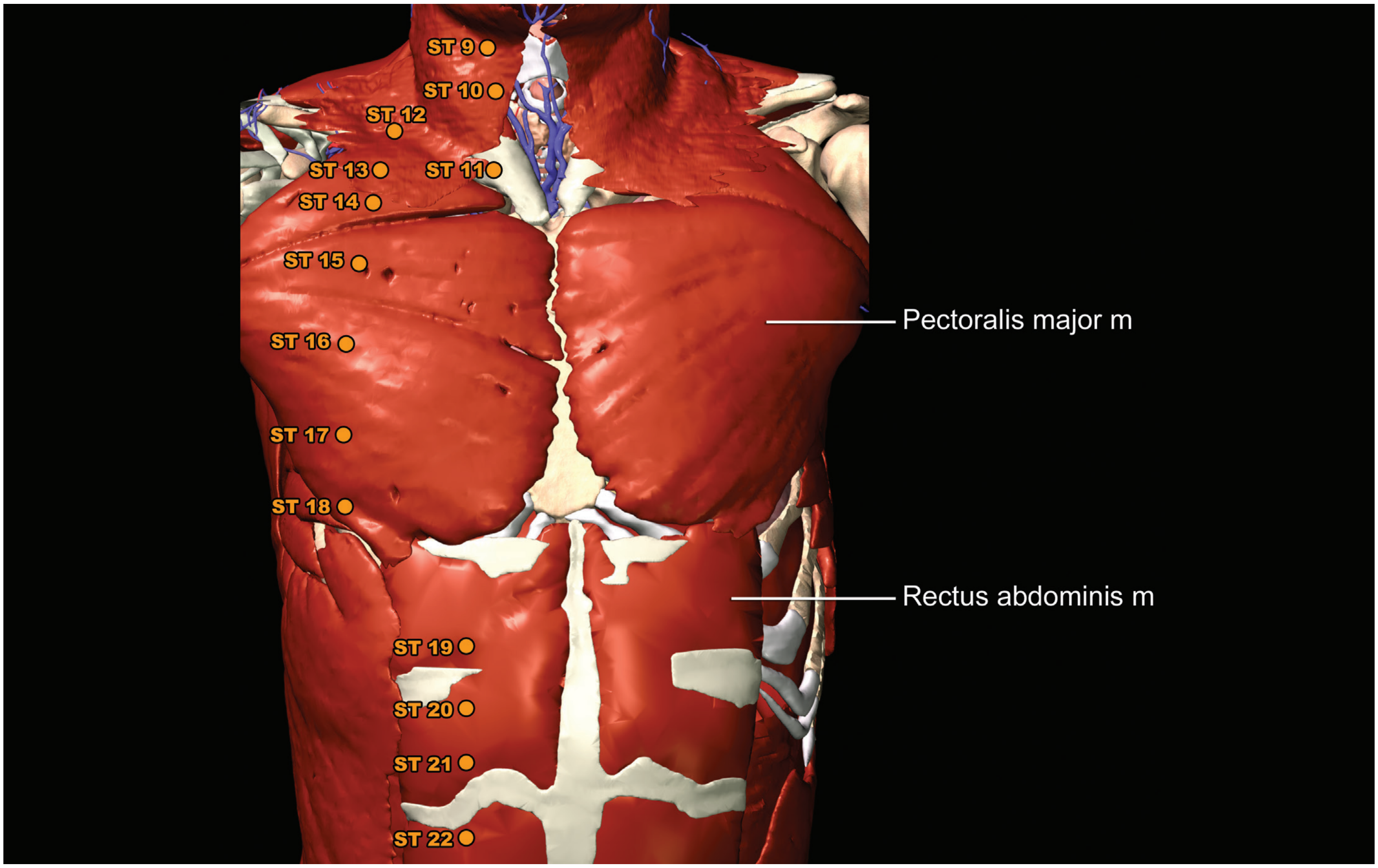
This neurovascular view shows how the ST line partners with major vasculature of the head and neck, beginning with the facial artery and vein and continuing on with the jugular and carotid vessels.



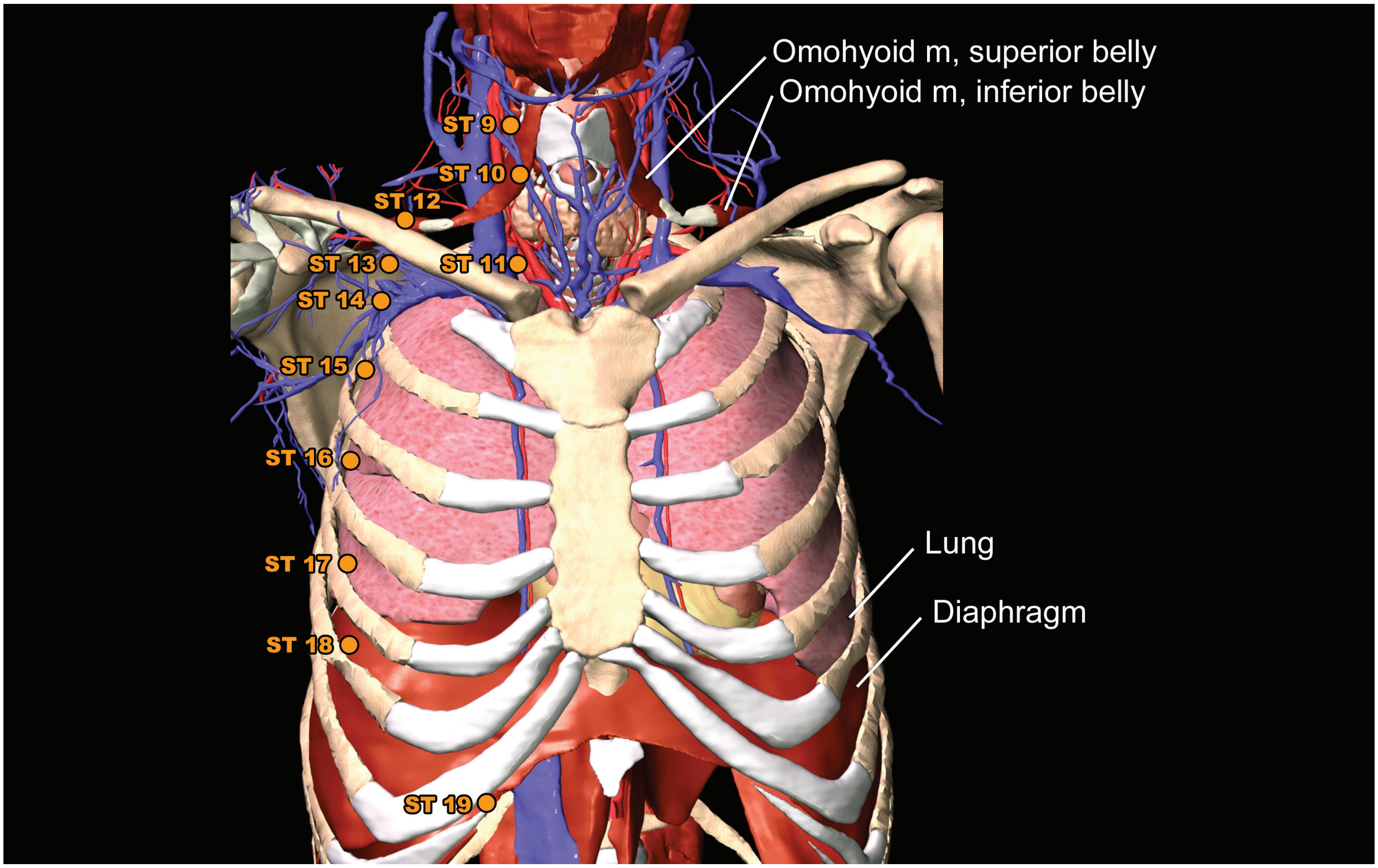
ST points on the pelvic limb differentially stimulate the autonomic nervous system, with points on the anterior tibial muscle (ST 36, especially) augmenting parasympathetic function while distal points on the foot neuromodulate sympathetic pathways.

Points along the facial portion of the ST channel address a variety of conditions, including sinusitis, dental pain, nasal stuffiness, mandibular discomfort, ocular distress, head pain, and cranial nerve dysfunction. As the ST line courses caudally, it covers highly vascular territory packed with chemo- and pressure-sensitive nerve endings. For example, ST crosses the carotid sheath, which contains the common and internal carotid arteries, the vagus nerve, the internal jugular vein, the carotid sinus nerve, and sympathetic nerve fibers constituting the carotid periarterial plexuses. This sheath blends with pretracheal and deep cervical fascia; this fascial expanse communicates with the thoracic mediastinum and cavity, representing fascial continuity between the head and chest.

Structures along the ST line link head, neck, and chest in functional ways, as well as anatomically. In the case of the omohyoid muscle, contracting it during yawning tenses the cervical fascia and promotes drainage of blood from the head into the internal jugular vein.[1] Additionally, cervical strap muscles, the pectoralis, and the rectus abdominis muscle, all of which fall along the ST line, participate in the work of breathing when additional force becomes necessary.[2]


ST 9
ST 10
ST 12
ST 13
ST 11
ST 14
ST 15
ST 16
ST 17
ST 18
ST 19
ST 20
ST 21
ST 22
Pectoralis major m
Rectus abdominis m

Muscles that assist respiration, namely the pectoralis major and rectus abdominis muscles relate closely to the ST channel.


Omohyoid m, superior belly
Omohyoid m, inferior belly
ST 9
ST 10
ST 12
ST 13
ST 11
ST 14
ST 15
ST 16
ST 17
ST 18
ST 19
Lung
Diaphragm

This image outlines the relationship between the ST line, the omohyoid muscle, and accessory muscles of respiration.

Several ST points neuromodulates digestion. This begins with seeing food (ST 1); smelling it (ST 2, ST 3); salivating, prehending, and masticating (ST 4-8), and swallowing (ST 9-11). Stimulation of ST lines on the trunk may inhibit gastric motility while those on the pelvic limb (ST 36, especially) promote digestive movement.[3] Neuromodulatory processes that make this happen reflex through the nucleus tractus solitarius and dorsal motor nucleus of the vagus.[4,5] Facial ST points affect digestion as well, first activating the trigeminal nerve and, secondarily, vagal pathways. Sympathoadrenal medullary function may respond to ST line stimulation, as well.[6] From a broader perspective, long-loop reflexes coursing through propriospinal connections link somatic afferent stimulation between the arm and leg. This may provide a neuroanatomic basis for pairing thoracic and pelvic limb lines, such as LI/ST, HT/KI, LU/SP, and so on.[7] More research would need to be done in order to show specificity linking typically associated channels.

References

1. Patra P, Gunness TK, Robert R, et al. Physiologic variations of the internal jugular vein surface, role of the omohyoid muscle, a preliminary echocardiographic study. *Surg Radiol Anat*. 1988;10(2):107-112.
2. Banner MJ. Respiratory muscle loading and the work of breathing. *Journal of Cardiothoracic and Vascular Anesthesia*. 1995;9(2):192-204.
3. Sato A, Sato Y, Suzuki A, et al. Neural mechanisms of the reflex inhibition and excitation of gastric motility elicited by acupuncture-like stimulation in anesthetized rats. *Neuroscience Research*. 1993;18:53-62.
4. Wang JJ, Liu XD, Qin M, et al. Electro-acupuncture of Tsusanli and Shangchuhsu regulates gastric activity possibly through mediation of the vagus solitary complex. *Hepatogastroenterology*. 2007;54(78):1862-1867.
5. Wang JJ, Ming Q, Liu XD, et al. Electro-acupuncture of Foot YangMing regulates gastric activity possibly through mediation of the dorsal vagal complex. *Am J Chin Med*. 2007;35(3):455-464.
6. Mori H, Uchida S, Ohsawa H, et al. Electro-acupuncture stimulation to a hindpaw and a hind leg produces different reflex responses in sympathoadrenal medullary function in anesthetized rats. *Journal of the Autonomic Nervous System*. 2000;79:93-98.
7. Meinck HM and Piesiur-Strehlow B. Reflexes evoked in leg muscles from arm afferents: a propriospinal pathway in man? *Exp Brain Res*. 1981;43:78-86.

ST 1

Cheng Qi “Tear Container”

Between the globe and the midpoint of the infraorbital ridge.

Note: Deep insertion may damage ocular structures. High risk point. No moxa.

Orbital Fat and Its Encapsulating Connective Tissue (OFCT)[1]

- Provides an elastic cushion for the eyelids. May contribute to orbital biomechanics by preventing anterior globe displacement in head trauma, thus stabilizing the eye. OFCT displaces and deforms proportionally and in the same direction as the extraocular muslces and optic nerve during eye movements.

Clinical Relevance: The thixotropic or anti-thixotropic behavior of subcutaneous fat (possibly including that around the orbit) may modify the impact of blunt trauma to the individual. In this case, the consequences of blunt trauma to the eye may depend on the health and viscosity of the overlying subcutaneous tissue and fat.[2] Considering the inclusion of ST 1 in an acupressure or acupuncture “face lift” treatment, ST 1 may hold value for its support of periorbital connective tissue health and repair.

Fascia

- **Capsulopalpebral Fascia:**[3] An analogue of the levator aponeurosis in the upper lid, originates from the belly of the inferior rectus muscle and extends to the lower border of the inferior oblique muscle. The capsulopalpebral head embodies a firm adhesion between the capsulopalpebral fascia and the inferior rectus muscle.

Clinical Relevance: Surgical dissection of the region at and near ST 1 may lead to scarring or fibrosis. Perhaps injury to the floor of the orbit, localized infection, myofascial dysfunction in the region, or congenital disorders could lead to inordinate amounts of restriction in the capsulopalpebral fascia. Neuromodulation and fascial release of the tissue within reach of ST 1 could conceivably improve local tissue health and biomechanics of the eye.

Muscles

- **Orbicularis oculi muscle:** The lacrimal part brings the eyelids and the lacrimal puncta medially. It presses the lacrimal puncta into the lacrimal lake, which allows drainage of lacrimal fluid from the lake into the puncta via capillary action. The palpebral part closes the eyelids gently, helping to keep the cornea moist. The orbital part of the muscle closes the lids more forcefully, as when one squints. This helps prevent dust and glaring light from entering the eye.
- **Inferior oblique muscle (with intraorbital insertion):** Abducts, elevates, and rotates the globe laterally.
- **Inferior rectus muscle:** Depresses, adducts, and rotates the globe laterally.

Clinical Relevance: The periocular and extraocular musculature in this region serve many purposes, from eye movement to closure of the eyelid and management of tear exodus. As such, stimulation of ST 1 can influence multiple problems pertaining to the eye, though careless needling could cause damage to the globe.

Nerves

- **Palpebral branches of the infraorbital nerve (CN V_2):** Provides sensation to the lower lid.
- **Zygomatic and temporal branches of the facial nerve (CN VII):** Provides motor supply to the orbicularis oculi muscle.
- **Oculomotor nerve (intraorbital; CN III):** Innervates the inferior oblique and inferior rectus muscles, as well as the superior and

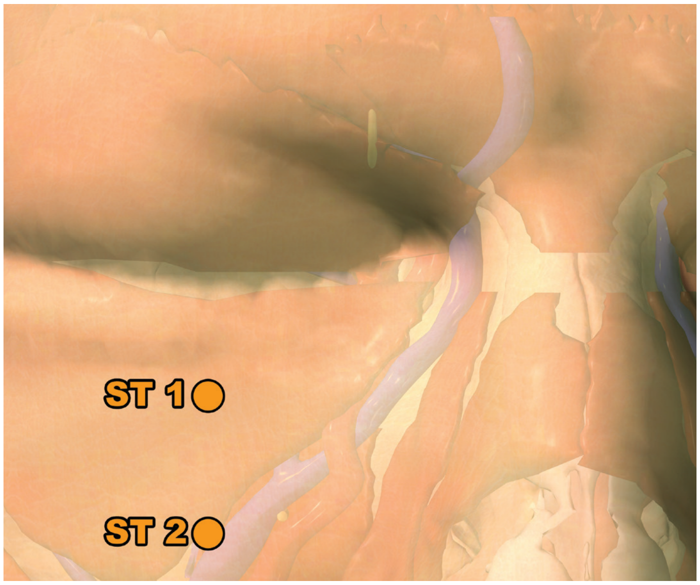


Figure 3-1. This close-up of the right eye and upper portion of the nose shows the origins of the ST channel at ST 1. Some approach ST 1 with an intraorbital needle insertion, beginning at the conjunctival layer of the lid. The Chinese name, “Tear Container”, suits this point well, given its location at the bottom of the infraorbital sac.

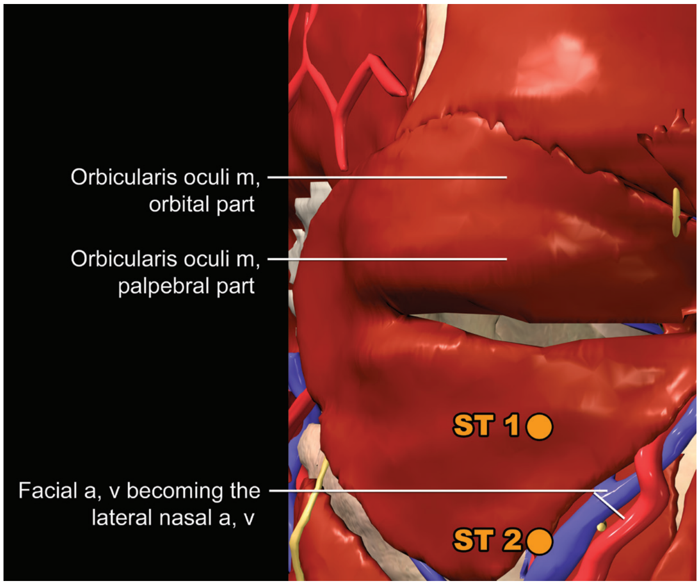

Orbicularis oculi m, orbital part
Orbicularis oculi m, palpebral part
ST 1
Facial a, v becoming the lateral nasal a, v
ST 2

Figure 3-2. ST 1 lands at the intersection of the palpebral and orbital parts of the orbicularis oculi muscle, innervated by the zygomatic branch of the facial nerve.

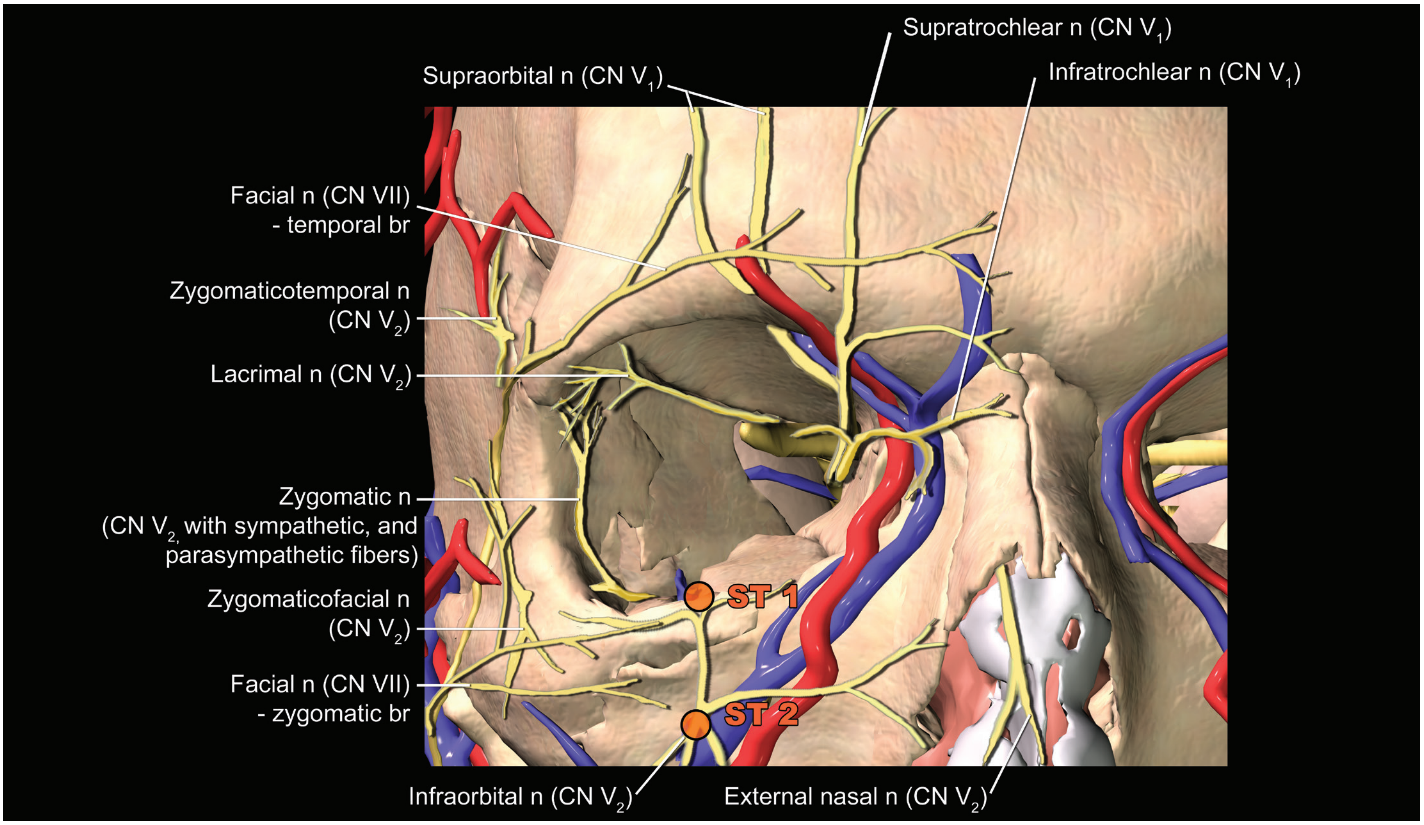

Supratrochlear n (CN V$_1$)
Supraorbital n (CN V$_1$)
Infratrochlear n (CN V$_1$)
Facial n (CN VII) - temporal br
Zygomaticotemporal n (CN V$_2$)
Lacrimal n (CN V$_2$)
Zygomatic n (CN V$_2$, with sympathetic, and parasympathetic fibers)
Zygomaticofacial n (CN V$_2$)
ST 1
ST 2
Facial n (CN VII) - zygomatic br
Infraorbital n (CN V$_2$)
External nasal n (CN V$_2$)

Figure 3-3. This neurovascular layer illustrates the connection between ST 1 and the zygomaticofacial and infraorbital sensory nerves.

medial recti muscles and the levator palpebrae superioris muscle.

Clinical Relevance: The nerves (CN VII and CN III) listed above enliven the muscles just described, while CN V supplies sensation. Thus, conditions such as blepharospasm or facial nerve injury or disease (e.g., Bell's palsy) may benefit from neuromodulation applied to ST 1. Disorders of the extraocular musculature may lead to strabismus. Orbital floor fractures may disrupt or otherwise impair function of the inferior rectus and inferior oblique muscles. Ensuing fibrotic restriction may impair supraduction (upward rotation of the eye around the horizontal axis). CN V$_2$ supplies sensation to the lower lid and may assist with pain control involving the lid or eye.

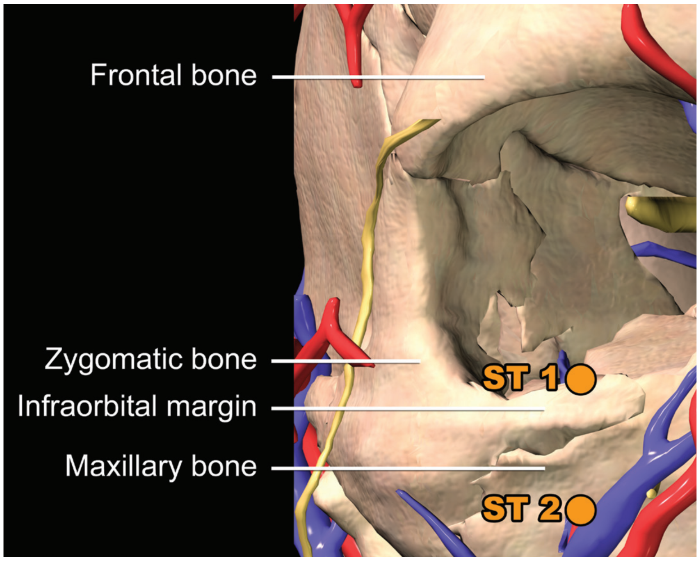

Frontal bone
Zygomatic bone
Infraorbital margin
Maxillary bone
ST 1
ST 2

Figure 3-4. ST 1 lies on the precipice of the infraorbital rim, illustrating the proximity of the floor of the orbit. In life, the floor would be covered bynd extraocular musculature.

Vessels

- **Lacrimal artery:** From the ophthalmic artery, the lacrimal artery supplies the lacrimal gland, conjunctiva, and eyelids.
- **Infraorbital artery branches:** Supply part of the orbit.
- **Infraorbital vein branches:** Drain into the inferior ophthalmic vein, a tributary of the cavernous sinus.

Clinical Relevance: ST 1 sits along a highly vascularized circumference of an oval surrounding the orbit. As such, deep or aggressive stimulation and needle rotation can lead to ecchymosis within the fragile periocular tissues.

Indications and Potential Point Combinations

- **Eye pain:** ST 1, BL 1, TH 23; tailor approach to source of eye pain (whether intrinsic ocular pain or referred. Substitute other, safer points for ST 1 if possible.
- **Blepharospasm:** For twitching in the lower lid. ST 1, ST 2, GB 1.

References

1. Chen K and Weiland JD. Mechanical properties of orbital fat and its encapsulating connective tissue. *J Biomechanical Engineering.* 2011;133(6): 064505 (3 pages).
2. Geerligs M, Peters GWM, Ackermans PAJ, et al. Does subcutaneous adipose tissue behave as an (anti-)thixotropic material? *Journal of Biomechanics.* 2010;43:1153-1159.
3. Nam YS, Han S-H, and Shin SY. Detailed anatomy of the capsulopalpebral fascia. Clinical Anatomy. *Clin Anat.* 2012;25(6):709-713.

ST 2

Si Bai "Four Whites"

In line with the pupil, in the depression of the infraorbital foramen, approximately half cun below ST 1, or about 1 cun below the pupil.

Muscles

- **Orbicularis oculi muscle, orbital part:** The orbital part of the muscle closes the lids in a squinting motion. This helps prevent dust and glaring light from entering the eye.
- **Levator labii superioris muscle:** Raises upper lip and dilates the nostril.
- **Levator anguli oris muscle:** Elevates the corner of the mouth.

Clinical Relevance: The midface musculature can pose challenges for rejuvenation surgery.[3] Myofascial release and local neuromodulation at and around ST 2 may assist a patient in attaining a more youthful appearance, in accordance with claims made concerning an acupressure facelift.

Nerves

- **Infraorbital trunk (CN V_2):** Terminal branch of maxillary n (CN V_2); supplies sensation to the skin of the cheek and lower lid, as well as the lateral nose, inferior septum, and upper lip. Provides dental sensation to the upper premolar incisors and canine teeth. Supplies sensation to the mucosae of the maxillary sinus and upper lip. Trigeminovagal reflexes lead to gastrointestinal modulation.[4]
- **Zygomatic branch of the facial nerve (CN VII):** Provides motor supply to the orbicularis oculi muscle.

Clinical Relevance: Facial and sinus pain, ocular discomfort. Site for infraorbital nerve block, providing local analgesia/anesthesia. Caution should be employed; too vigorous stimulation of the infraorbital nerve may lead to trigeminocardiac reflex.[5] Activation of trigeminal nerve endings in this region may cause a blink reflex due to trigeminal connections to facial nerve nuclei in the brainstem.[6] Cluster headache treatment through trigeminoautonomic reflexes. Connections between the infraorbital nerve and cervical musculature (i.e., the trigeminocervical reflex) participate in chronic tension-type headaches, suggesting benefit of neuromodulating infraorbital nerve territory for these patients.[7]

Vessels

- **Infraorbital artery branches:** Supply the inferior eyelid, lacrimal sac, side of the nose, and upper lip.
- **Anastomosing branches from the lateral nasal artery (the continuation of the facial artery) to the superior labial artery (a branch of the facial artery):** These arteries supply the upper lip and the ala, dorsum and septum of the nose.
- **Infraorbital vein branches:** Drain into the inferior ophthalmic vein, a tributary of the cavernous sinus.
- **Tributaries of facial vein:** The facial vein drains directly or indirectly into the inferior jugular vein, and communicates with the superior ophthalmic vein (which drains into the cavernous sinus) at the medial angle of the eye.

Clinical Relevance: Vessels in the vicinity of ST 2 may suffer damage during midface lift.[8] Similarly, caution is advised when needling this region.

Indications and Potential Point Combinations

- **Eye conditions:** Eye pain and irritation, blepharospasm: ST 2, BL 2, TH 23, GB 1, ST 36.
- **Sinus congestion:** ST 2, ST 3, GV 24.5, GB 14, LI 4.
- **Trigeminal neuralgia:** ST 2, ST 7, LI 4, BL 10.
- **Maxillary pain:** ST 2, ST 3, ST 4, ST 7.
- **Dental pain, maxillary arcade:** ST 2, ST 3, LI 19, LI 4, LU 7.
- **Gastric motility issues, colic:** ST 2, ST 36, ST 25, SP 6.

Evidence-Based Applications

- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **keratoconjunctivitis sicca** (KCS, or dry eye).[1]
- Afferents from ST 2, like ST 36, affect gastric myoelectric activity. In the case of ST 2, the nucleus tractus solitarius (NTS) receives somatic afferent projection from the face via the sensory nucleus of the trigeminal nerve. The NTS, a major visceral sensory nucleus in the medulla oblongata, receives afferent input from several somatic and visceral sources. This includes information from the oculomotor, facial, and vagus nerves, in addition to the trigeminal nerve. The dorsal vagal complex (DVC) comprises the NTS and the dorsal motor nucleus of the vagus (DMNV). The DVC sends efferent vagal neurons to the viscera. As such, it participates in the **regulation of gastric function.**[2]

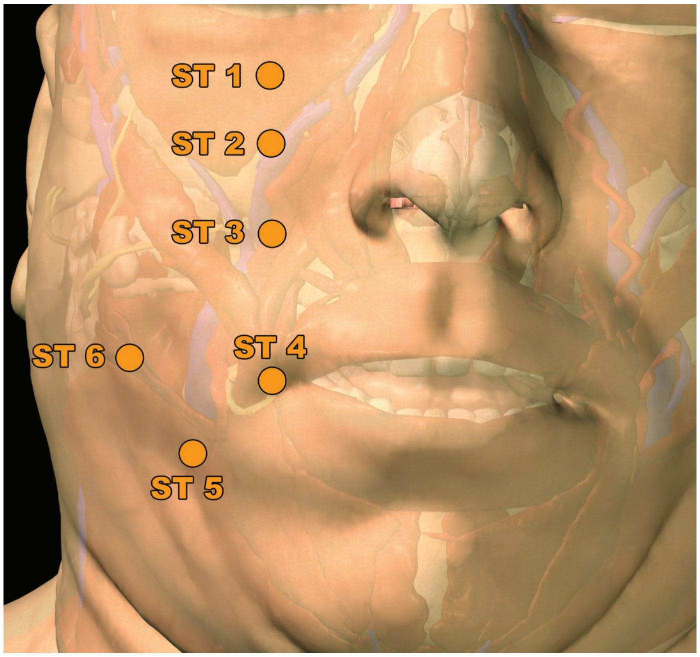


Figure 3-5. ST 1 through ST 4 line up below the pupil when the patient is looking straight ahead. The infraorbital nerve exits the skull at the infraorbital foramen, located at ST 2. Known as the "Four Whites" point, ST 2 helps to clear redness from the eye, allowing the sclera to turn white again. This happens by means of reflexes involving the infraorbital nerve and sympathetic pathways.

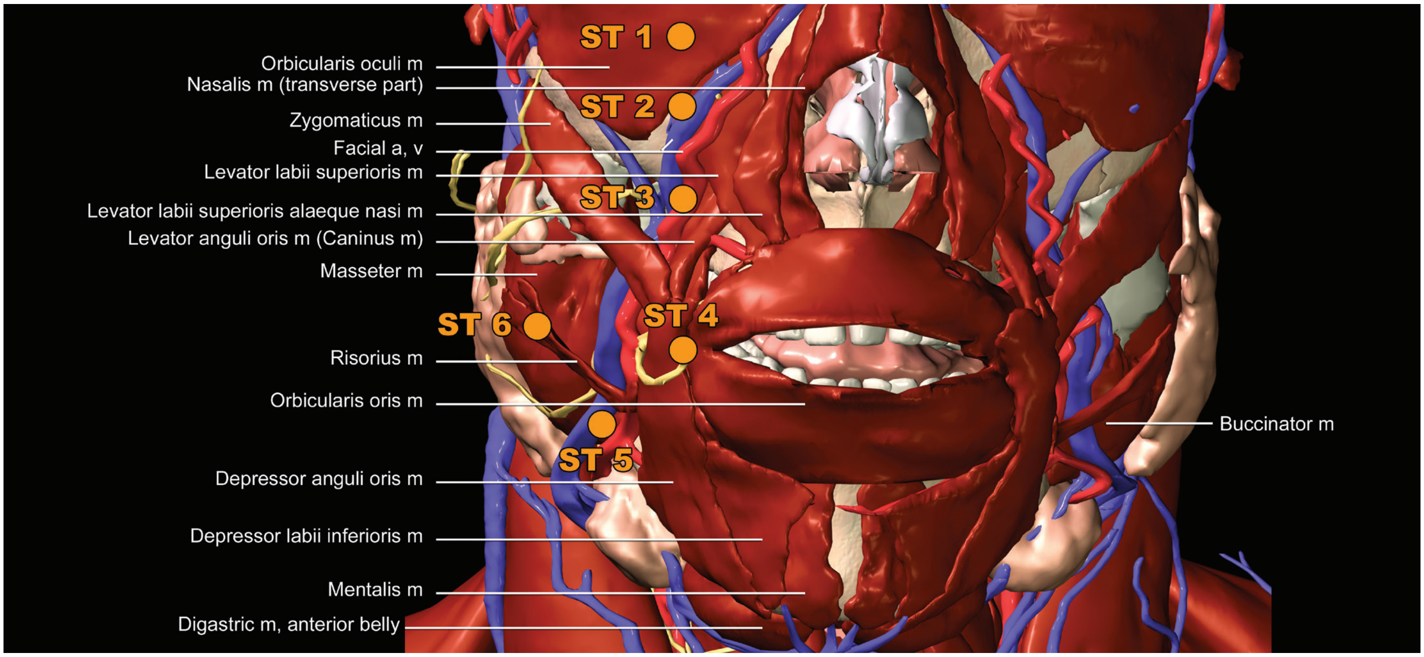

ST 1
Orbicularis oculi m
Nasalis m (transverse part)
ST 2
Zygomaticus m
Facial a, v
Levator labii superioris m
ST 3
Levator labii superioris alaeque nasi m
Levator anguli oris m (Caninus m)
Masseter m
ST 6
ST 4
Risorius m
Orbicularis oris m
Buccinator m
ST 5
Depressor anguli oris m
Depressor labii inferioris m
Mentalis m
Digastric m, anterior belly

Figure 3-6. ST points on the face relate to one or more muscles of facial expression, all of which receive innervation from the facial nerve. As shown here, ST 2 resides between the orbicularis oculi muscle and the levator labii superioris muscle.

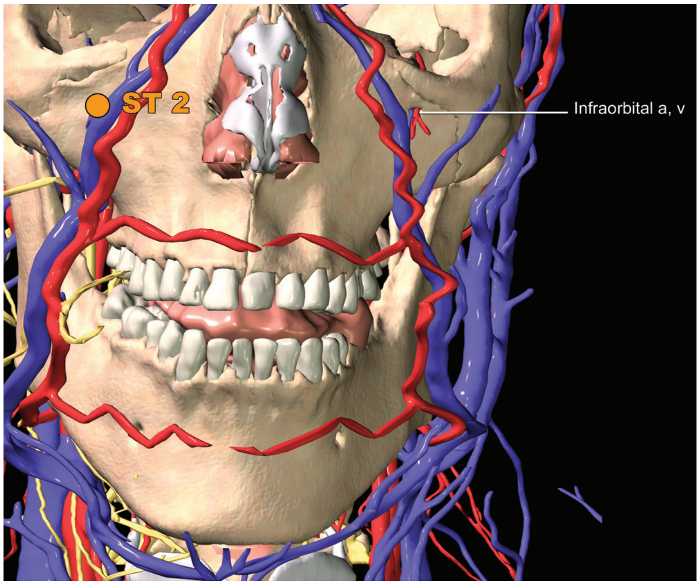

ST 2
Infraorbital a, v

Figure 3-7. The infraorbital foramen transmits the infraorbital nerve, a sensory branch of the trigeminal nerve. The nerve travels through the infraorbital foramen with its companions, the infraorbital artery and vein, shown in this image. The structure-function relationship between the nerve supply and the point indications becomes clear when considering the actions of the nerve and the indications for the point. That is, the infraorbital nerve supplies the maxillary sinus mucosa, the skin of the upper cheek, maxillary arcade teeth (incisors, canines, and premolars) and adjacent gingiva, skin and conjunctiva of the lower eyelid, a portion of the nose, and the skin and upper lip mucosa. This matches the indications for ST 2, which include sinus congestion and pain, maxillofacial pain, trigeminal neuralgia, dental pain, and ocular dysfunction.

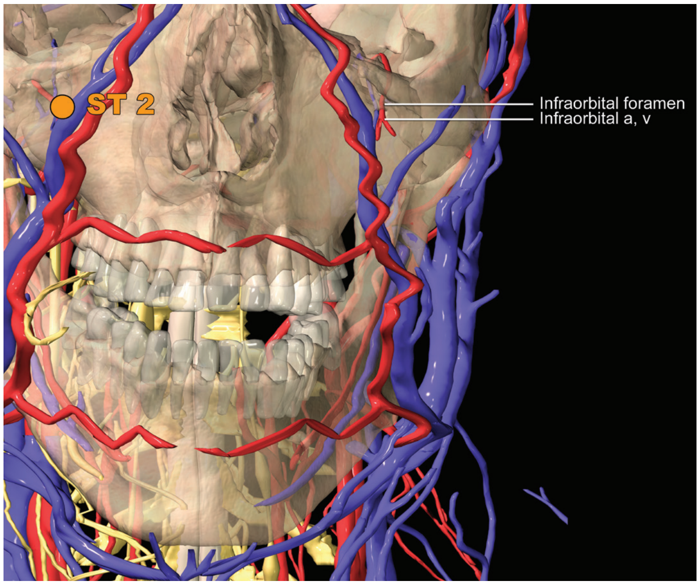

ST 2
Infraorbital foramen
Infraorbital a, v

Figure 3-8. This transparent skull view displays the course of the infraorbital vessels as they embark through the foramen.

References

1. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand.* 2004;82:283-290.
2. He J, Yan J, Chang X, et al. Neurons in the NTS of rat response to gastric distention stimulation and acupuncture at body surface points. *Am J Chin Med.* 2006;34(3):427-433.
3. Le Louam C. The concentric malar lift: malar and lower eyelid rejuvenation. *Aesthetic Plast Surg.* 2004;28(6):359-372.
4. Li Y-Q, Zhu B, Rong P-J, et al. Effective regularity in modulation on gastric motility induced by different acupoint stimulation. *World J Gastroenterol.* 2006;12(47):7642-7648.
5. Yorgancilar E, Gun R, Yildirim M, et al. Determination of trigeminocardiac reflex during rhinoplasty. *Int J Oral Maxillofac Surg.* 2012 doi:10.1016/j.ijom.2011.12.025
6. Bernard J-M and Pereon Y. Nerve stimluation for regional anesthesia of the face: use of the blink reflex to confirm the localization of the trigeminal nerve. *Anesth Analg.* 2005;101:589-591.
7. Nardone R and Tezzon F. The trigemino-cervical reflex in tension-type headache. *European Journal of Neurology.* 2003;10:307-312.
8. Hwang K, Kim DH, Huan F, et al. The anatomy of the palpebral branch of the infraorbital artery rela ting to midface lift. *J Craniofac Surg.* 2011;22(4):1489-1490.

ST 3

Ju Liao "Great Crevice" or "Greater Bone-Hole"

Directly below the pupil, level with the lower border of the alae nasi, lateral to the nasolabial groove.

Note: ST 3 and GB 29 share the name "Ju Liao", although the translation for Ju Liao when referring to GB 29 is sometimes given as "Squatting Crevice" or "Stationary Crevice". This illustrates the confusion that exists in acupuncture nomenclature. It also emphasizes the importance of including anatomical locations and the alphanumeric designation when referring to point placement, especially for research studies.

Muscles

- **Levator labii superioris muscle:** Raises upper lip and dilates the nostril.
- **Levator anguli oris muscle:** Elevates the corner of the mouth.

Clinical Relevance: Acupuncture/acupressure face lift, facial nerve injury.

Nerves

- **Infraorbital nerve (CN V_2):** Terminal branch of maxillary nerve (CN V_2); supplies sensation to the skin of the cheek and lower lid, as well as the lateral nose, inferior septum, and upper lip. Provides dental sensation to the upper premolar incisors and canine teeth. Supplies sensation to the mucosae of the maxillary sinus and upper lip. Trigeminovagal reflexes participate in the modulation of gastrointestinal motility.[2]
- **Zygomatic branches of facial nerve (CN VII):** Supplies the muscles of facial expression inferior part of the orbicularis oculi muscle as well as other facial muscles inferior to the orbit.
- **Buccal branches of facial nerve (CN VII):** Supplies the buccinator muscle and muscles of the upper lip (i.e., the orbicularis oris and levator labii superioris mm).

Clinical Relevance: Acupuncture/acupressure face lift, facial nerve injury, maxillary sinusitis, trigeminal nerve injury, trigeminal neuralgia, cluster headache,[3] modulation of digestive system motility through trigeminovagal reflexes. Connections between the infraorbital nerve and cervical musculature (i.e., the trigeminocervical reflex) participate in chronic tension-type headaches, suggesting benefit of neuromodulating infraorbital nerve territory for these patients.[4]

Vessels

- **Infraorbital artery branches:** Supply the inferior eyelid, lacrimal sac, side of the nose, and upper lip.
- **Infraorbital vein branches:** Drain into the inferior ophthalmic vein, a tributary of the cavernous sinus.
- **Anastomosing branches from the lateral nasal artery (the continuation of the facial artery) to the superior labial artery (a branch of the facial artery):** These arteries supply the upper lip and the ala, dorsum and septum of the nose.
- **Tributaries of facial vein:** The facial vein drains directly or indirectly into the inferior jugular vein, and communicates with the superior ophthalmic vein (which drains into the cavernous sinus) at the medial angle of the eye.

Clinical Relevance: One should exercise caution needling this region of the face. Note the multiplicity of large vessels occupying this site of the face as shown in Figure 3-9.

Indications and Potential Point Combinations

- **Sinus problems, especially maxillary sinusitis:** ST 3, LI 19, LI 20, GV 23, BL 10.
- **Facial paralysis affecting the zygomatic or buccal branch of the facial nerve:** ST 3, ST 7, TH 17.
- **Dental pain:** ST 3, LI 19, LI 4, LU 7.
- **Blepharospasm:** ST 3, GB 1, TH 23, BL 2.
- **Dryness of the eyes and mouth:** ST 3, ST 7, TH 23.

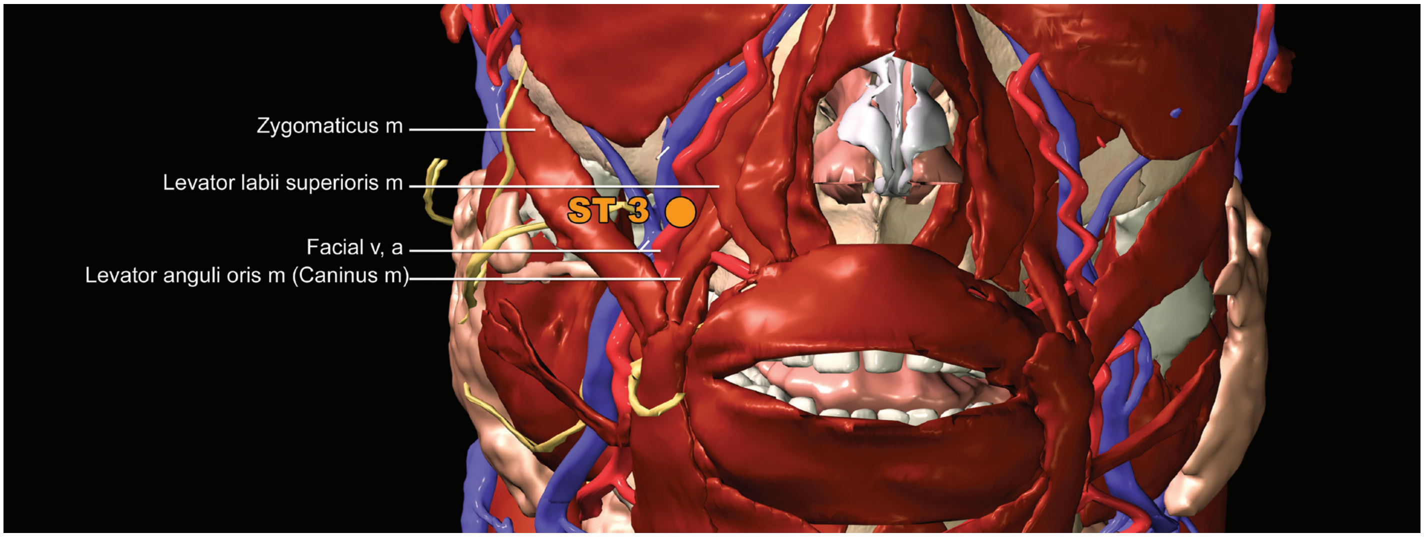


Figure 3-9. ST 3 sits at the intersection of several facial muscles and vessels. Its proximity to prominent veins implies benefit for edema of the lips and cheeks but also suggests a cautious approach with needling in order to avoid traumatizing facial vessels. Perhaps a safer approach in swollen circumstances would involve the introduction of acupressure/massage or carefully delivered laser therapy.

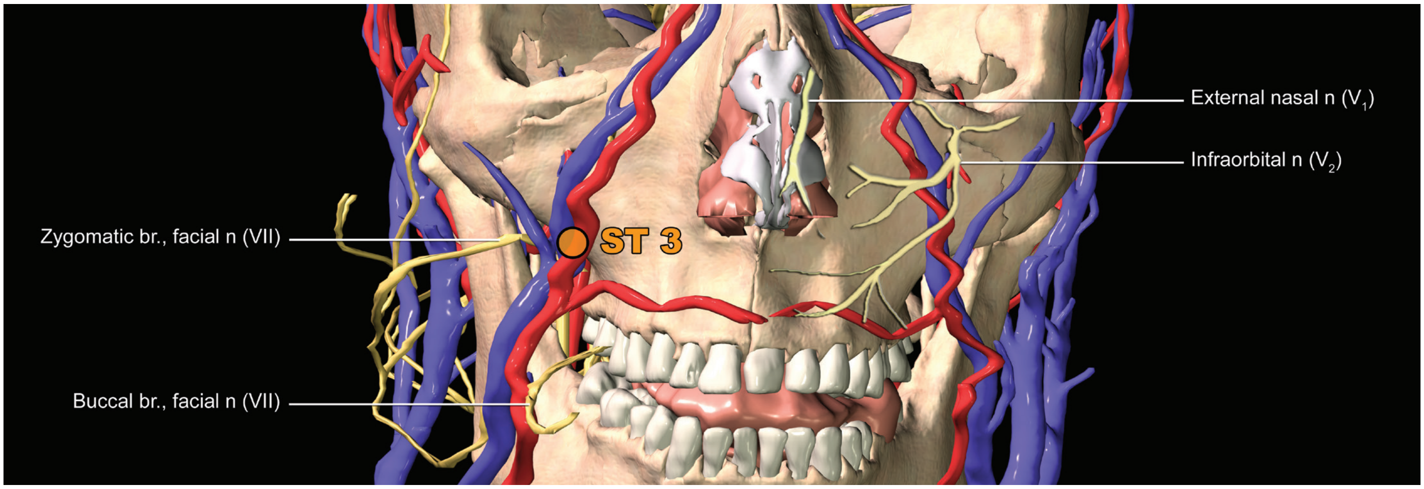

External nasal n (V_1)
Infraorbital n (V_2)
Zygomatic br., facial n (VII)
ST 3
Buccal br., facial n (VII)

Figure 3-10. Note the skeletal contour in the maxilla where the sharp angle on the bony ridge forms a "Great Crevice", the descriptive name for ST 3. Nerves supplying this point include the infraorbital nerve (from CN V) and the zygomatic and buccal branches of the facial nerve. The infraorbital nerve mediates sinus, ocular, facial, and dental pain, affording several applications for neuromodulation, while facial nerve branches offer treatment pathways for facial nerve injury.

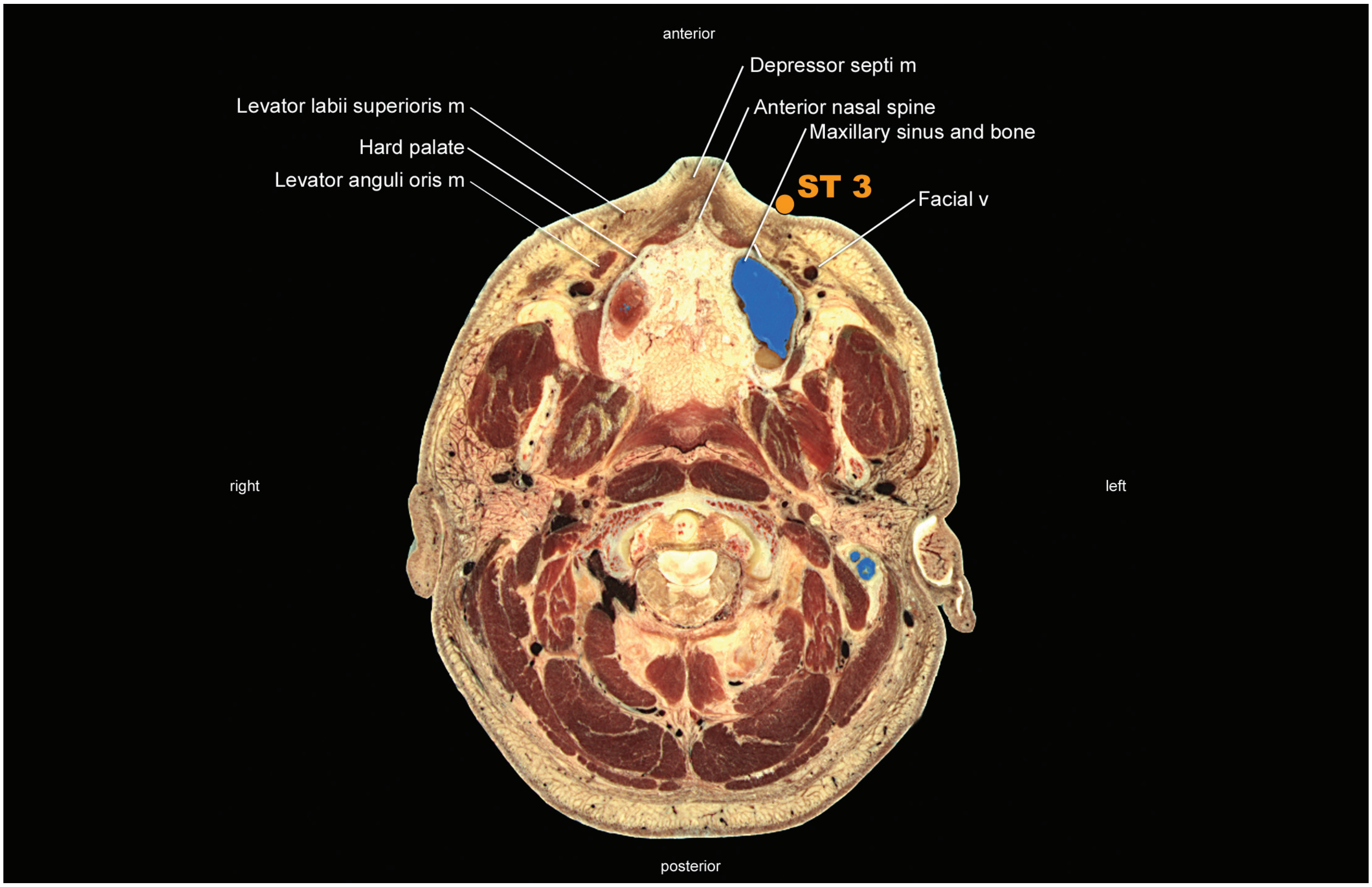

anterior
Depressor septi m
Levator labii superioris m
Anterior nasal spine
Maxillary sinus and bone
Hard palate
Levator anguli oris m
ST 3
Facial v
right
left
posterior

Figure 3-11. This cross section at ST 3 demonstrates the proximity of ST 3 to the maxillary sinus (illustrated in blue).

Evidence-Based Applications

- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of xerostomia due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[1]

References

1. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases.* 2000;6:15-24.
2. Li Y-Q, Zhu B, Rong P-J, et al. Effective regularity in modulation on gastric motility induced by different acupoint stimulation. *World J Gastroenterol.* 2006;12(47):7642-7648.
3. Mammis A, Gudesblatt M, and Mogilner AY. Peripheral neurostimulation for the treatment of refractory cluster headache, long-term follow-up: case report. *Neuromodulation.* 2011;14(5):432-435.
4. Nardone R and Tezzon F. The trigemino-cervical reflex in tension-type headache. *European Journal of Neurology.* 2003;10:307-312

ST 4

Di Cang "Earth Granary"

Lateral to the oral labial commissure (i.e., corner of the mouth), in the continuation of the nasolabial groove, directly in line with the pupil, below ST 3.

Muscles

- **Marginal part of the orbicularis oris muscle:** Sphincter of the mouth; works with the tongue to hold food between the teeth while chewing. Also aids in speech articulation.
- **Buccinator muscle:** Aids in mastication by pressing the cheek against the molars while chewing.

Clinical Relevance: Muscles of facial expression that may become dysfunctional from facial nerve injury.

Nerves

- **Infraorbital nerve (CN V_2):** Terminal branch of maxillary nerve (CN V_2); supplies sensation to the skin of the cheek and lower lid, as well as the lateral nose, inferior septum, and upper lip. Provides dental sensation to the upper premolar incisors and canine teeth. Supplies sensation to the mucosae of the maxillary sinus and upper lip.
- **Buccal nerve from mandibular nerve (CN V_3):** A small sensory branch of the mandibular nerve, the buccal nerve provides sensation to the cheek skin and mucosal lining, as well as the posterior portion of the buccal gingiva.

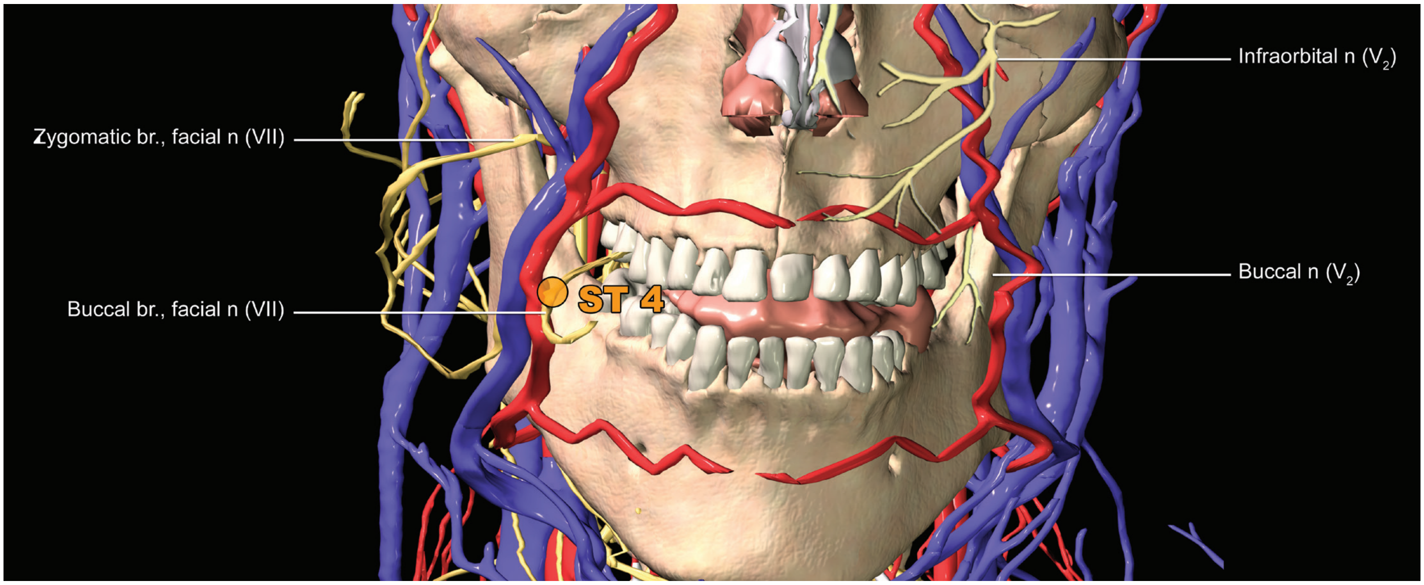


Figure 3-12. Like other points on the face, ST 4 receives dual nerve supply from the facial and trigeminal nerves. Here, the innervation of ST 4 by the buccal branch of the facial nerve explains its application for problems with facial nerve injury (including, specifically, difficulty keeping food or saliva in the mouth) from stroke or Bell's palsy. The buccal nerve, a sensory branch of the trigeminal nerve, provides sensation to a small, thumb-sized section of the cheek skin and underlying mucous membrane, as well as the posterior part of the buccal gingiva.

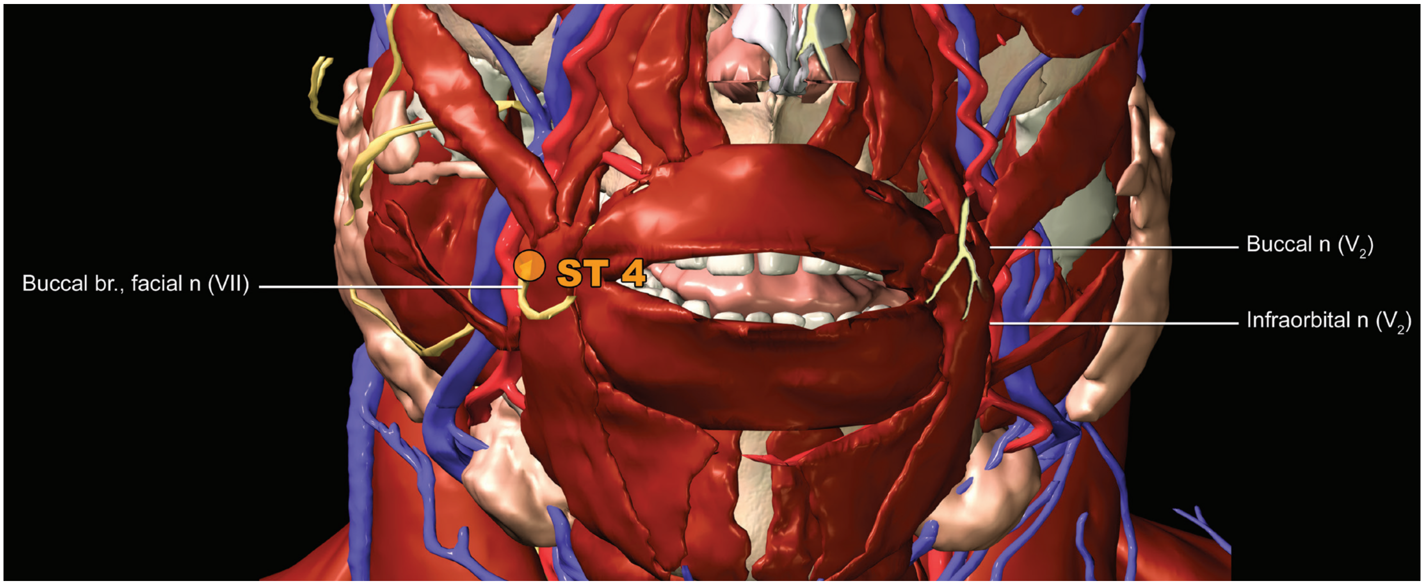


Figure 3-13. ST 4 promotes the ability to retain food in the mouth. Needling this area impacts nerves that control these muscles, specifically the orbicularis oris and the buccinator. The point's name, "Earth Granary", refers to ST 4 for its ability to maintain the oral vestibule as a storehouse for grain or food.

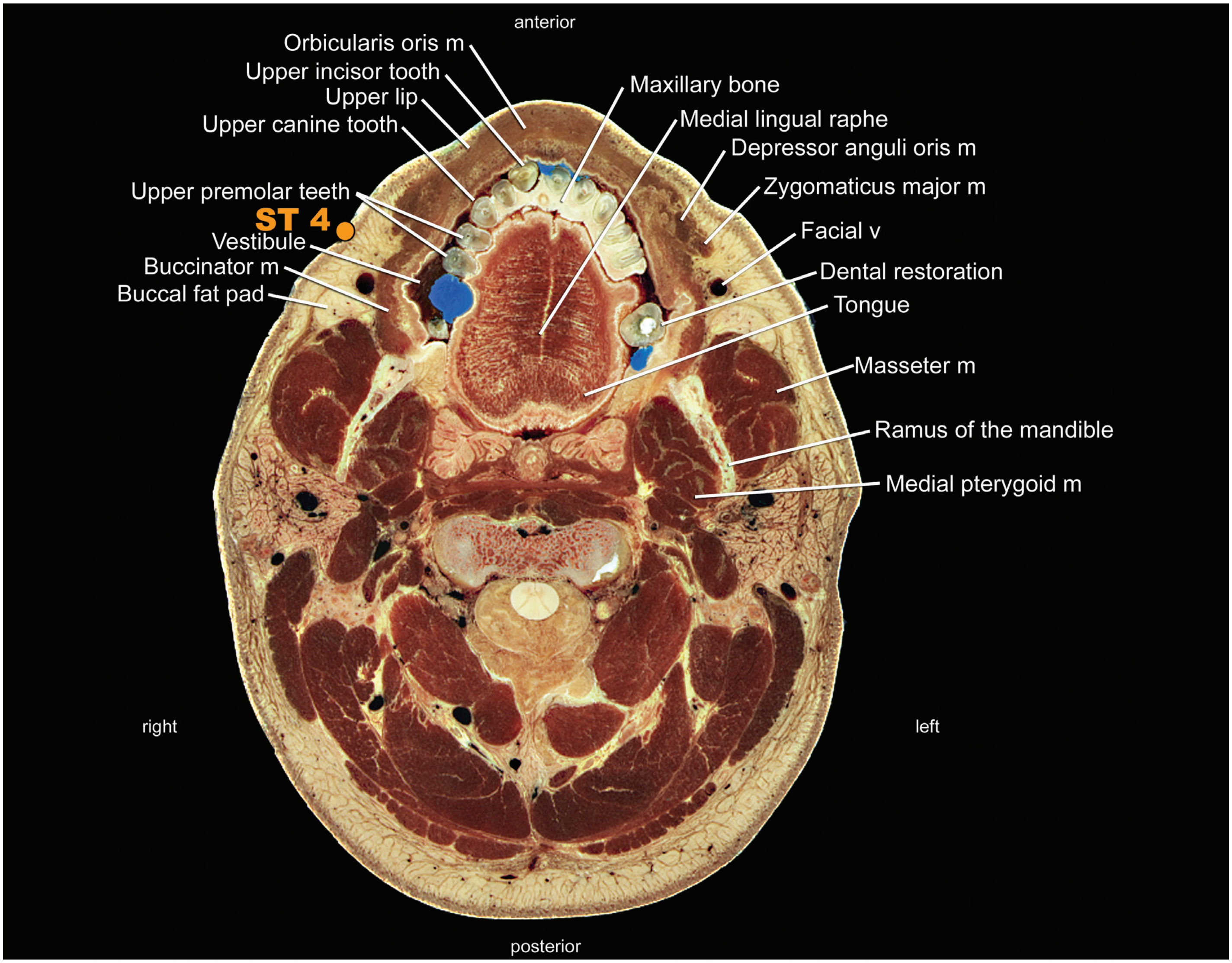

anterior
Orbicularis oris m
Upper incisor tooth
Upper lip
Upper canine tooth
Maxillary bone
Medial lingual raphe
Depressor anguli oris m
Zygomaticus major m
Upper premolar teeth
ST 4
Vestibule
Buccinator m
Buccal fat pad
Facial v
Dental restoration
Tongue
Masseter m
Ramus of the mandible
Medial pterygoid m
right
left
posterior

Figure 3-14. Note the proximity of ST 4 to the vestibule, buccinator muscle, and orbicularis oris m.

- **Buccal branches of facial nerve (CN VII):** Supplies the buccinator muscle and muscles of the upper lip (i.e., the orbicularis oris and levator labii superioris muscles).

Clinical Relevance: Restoring the ability to retain food in the mouth requires adequate function of the sensory (trigeminal n) and motor (facial n) nerves that feed this point.

Vessels

- **Facial artery:** Provides the major blood supply to the face.
- **Facial vein:** Provides the venous drainage of the face.

Clinical Relevance: Neuromodulation at ST 4 involves the nervi vasorum associated with the facial vessels, promoting local circulatory supply and venous drainage.

Indications and Potential Point Combinations

- **Problems of lower lip, teeth, and jaw**
- **Post-stroke problems:** drooling (sialorrhea), facial paralysis, and facial tension: ST 4, ST 3, TH 17.
- **Trismus:** ST 4, ST 6.
- **Facial nerve injury, buccal branch:** ST 4, ST 6, ST 7, TH 17.
- **Oral or lip sores:** ST 4, ST 36.
- **Toothache, dental analgesia:** ST 4, LI 19, LI 4, LU 7.

Evidence-Based Applications

- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flo w in the skin over the parotid gland in patients with **Sjögren's syndrome**.[1]

References

1. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation.* 1993;20:541-548.

ST 5

Da Ying "Great Reception"

On the cheek, on the anterior border of the masseter muscle, in the groove-like depression that appears there when the teeth are clenched.

Muscles

- **Platysma muscle:** Helps depress mandible and participates in the grimace expression.
- **Masseter muscle:** Closes and retrudes (thrusts back) the jaw.

Clinical Relevance: Clinical indications include myofascial dysfunction associated with mastication and temporomandibular dysfunction. Myofascial trigger points in the masseter and other muscles of mastication may produce tinnitus, suggesting that addressing myofascial dysfunction with neuromodulation (acupuncture, massage, laser therapy) could provide meaningful benefits for this often intractable condition.[3] In addition to the ear, trigger points in the masseter muscle may refer to the mandible, molars, maxilla, TMJ, or eyebrow.

Nerves

- **Buccal nerve from mandibular nerve (CN V_3):** A small sensory branch of the mandibular nerve that provides sensation to the cheek skin and its mucosal lining, as well as the posterior portion of the buccal gingiva.
- **Marginal mandibular branch of facial nerve (CN VII):** Supplies the risorius muscle and muscles of the lip and chin.
- **Cervical branch of facial nerve (CN VII):** Supplies the platysma muscle.
- **Masseteric nerve (motor branch from mandibular nerve, CN V_3):** Innervates the masseter muscle.

Clinical Relevance: Facial nerve injury, facial pain involving the masseter muscle.

Vessels

- **Facial artery:** Provides the major blood supply to the face.
- **Facial vein:** Provides the venous drainage of the face.

Clinical Relevance: ST 3, ST 4, and ST 5 line up with the facial a and v, implicating their effects on local blood supply and venous drainage.

Indications and Potential Point Combinations

- **Facial, cheek or jaw pain:** ST 5, ST 3, ST 6, ST 7, BL 10.

Evidence-Based Applications

- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[1]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **KCS**.[2]
- Manual and electrical acupuncture eat ST 5, ST 6, ST 7, GV 20, GV 24, and several additional points for patients with **dysphagia after chemoradiation** experienced reduced symptom severity.[4]

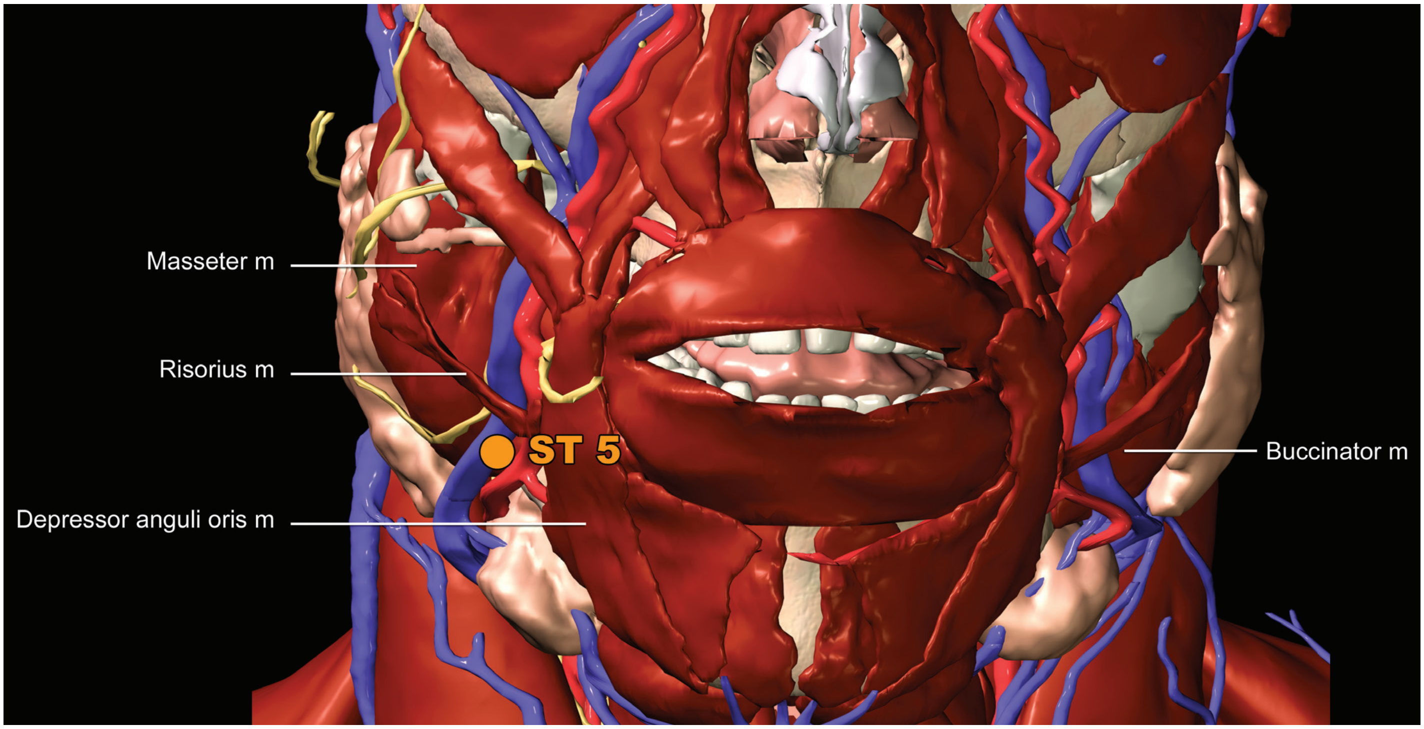


Figure 3-15. ST 5 sits at the intersection of mouth and cheek, explaining its analgesic effects for both mouth and cheek. The name "Great Reception" connotes a celebration of the intersecting neurovasculature.

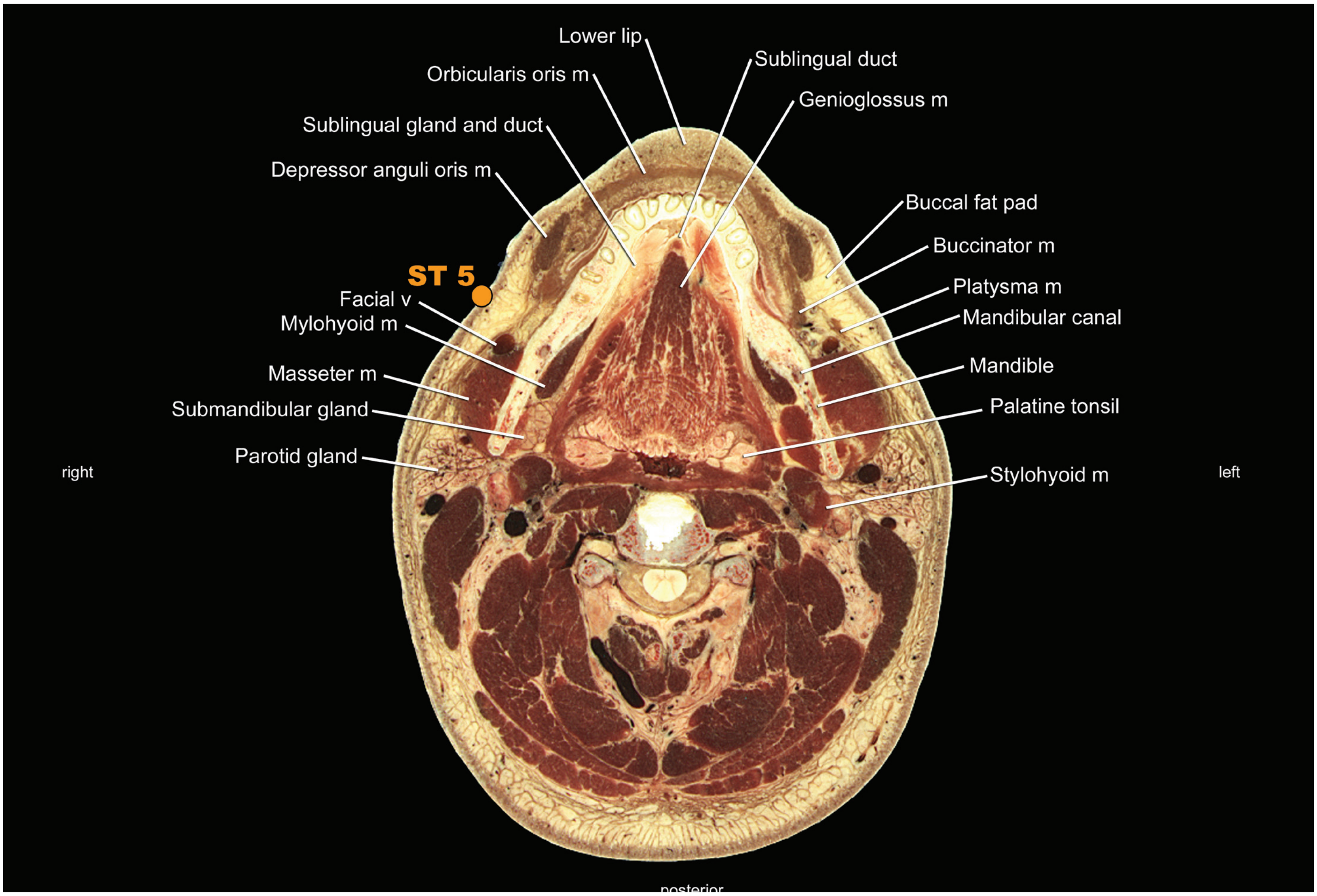

Lower lip
Sublingual duct
Orbicularis oris m
Genioglossus m
Sublingual gland and duct
Depressor anguli oris m
Buccal fat pad
Buccinator m
ST 5
Platysma m
Facial v
Mandibular canal
Mylohyoid m
Mandible
Masseter m
Submandibular gland
Palatine tonsil
Parotid gland
right
Stylohyoid m
left
posterior

Figure 3-16. A number of salivary glands lie in the vicinity of ST 5, suggesting its value fpr xerostomia.

References

1. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.
2. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2*. New York: Plenum Press, 1998. pp. 1011-1016.
3. Bezerra Roche CA, Sanchez TG, and Tesseroli de Siqueira JT. Myofascial trigger point: a possible way of modulating tinnitus. *Audiol Neurootol*. 2008;13(3):153-160.
4. Lu W, Posner MR, Wayne P, et al. Acupuncture for dysphagia after chemoradiation therapy in head and neck cancer: a case series report. *Integr Cancer Ther*. 2010;9(3):284-290.

ST 6

Jia Che "Jaw Bone" or "Cheek Carriage"

On the cheek, one finger's breadth anterior and superior to the angle of the mandible, in the belly of the masseter muscle. At the prominence of the muscle when the teeth are clenched.

Note: The parotid duct crosses the masseter muscle in the region of ST 6.

Muscles

- **Masseter muscle:** Closes and retrudes (thrusts back) the jaw.

Clinical Relevance: Psychophysical stress increases masseter muscle tension and local tissue irritability.[5] Stimulation of ST 6, ST 7, and LI 4 reduced TMJ symptoms and reduced masseter muscle activity on EMG.[6] Myofascial trigger points in the masseter and other muscles of mastication may produce tinnitus, suggesting that addressing myofascial dysfunction with neuromodulation (acupuncture, massage, laser therapy) could provide meaningful benefits for this often intractable condition.[7] In addition to the ear, trigger points in the masseter muscle may refer to the mandible, molars, maxilla, TMJ, or eyebrow.

Nerves

- **Great auricular nerve (C2, C3 – arises from the cervical plexus):** Innervates the parotid gland sheath and the skin over the parotid gland; also supplies the posterior aspect of the auricle and the skin between the angle of the mandible and the mastoid process.
- **Buccal nerve from mandibular nerve (CN V_3):** A small sensory branch of the mandibular nerve that provides sensation to the cheek skin and its mucosal lining, as well as the posterior portion of the buccal gingivae.
- **Marginal mandibular branch of facial nerve (CN VII):** Supplies the risorius muscle and muscles of the lip and chin.
- **Masseteric nerve (motor branch from mandibular nerve, CN V_3):** Innervates the master muscle.

Clinical Relevance: Perhaps not surprisingly, nerves supplying ST 6 pertain to activities related to eating, including mastication, salivation, cheek sensation, and food retention within the oral cavity.

Vessels

- **Masseteric artery and vein:** The small masseteric artery, a branch of the maxillary (formerly internal maxillary) artery, passes through the mandibular notch and supplies the deep surface of the masseter muscle. It anastomoses with masseteric branches of the external maxillary and transverse facial arteries. The facial (formerly external maxillary) artery winds around the ventral aspect of the mandible along a passageway called the "groove for the external maxillary artery", near ST 5. The masseteric nerve, a branch of the mandibular nerve (CN V_3), accompanies the masseteric artery and vein
- **Facial vein:** Provides the venous drainage of the face.

Clinical Relevance: Unlike ST 3, ST 4, and ST 5, ST 6 does not line up along the facial vessels, instead landing squarely over the masseter muscle consistent with its trigger point nature. Deep and superficial blood flow to the masseter muscle differ, with more flow supplying deeper sites. Blood flow increases significantly during biting. These regional differences may relate to specific muscle fiber types and recruitment that characterize the masseter, and may hold implications for trigger point development and deactivation with needling.[8] Trigger points exhibit reduced blood flow and perfusion, setting up a vicious cycle that includes of muscle tension clamping down on vessels, unhappy nerves from reduced blood supply, and continued tension from nerve irritation. Improving blood flow to the deep and superficial regions of the masseter muscle may alleviate pain associated with mastication as well as secondary problems such as tinnitus from regional myfoascial restriction.

Indications and Potential Point Combinations

- **Temporomandibular joint (TMJ) pain:** ST 6, SI 19, TH 21, local trigger points in the temporalis, trapezius, and cervical region.

Evidence-Based Applications

- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders**, prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[1]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 6, ST 7, and SI 17, splint therapy, and point injection therapy

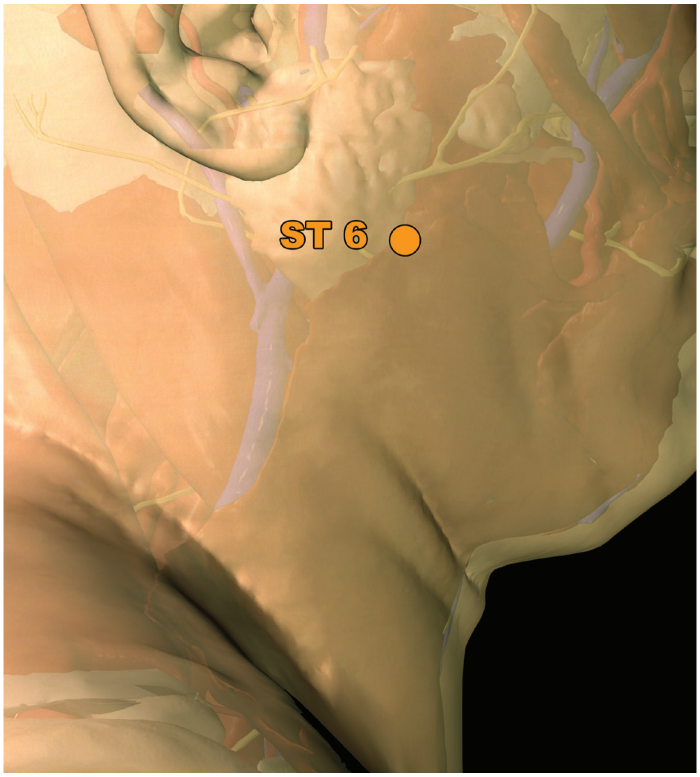


Figure 3-17. This image shows the location of ST 6, "Cheek Carriage", on the face.

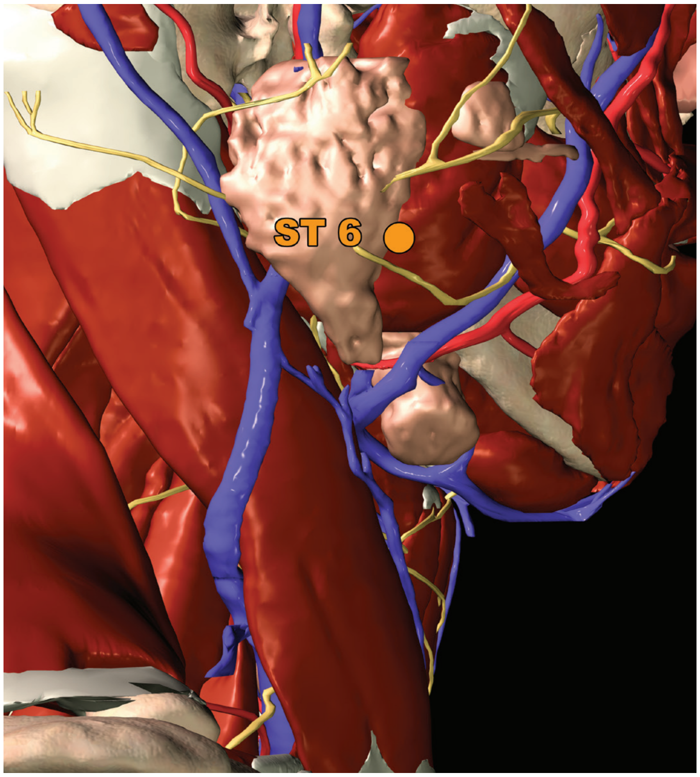


Figure 3-18. As a site for myofascial trigger point deactivation, ST 6 sits centrally upon the belly of the masseter muscle. Point applications include jaw pain and trismus (i.e., inability to fully open the mouth), although referred pain from the masseter can travel to the molars (upper and lower), the ear, and the eyebrow. After exiting the stylomastoid foramen, the facial nerve trunk gives off the posterior auricular nerve, coursing caudally over the sternocleidomastoid muscle. The facial nerve then enters the parotid gland, forming the parotid plexus, consisting of five terminal branches: the temporal, zygomatic, buccal, marginal mandibular, and cervical branches of the facial nerve.

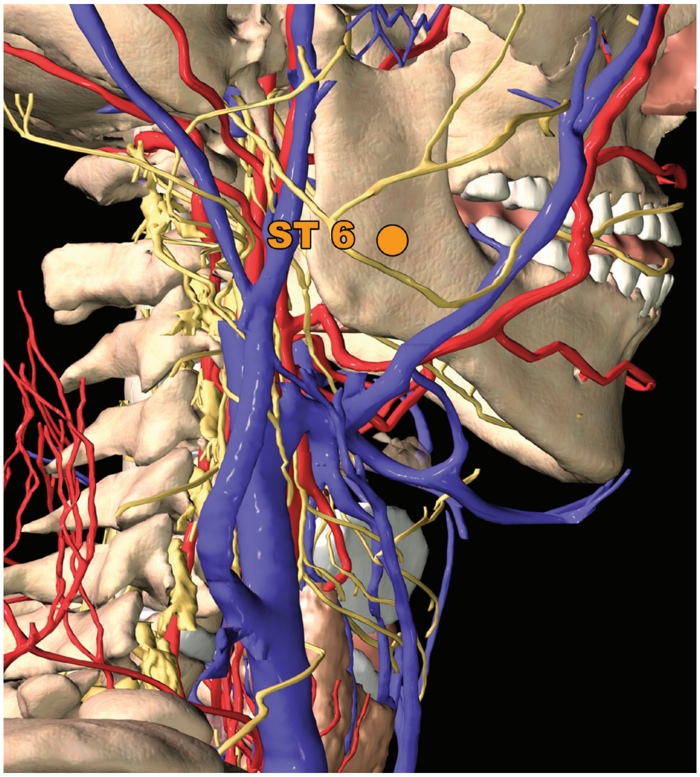


Figure 3-19. One can also find ST 6, "Jaw Bone", one fingerbreadth anterior and superior to the angle of the mandible, as shown here.

suggested that this combination was effective for managing **temporomandibular disorders.**[2]

- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[3]
- Acupuncture at LI 4, ST 6, ST 7, and TH 17 was superior to placebo for the prevention of **postoperative dental pain.**[4]

References

1. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases*. 2001;7:109-115.
2. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine*. 2003;21(4):138-149.
3. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.
4. Lao L, Bergman S, Hamilton GR, Langenberg P, and Berman B. Evaluation of Acupuncture for Pain Control After Oral Surgery: A Placebo-Controlled Trial *Arch Otolaryngol Head Neck Surg*. 1999;125:567-572.
5. Okamoto K, Tashiro A, Chang Z, et al. Temporomandibular joint-evoked responses by spinomedullary neurons and masseter muscle are enhanced after repeated psychophysical stress. *European Journal of Neuroscience*. 2012;36:2025-2034.
6. Hotta PT, Hotta TH, Bataglion C, et al. EMG analysis after laser acupuncture in patients with temporomandibular dysfunction (TMD). Implications for practice. *Complementary Therapies in Clinical Practice*. 2010;16:158-160.
7. Bezerra Roche CA, Sanchez TG, and Tesseroli de Siqueira JT. Myofascial trigger point: a possible way of modulating tinnitus. *Audiol Neurootol*. 2008;13(3):153-160.
8. Curtis DA, Gansky SA, and Plesh O. Deep and superficial masseter muscle blood flow in women. *J Prosthodont*. 2012; 21(6):472-7.

ST 7

Xia Guan "Below the Joint" ("Joint" = TMJ)

In the depression below the zygomatic arch and anterior to the condyloid process of the mandible (the posterior "prong" of the mandible), nearly level with the tragus of the ear. Needle with the mouth closed, but find the point with the mouth open, in order to locate the condyloid process of the mandible. Rest a finger on the condyloid process with the mouth open; when the mouth closes, the finger will fall into ST 7.

Gland

- **Parotid gland:** The largest of the three paired salivary glands, the parotid gland it enclosed within a tough fascial capsule called the parotid sheath.

Connective Tissues

- **Temporomandibular ligament:** This ligament represents a thickening of the portion of the temporomandibular capsule. It consists of two parts. The outer oblique portion limits the extent of mouth opening; the inner horizontal part limits posterior movement of the condyle and disc.

Clinical Relevance: The temporomandibular ligament controls or restrains mandibular motion and prevents tissue from being compressed caudal to the condyle. TMJ pain may originate in the synovial joint capsule, surrounding musculature, and associated connective tissue.

Muscles

- **Masseter muscle:** Closes and retrudes (thrusts back) the jaw. The masseter muscle consists of a deep and superficial portion, each with different blood supply (i.e., branches of the maxillary and facial arteries, respectively). The deep portion of the masseter muscle lies adjacent to ST 7.
- **Lateral pterygoid muscle:** This muscle has two heads. The dorsal (or superior) head inserts onto the articular disc and fibrous capsule of the TMJ, while the ventral (or inferior) head inserts onto the neck of the condyle of the mandible. Trigger points in the lateral pterygoid muscle refer to the zygomatic arch and the TMJ.

Clinical Relevance: These muscles of mastication can experience myofascial dysfunction and lead to a number of chronic, potentially debilitating pain syndromes, most notably TMJ disorder. Trigger points in the masseter muscle may refer pain to the upper and lower molars, the ear, the TMJ, and the superciliary ridge (the bony ridge beneath the eyebrow), thereby mimicking frontal sinus pain. Lateral pterygoid triggers refer to the tragus and the zygomatic arch.

Nerves

- **Auriculotemporal nerve (CN V_3):** This sensory mandibular nerve branch sends articular fibers to the temporomandibular joint. It provides sensation to the skin anterior to the ear and of the posterior temporal region. Also supplies the tragus and part of the helix of the auricle, and the roof of the external acoustic meatus and the upper tympanic membrane. In addition to its somatosensory aspects, the auriculotemporal nerve carries postganglionic parasympathetic fibers to the parotid gland. These secretomotor fibers originate in the glossopharyngeal nerve (CN IX) as the lesser petrosal nerve, synapse in the otic ganglion, and travel with the auriculotemporal nerve until the fibers leave the nerve to supply the parotid gland.
- **Temporal branch of the facial nerve (CN VII):** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior part of the orbicularis oculi muscle.
- **Zygomatic branch of the facial nerve (CN VII):** Supplies the inferior part of the orbicularis oculi muscle as well as other muscles of the face inferior to the orbit.
- **Masseteric nerve (motor branch from mandibular nerve, CN V_3):** Innervates the master muscle.
- **Lingual nerve (CN V_3):** The lingual nerve exits the mandibular division of the trigeminal ganglion and courses beneath the lateral pterygoid muscle, medial and rostral to the inferior alveolar nerve. It provides somatosensory information from the anterior two-thirds of the tongue, the floor of the oral cavity, and the lingual gingivae.
- **Inferior alveolar nerve (CN V_3):** Forms the inferior dental plexus, which sends branches to the ipsilateral mandibular teeth.
- **Otic ganglion (parasympathetic):** Presynaptic parasympathetic fibers, mostly from the glossopharyngeal nerve, synapse here. The postsynaptic fibers provide secretory function to the parotid

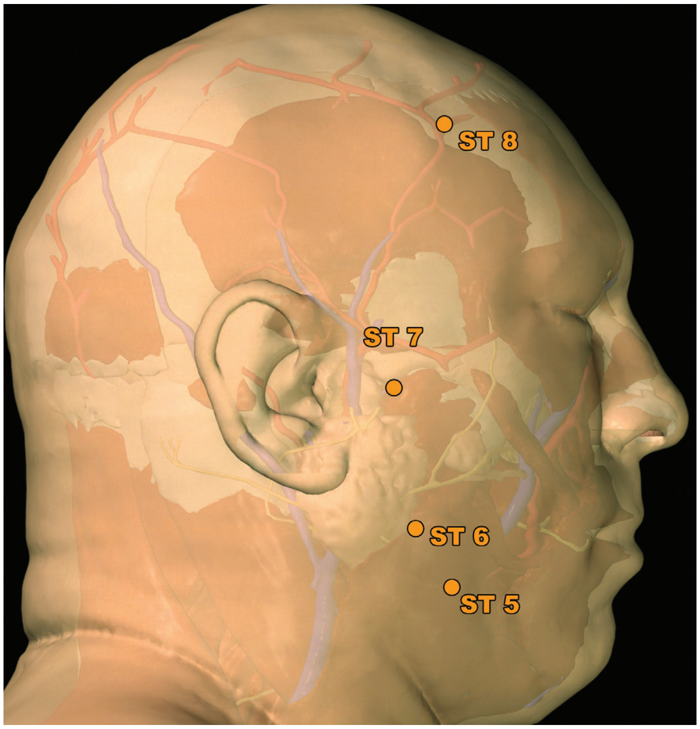


Figure 3-20. This image illustrates the layout of ST 5, ST 6, ST 7, and ST 8. The arc they describe traverses muscles of mastication beginning with the masseter muscle at ST 5 and ST 6, the lateral pterygoid and masseter at ST 7, and the temporalis at ST 8. Making a lifting, sweeping motion from ST 5 to ST 8 helps to release downward droop and tension in the face, encouraging a more youthful appearance to emerge.

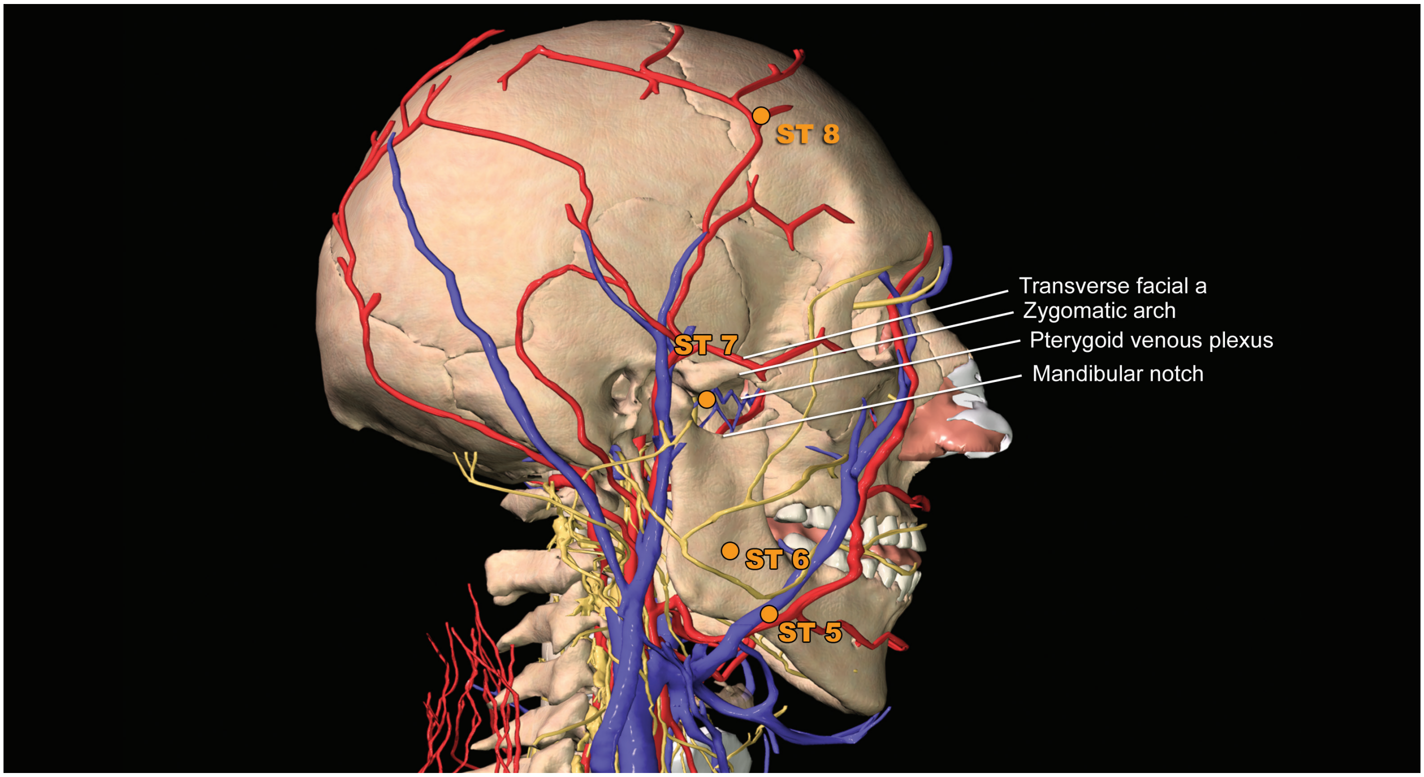


Figure 3-21. ST 7, "Below the Joint", resides in the depression formed between the mandibular notch and the zygomatic arch, anterior and inferior to the TMJ (temporomandibular joint). More than merely an articulation between the temporal bone and the mandible, the TMJ embodies an assembly of muscular and ligamentous connections attaching not only these bones but instead creating a functional complex called the "cranio-cervico-mandibular" system.[9] These extensive connections help provide insight into the complexity of the TMJ, multifactorial causes of dysfunction, and multimodal interventions often required for successful alleviation of TMJ disorders.

gland and pass from the otic ganglion to the parotid gland via the auriculotemporal nerve.

Clinical Relevance: As indicated by the extensive list above, many nerves either course through or supply the ST 7 region. They carry sensory, motor, and autonomic information to and from a wide array of structures. As such, myofascial dysfunction in the TMJ locale may interrupt or impair normal neural traffic, leading to peripheral and central sensitization. Neuromodulation at ST 7 by means of acupuncture and related techniques (e.g., laser therapy, massage) may thereby impart analgesia and myofascial relaxation for patients with TMJ dysfunction and concomitant problems such as tinnitus, neck pain, and stress.

Vessels

- **Transverse facial artery:** Arises from the superficial temporal artery and divides into several braches to supply the parotid gland, parotid duct, and masseter muscle as well as the skin of the face. Anastomoses with the facial, masseteric, buccinator, and infraorbital arteries.
- **Inferior alveolar artery:** A branch of the maxillary artery, the inferior alveolar artery supplies the mandible, gingivae, and teeth.
- **Middle meningeal artery**: A branch of the maxillary artery that supplies the dura mater and calvaria.
- **Maxillary artery:** The larger of the two terminal branches of the external carotid artery; divides into three parts to supply a large area and many structures on the side of the face. ST 7 relates with the 1st part of the artery. Branches off of the first or mandibular portion include the deep auricular, anterior tympanic, middle meningeal, inferior alveolar, and accessory meningeal arteries.

Clinical Relevance: Normalizing blood flow to the muscles, nerves, and ganglia with neuromodulation helps reduce nerve irritability and trigger point dysfunction.

Indications and Potential Point Combinations

- **Facial pain, trigeminal neuralgia:** Identify painful region and structure to the extent possible, and treat accordingly. ST 7; consider BL 2 for supraorbital nerve distribution, ST 2 for infraorbital nerve distribution, ST 5 for mandibular nerve distribution.
- **Dental pain, lower arcade:** ST 7, ST 5, LI 4, LU 7, CV 24.
- **TMJ:** ST 7, ST 6, SI 19, TH 22, GB 12, GB 21.
- **Facial nerve paralysis:** ST 7, TH 17, plus points that address specific nerve branch involved.

Evidence-Based Applications

- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders**, prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[1]
- Case series reported that electroacupuncture at GB 14, SI 18, ST 7, GB 20, and LI 4 was effective treatment for **peripheral facial paralysis.**[2]
- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18,

TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[3]

- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with **Sjögren's syndrome.**[4]
- Acupuncture at LI 4, ST 6, ST 7, and TH 17 was superior to placebo for the prevention of **postoperative dental pain.**[5,6]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 6, ST 7, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[7]
- Acupuncture at ST 7 significantly changed the blood flow to kidney, brain, and heart, as well as to the ipsilateral masseter muscle. The local increase in masseteric blood flow likely works through largely a peripheral mechanism. Increasing **organ blood flow** through the needling of ST 7 suggests that a central mechanism is at work.[8]

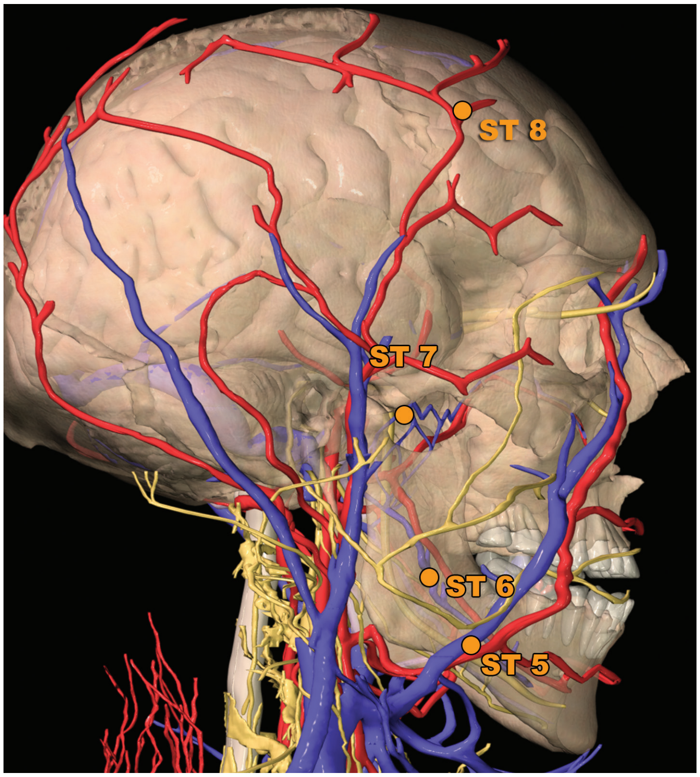


Figure 3-22. The transparent skull layer illustrates several usually hidden intracranial arteries and veins. The inferior alveolar artery and vein course medial to the mandible and connect ST 5 and ST 6. The maxillary artery leaves the external carotid artery and meanders toward the eye ventral to ST 7. The superficial temporal artery, the smaller terminal branch of the external carotid, begins within the parotid gland, coursing behind the neck of the mandible, crossing the zygomatic process of the temporal bone, and then dividing into a frontal and parietal branch. ST 8 lands along the parietal branch.

References

1. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases*. 2001;7:109-115.

2. Zhang X. Electric needle therapy for peripheral facial paralysis. *Journal of Traditional Chinese Medicine*. 1997;17(1):47-49.

3. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.

4. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation*. 1993;20:541-548.

5. Lao L, Bergman S, Hamilton GR, Langenberg P, Berman B. Evaluation of Acupuncture for Pain Control After Oral Surgery: A Placebo-Controlled Trial. *Arch Otolaryngol Head Neck Surg*. 1999;125:567-572.

6. Lao L, Bergman S, Langenberg P, Wong RH, and Berman B. Efficacy of Chinese acupuncture on postoperative oral surgery pain. *Oral Surgery Oral Medicine Oral Pathology Endod*. 1995;79:423-428.

7. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine*. 2003;21(4):138-149.

8. Tsuru H and Kawakita K. Acupuncture on the blood flow of various organs measured simultaneously by colored microspheres in rats. *eCAM*. 2009;6(1):77-83.

ST 8

Tou Wei "Head Corner"

Directly above ST 7, 0.5 cun within the anterior hairline at the corner of the forehead, 4.5 cun from the midline, in line with GB 13, GB 15, BL 3, BL 3, and GV 24.

Bone

- **Coronal suture:** This cranial suture, a dense and fibrous connective tissue joint, defines the border between the frontal and parietal bones of the skull. Cranial sutures may allow movement of the cranial bones, depending upon the age, species, and health of the individual. Unossified sutures allow compensatory movements of cranial bones in relation to loads placed on the skull, thereby helping absorb the impact of mechanical forces placed upon it.[2]

Clinical Relevance: Sutures may become tender with cranial dysfunction and benefit from localized treatment with acupuncture or related techniques.

Muscles

- **Temporalis muscle:** The temporalis muscle arises from the temporal fossa and deep part of the temporal fascia. When the temporalis muscle contracts, it retrudes (moves backward) the mandible and elevates it (closes the mouth). The temporalis muscle originates in the temporal fossa between the inferior temporal line of the parietal bone and the infratemporal crest. It inserts on the coronoid (anterior prong) of the mandible as well as the anterior ramus.

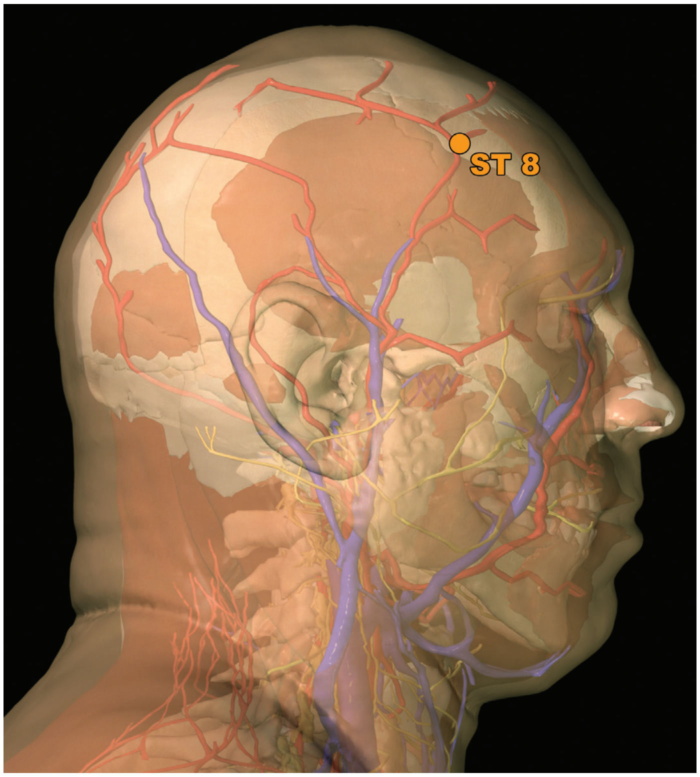


Figure 3-23. The intersecting temporal and anterior hairlines define the "Head Corner" of ST 8.

Clinical Relevance: The temporalis muscle causes myogenic head pain, diffuse jaw pain, and referred pain to the teeth, eyebrow/frontal sinus, and ear. As shown in Figure 3-23, ST 8 lands along the attachment site of the temporalis muscle to the skull, thereby qualifying as an attachment trigger point of sorts. Since myofascial dysfunction of the temporalis may provoke migraine, ST 8 may aid in its treatment.[3]

Nerves

- **Deep temporal nerves (CN V_3):** These branches of the mandibular division of the trigeminal nerve supply motor function to the temporalis muscle.
- **Zygomaticotemporal nerve, from maxillary nerve CN V_2:** One of the branches of the zygomatic nerve, along with the zygomaticofacial nerve. Supplies the skin over the zygomatic arch and anterior temporal area. Postsynaptic parasympathetic fibers from the pterygopalatine ganglion travel with this nerve to the lacrimal nerve.
- **Auriculotemporal nerve from the mandibular nerve (CN V_3):** Conveys postsynaptic parasympathetic secretomotor fibers to the parotid gland, provides sensation to the auricle, external acoustic meatus, external surface of the tympanic membrane, and the skin superior to the auricle.
- **Temporal branches of facial nerve (CN VII):** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior part of the orbicularis oculi muscle.

Clinical Relevance: The nerves in the vicinity of ST 8 impact a variety of functions including mastication, facial expression, scalp and facial sensation, and local autonomic supply to the eye. This multiplicity of neural activities explains the benefits of ST 8 for frontal headache, migraine, dizziness, and referred pain.

Vessels

- **Superficial temporal artery:** a branch of the external carotid artery, supplying the scalp and temporal regions.
- **Superficial temporal veins:** This widespread network drains the scalp and zygomatic arch.

Clinical Relevance: A mass in the lateral forehead and temporal fossa should not be needled, as it could represent a pseudoaneurysm of the superficial temporal artery, especially with a history of recent blunt trauma or surgery to the forehead.[4] Do not needle a mass in this region.

Indications and Potential Point Combinations

- **Frontal headache:** ST 8, GB 14, GV 24.5.
- **Migraine:** ST 8, GB 5, GB 20, GV 14, LU 7.
- **Dizziness:** ST 8, GB 20, BL 10; or Jiaji points from C1-C4, Taiyang, and ST 8.[5]

Evidence-Based Applications

- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4

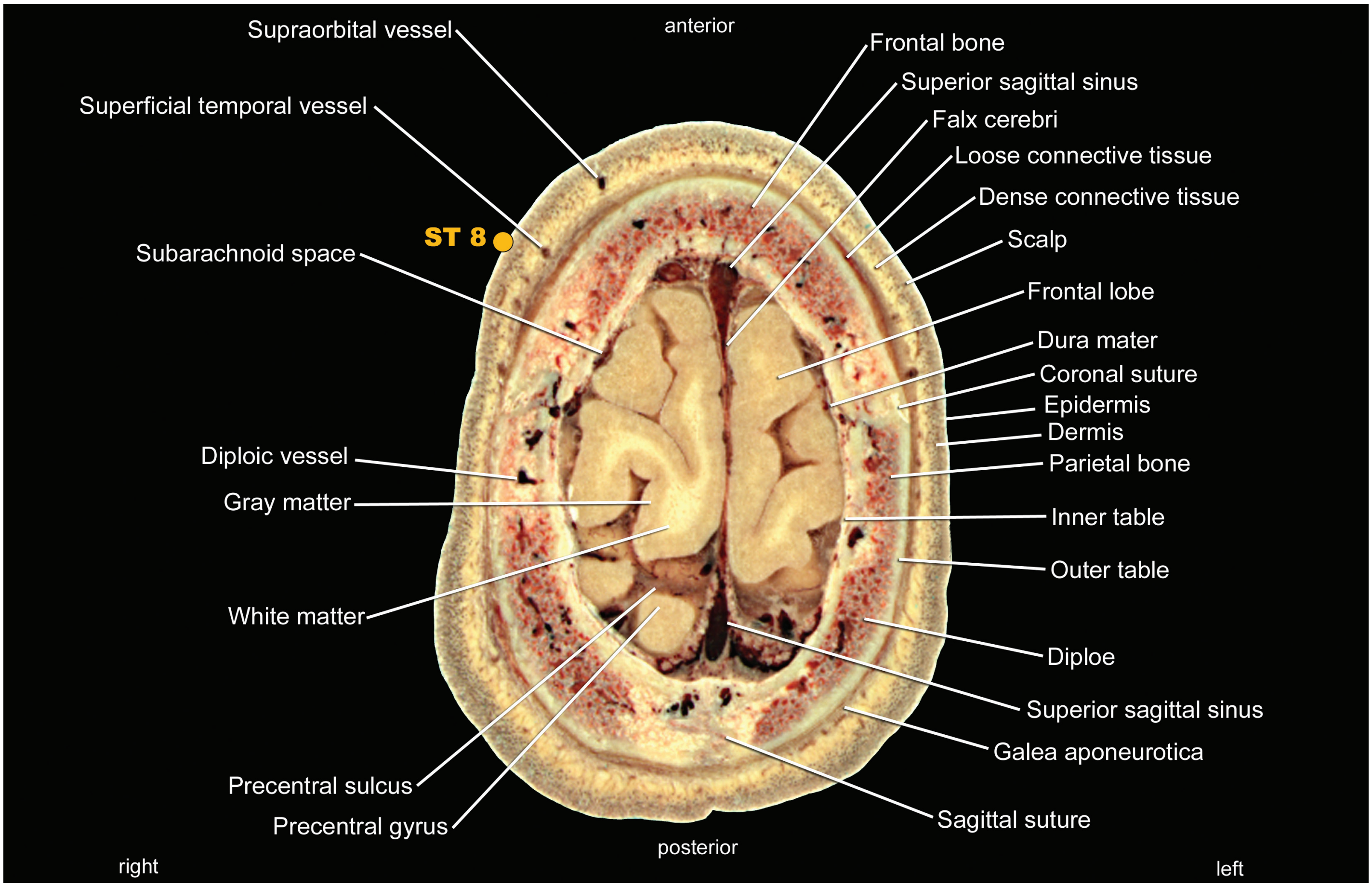

Supraorbital vessel
anterior
Frontal bone
Superior sagittal sinus
Superficial temporal vessel
Falx cerebri
Loose connective tissue
Dense connective tissue
ST 8
Scalp
Subarachnoid space
Frontal lobe
Dura mater
Coronal suture
Epidermis
Dermis
Diploic vessel
Parietal bone
Gray matter
Inner table
Outer table
White matter
Diploe
Superior sagittal sinus
Galea aponeurotica
Precentral sulcus
Precentral gyrus
Sagittal suture
posterior
right
left

Figure 3-24. This cross section illustrates the proximity of ST 8 to the superficial temporal vasculature.

provided subjective beneficial effects in patients with **keratoconjunctivitis sicca** (KCS, or dry eye).[1]

- Acupuncture at LU 7, ST 8, GB 20, GB 5, GB 20, and GV 14 afforded large cost-savings for **migraineurs** who would otherwise have missed work, according to a controlled trial testing acupuncture against conventional drug treatment.[6]

References

1. Jaslow CR. Mechanical properties of cranial sutures. *J Biomechanics.* 1990;23(4):313-321.
2. LIguori A, Petti F, Bangrazi A, et al. Comparison of pharmacological treatment versus acupuncture treatment for migraine without aura – analysis of socio-medical parameters. *J Tradit Chin Med.* 2000;20(3):231-240.
3. Han K, and Borah GL. Pseudoaneurysm of the anterior superficial temporal artery. *Ann Plast Surg.* 1996;37(6):650-653.
4. Guo F. Observation on treatment of dizziness mainly by acupuncture. *J Tradit Chin Med.* 2007;27(1):16-18.
5. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand.* 2004;82:283-290.
6. Liguori A, Petti F, Bangrazi A, et al. Comparison of pharmacological treatment versus acupuncture treatment for migrained without aura – analysis of socio-medical parameters. *J Tradit Chin Med.* 2000;20(3):231-240.

ST 9

Ren Ying “Man’s Pulse” or “Man’s Prognosis”

On the anterior border of the sternocleidomastoid muscle, level with the laryngeal prominence, over the common carotid artery.

Note: Avoid puncturing the common carotid artery and the adjacent internal jugular vein (IJV). Deep needling and injury to the major vessels in this region could lead to death. Needle superficially or between the artery and the lateral border of the thyroid cartilage, which places the needle tip medial to the common carotid, rather than in the rich venous territory on its lateral aspect. That is, the IJV lies lateral to the common carotid artery and should be avoided, as illustrated in Figure 3-28. Furthermore, electrical stimulation over this area, i.e., in the vicinity of the carotid body or the vagus nerve in the anterior triangle of the neck could cause bradycardia due to the rich autonomic supply serving this region.[1]

Muscles

- **Platysma muscle:** Helps depress mandible and participates in the grimace expression.
- **Sternocleidomastoid (SCM) muscle:** Tilts head in a lateral direction. Flexes and rotates the neck so that the face turns up and to the opposite side. When activated bilaterally, the SCM flexes the neck and thrusts the chin forward.
- **Omohyoid muscle:** Acts on the hyoid bone to depress, retract, and steady it.

Clinical Relevance: Muscle tension in this region can lead to referred pain and craniofascial somatic dysfunction.[6] Myofascial restriction in the SCM accompanies several pain problems, including headache and temporomandibular disorders (TMD).[7,8] Trigger points in the SCM refer to the ear, the back of the head, the vertex, the chin, the forehead, the cheek, and angle of the mandible, the TMF, and the eye. Tension in the omohyoid can cause transient swelling in the caudal neck during deglutition.[9] This occurs when the fascial attachment of the intermediate tendon of the omohyoid muscle weakens, leading to pseudodysphagia.[10] That said, the locus of ST 9 gears its indications more toward somatoautonomic effects instead of myofascial, given its position on the medial border of the SCM.

Nerves

- **Facial nerve, cervical branch (CN VII):** Innervates the platysma

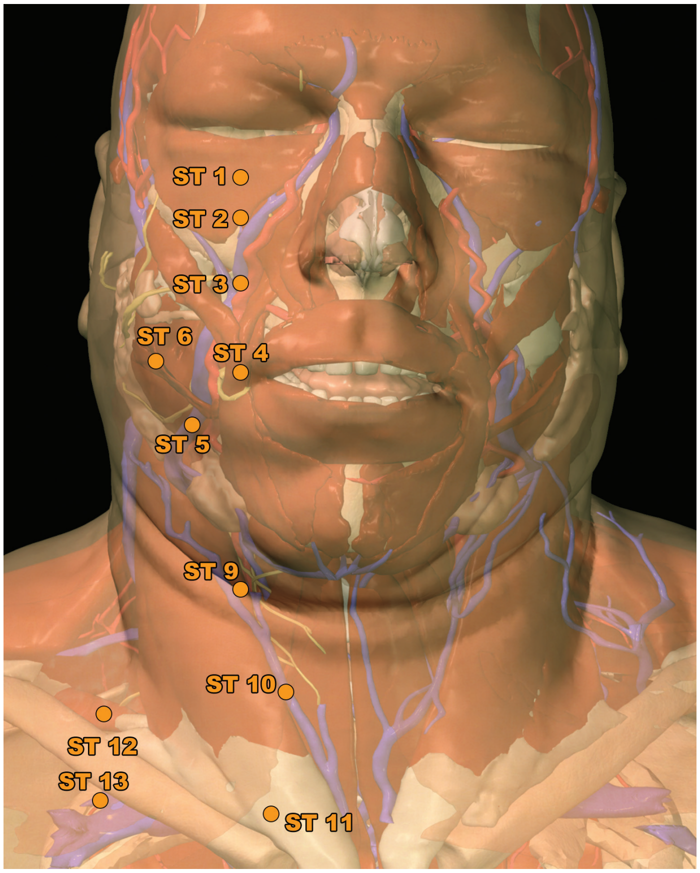


Figure 3-25. The semi-transparent skin in this image allows visualization of the anatomical relationships between ST 1-6 and ST 10-13. Note their close vascular relationships with the facial artery and vein (most notably ST 2-ST 5), the jugular vessels (ST 9, ST 10), and the subclavian vein (ST 12, ST 13).

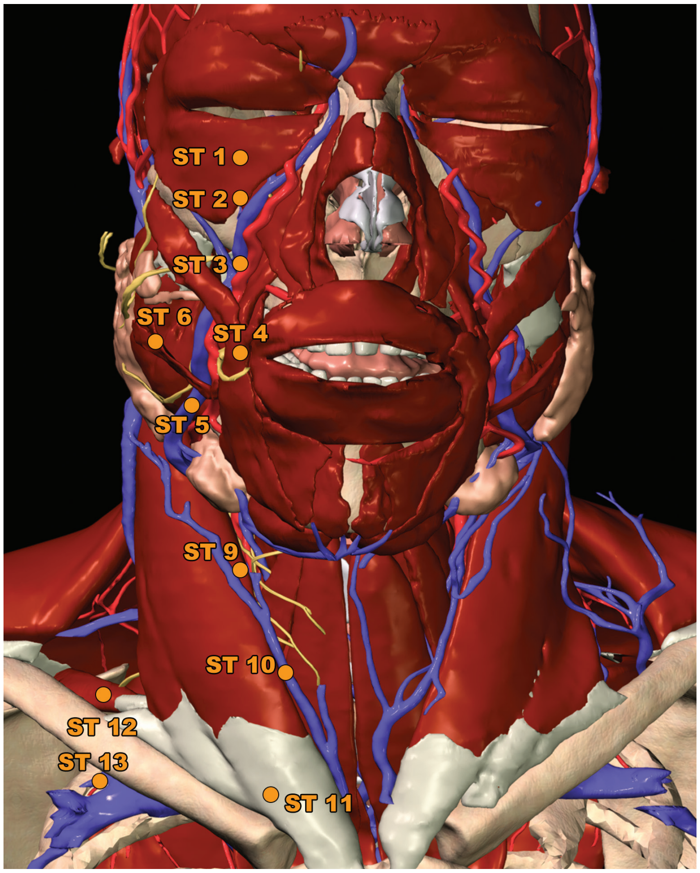


Figure 3-26. Both ST 9 and ST 10 are located along the anterior border of the SCM over the carotid artery. Ancient practitioners would assess pulse quality here as one of the nine locations palpated in the course of pulse diagnosis. Quirico, *in Teaching Atlas of Acupuncture. Volume 2: Clinical Indications,* Thieme, p. 24, notes that of these nine locations, three belonged to the sky, three to man, and three to the earth. ST 9, also called “Man’s Pulse” corresponded to the “man” position and occupied the middle position of the three “man” pulses.

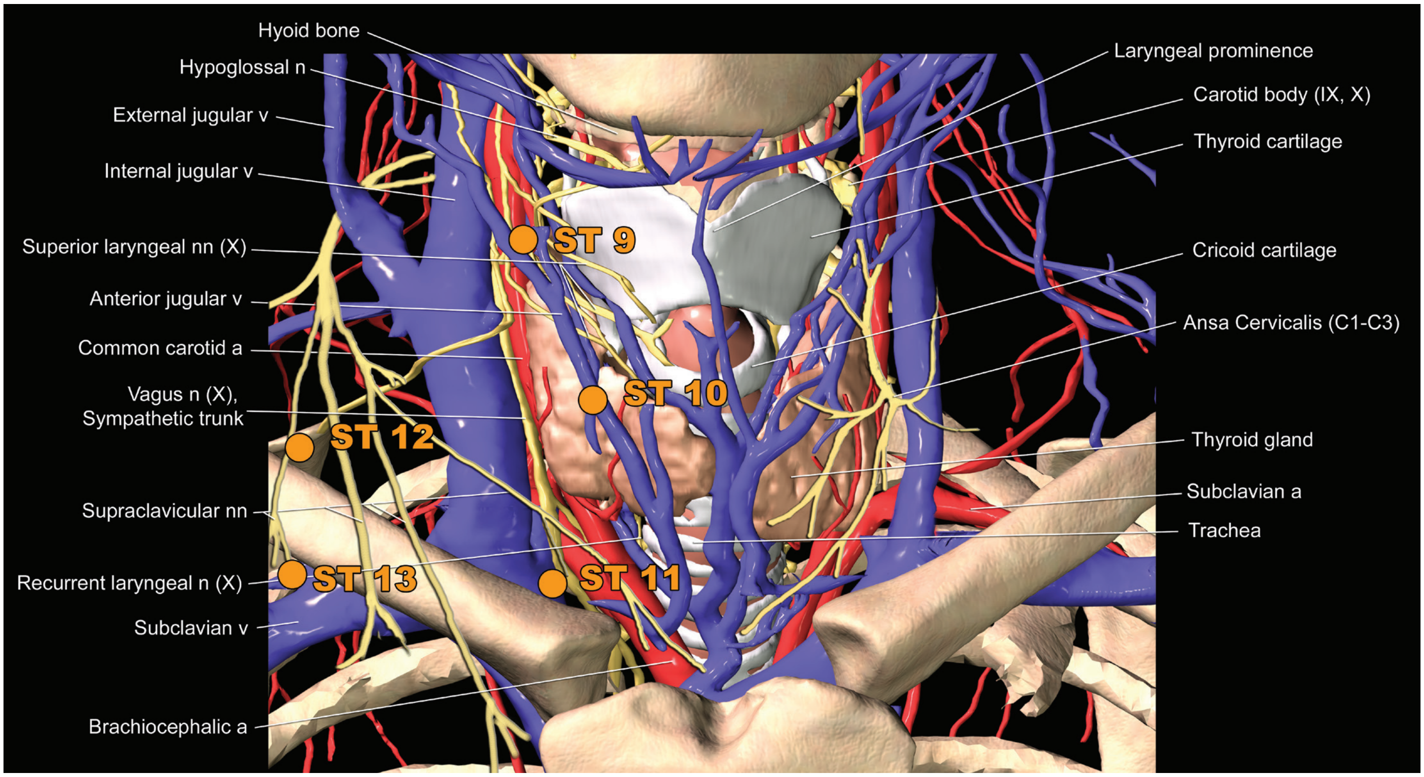


Figure 3-27. ST 9 - ST 13 live within rich neurovascular territory on the anterior neck. Note specifically the relationship between ST 9 (shown only on the right) and the carotid body (only seen on the left). The carotid body senses blood oxygen and carbon dioxide levels as well as pH and temperature. In the face of low circulating oxygen tension, the carotid body initiates a reflex that increases cardiac rate, blood pressure, and the respiratory rate and inspiratory depth. No wonder ST 9 is so often included in protocols for respiratory difficulty, hypertension, and related conditions. Too, the proximity of ST 9 with the superior laryngeal nerve territory explains its application in laryngeal disorders.

muscle. The facial nerve communicates with the transverse cervical nerve, thereby creating a faciocervical anastomosis ventral or caudal to the submandibular gland and sometimes within the parotid gland.[11]

- **Transverse cervical nerve (C2, C3):** Supplies the skin of the anterior triangle.[2]

- **Ansa cervicalis (C1-C3 motor fibers):** A nerve loop that supplies the infrahyoid muscles in the anterior cervical triangle. The ansa cervicalis provides donor tissue for neural reconstruction and restoration of function for the vocal cords in cases of recurrent laryngeal nerve paralysis.[12] Iatrogenic injuries to the ansa cervicalis may occur during surgical procedures such as arytenoid adduction and thyroplasty.

- **Vagus nerve (CN X):** Sensory to the inferior pharynx, larynx, thoracic organs, abdominal organs; taste sensation from the root of the tongue and taste buds on the epiglottis; motor supply to the soft palate, pharynx, the palatoglossus muscle, and the intrinsic laryngeal muscles (which are responsible for phonation); proprioceptive to the aforementioned musculature; parasympathetic supply to the thoracic and abdominal viscera.

- **Sympathetic trunk (C8-T5):** The sympathetic trunks in the neck are associated with three cervical sympathetic ganglia (superior, middle, and inferior) which receive presynaptic fibers from the superior thoracic spinal nerves and associated white rami communicantes via the sympathetic trunk. From these ganglia, postsynaptic fibers pass to splanchnic nerves to the spinal nerve in the cervical region via gray rami communicantes, or they proceed as direct visceral branches, or splanchnic nerves. Sympathetic branches destined to reach the head and neck viscera travel with the arteries (vertebral and carotid) and their branches. Although the cervical sympathetic trunk lies interior to the carotid sheath within the prevertebral fascia and one would not needle this location for acupuncture, neuromodulation in this vicinity does influence autonomic function.

- **Carotid body:** Supplied by the carotid sinus nerve (CN IX). This cluster of chemoreceptors and supporting cells located at the carotid artery bifurcation monitors arterial oxygen and carbon dioxide levels. It senses changes in pH and temperature as well. In response to low blood oxygen levels, the chemoreceptors trigger an increase in the rate and depth of respiration, heart rate, and blood pressure. Feedback about blood chemistry travels to cardiorespiratory centers in the medulla oblongata (brainstem) through CN IX afferent branches. The medullary cardiorespiratory centers integrate carotid body messages with signals from aortic body chemoreceptors through vagal nerve afferents. Centers such as the rostral ventrolateral medulla (RVLM) coordinate changes in respiration and blood pressure as a result of the converging input from somatic and autonomic fibers.

Clinical Relevance: At ST 9, the facial nerve supplies only the superficial muscular layer constituting the platysma muscle. However, the facial nerve communicates with several cranial nerves including the all three divisions of the trigeminal nerve (CN V), as well as CN VIII, CN IX, and CN X. It also links to branches of the cervical plexus including the great auricular, the greater and lesser occipital, and transverse cervical nerves.[13] These connections may have clinical ramifications as the body adapts to nerve injury and alternate routes of nerve communication develop. In terms of acupuncture, the somatic afferent stimulation provided by

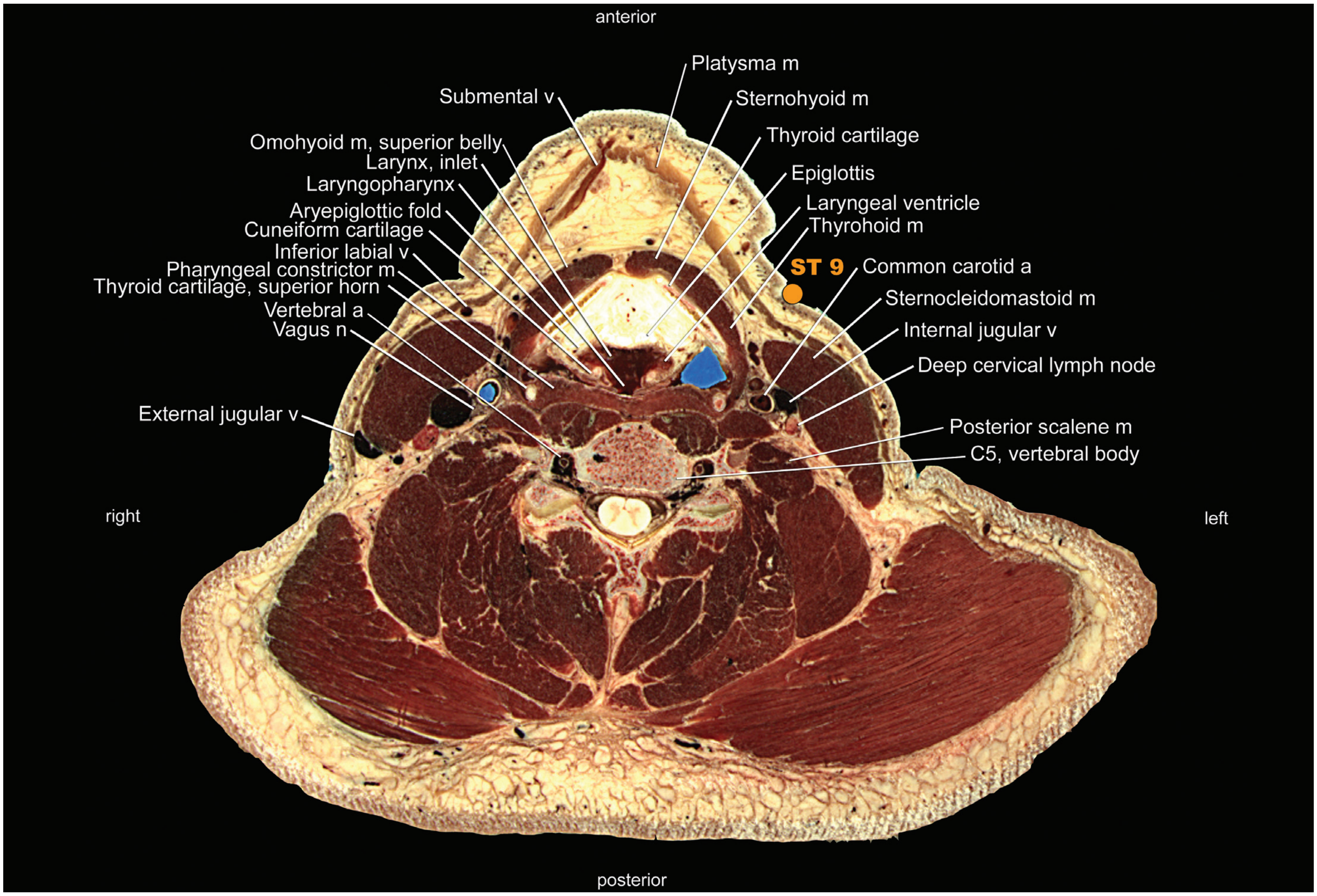

anterior
Platysma m
Submental v
Sternohyoid m
Omohyoid m, superior belly
Thyroid cartilage
Larynx, inlet
Laryngopharynx
Epiglottis
Aryepiglottic fold
Laryngeal ventricle
Cuneiform cartilage
Thyrohoid m
Inferior labial v
ST 9
Common carotid a
Pharyngeal constrictor m
Thyroid cartilage, superior horn
Sternocleidomastoid m
Vertebral a
Internal jugular v
Vagus n
Deep cervical lymph node
External jugular v
Posterior scalene m
C5, vertebral body
right
left
posterior

Figure 3-28. Note the density of prominent neurovascular structures in the vicinity of ST 9, reinforcing the need for caution.

needling may deliver a stronger and more widespread neurologic effect through interneural connections such as these involving the facial nerve. Medical acupuncture may also promote recovery of other regional nerve function, including the ansa cervicalis.

Far and away, however, the main clinical impact of ST 9 pertains to its autonomic influence over blood pressure and hemodynamics and local somatic influences over pharyngeal and laryngeal functions.

Vessels

- **Superior thyroid artery:** Supplies the thyroid gland. Originates beneath the anterior border of the SCM, branches into the hyoid (infrahyoid) artery, the SCM artery, the superior laryngeal artery, and the cricothyroid artery.
- **Anterior jugular vein:** Arises near the hyoid bone as the superficial submandibular veins join, and drains into either the external jugular vein or subclavian vein. This valveless vein communicates with its contralateral companion and connect by means of a transverse trunk called the venous jugular arch. The trunk receives tributaries from the inferior thyroid veins which also communicate with the internal jugular vein.
- **Internal jugular vein (IJV):** Usually the largest vein in the neck, the IJV receives blood from the brain (through the inferior petrosal sinus and sigmoid sinus), anterior face, deep cervical muscles, and cervical viscera (i.e., thyroid and parathyroid glands, larynx and trachea, and the pharynx and esophagus). The retromandibular, facial, and lingual veins likewise drain into the IJV. As shown in Figure 3-28, the right IJV is usually larger than the left, and sits a bit apart from the common carotid artery, whereas the left IJV overlaps the common carotid.

Clinical Relevance: The relatively superficial placement of the IJV's and their lack of body "armor" (e.g., bone or cartilage) makes these large and vital vessels more vulnerable to damage. An acupuncture needle too deeply placed can cause quick and significant loss of blood, leading to hypovolemic shock and patient death if left untreated. Ninety-five percent of the body's blood passes through the IJV. Aside from the safety hazards of deeply needling ST 9, cautious and appropriate placement supports neuromodulation and regulation of blood pressure. In addition, indirect benefits to the thyroid gland from neuromodulation of the vessels and nerves supplying it may hold value in thryoid disorders, though this is not yet supported by evidence.

Indications and Potential Point Combinations

- **Pharyngitis, tonsillitis, dysphonia, aphasia, vocal cord problems:**[3] ST 9, LI 10, LU 7, CV 22, CV 23.
- **Thyroid support:** ST 9, CV 22, CV 23, ST 36.

Evidence-Based Applications

- ST 9 (along with LU 7, KI 6, SI 3, and BL 60) significantly improved **dysphonias** associated with benign vocal pathologies.[4]
- Case series showed effectiveness of ST 9 for **trigeminal neuralgia**, along with "adjuvant points" along trigeminal nerve branches.[5]

References

1. Cummings M and Reid F. BMAS policy statements in some controversial areas of acupuncture practice. *Acupuncture in Medicine.* 2004;22(3):134-136.
2. Broniatowski M, Ilyes LA, Jacobs G, et al. Artificial reflex arc: a potential solution for chronic aspiration. I. Neck skin stimulation triggering strap muscle contraction in the canine. *Laryngoscope.* 1987;97(3 Pt 1):331-333.
3. Broniatowski M, Sohn J, Kayali H, et al. Artificial reflex arc: a potential solution for chronic aspiration. III. Stimulation of implanted cervical skin as a functional graft triggering glottis closure in the canine. *Laryngoscope.* 1994;104(10):1259-1263.
4. Yiu E, Xu JJ, Murry T, Wei WI, Yu M, Ma E, Huang W, and Kwong EY-L. A randomized treatment-placebo study of the effectiveness of acupuncture for benign vocal pathologies. *Journal of Voice.* 2006;20(1):144-156.
5. Lu X, Liu H, and Shi X. Treatment of trigeminal neuralgia with acupuncture at Renying point – a report of 7 cases. *Journal of Traditional Chinese Medicine.* 1997;17(2):122-123.
6. Lee JK, Moon HJ, Park MS, et al. Change of craniofacial deformity after sternocleidomastoid muscle release in pediatric patients with congenital muscular torticollis. *J Bone Joint Surg Am.* 2012;94(13):3931-937.
7. Alonso-Blanco C, de-la-Llave-Rincon A, Fernandez-de-las-Penas C. Muscle trigger point therapy in tension-type headache. *Expert Rev Neurother.* 2012;12(3):315-322.
8. Fernandez-de-Las-Penas C, Galan-Del-Rio F, Alonso-Blanco C, et al. Referred pain from muscle trigger points in the masticatory and neck-shoulder musculature in women with temporomandibular disorders. *J Pain.* 2010;11(12):1295-1304.
9. Wong DS and Li JH. The omohyoid sling syndrome. *Am J Otolaryngol.* 2000;21(5):318-322.
10. Kim L, Kwon H, and Pyun S-B. Pseudodysphagia due to omohyoid muscle syndrome. *Dysphagia.* 2009; 24(3):357-361.
11. Diamond M, Wartmann CT, Tubbs RS, et al. Peripheral facial nerve communications and their clinical implications. *Clinical Anatomy.* 2011;24:10-18.
12. Mwachaka PM, Ranketi SS, Elbusaidy H, et al. Variations in the anatomy of ansa cervicalis. *Folia Morphol.* 2010;69 (3):160-163.
13. Diamond M, Wartmann CT, Tubbs RS, et al. Peripheral facial nerve communications and their clinical implications. *Clinical Anatomy.* 2011;24:10-18.

ST 10

Shui Tu "Water Prominence"

On the anterior border of the sternocleidomastoid muscle, midway between ST 9 and ST 11. (This is the access point used in anesthesia for stellate ganglion block).

Gland

- **Lateral lobe of the thyroid gland:** The body's largest endocrine gland, producing thyroid hormone (which controls metabolic rate) and calcitonin (which controls calcium metabolism).

Clinical Relevance: Releasing fascial restrictions around the thyroid gland may improve blood flow and neural signaling, possibly improving thyroid health.

Cartilage

- **Cricoid cartilage:** A complete ring of cartilage between the larynx and trachea that provides attachments for various muscles, cartilages, and ligaments.

Clinical Relevance: Freeing up the local connective tissue fosters better function of the myriad structures that attach to the cricoid.

Muscles

- **Platysma muscle:** Helps depress mandible and participates in the grimace expression.
- **Sternocleidomastoid (SCM) muscle:** Tilts head in a lateral direction. Flexes and rotates the neck so that the face turns up and to the opposite side. When activated bilaterally, the SCM flexes the neck and thrusts the chin forward.
- **Omohyoid muscle:** Acts on the hyoid bone to depress, retract, and steady it.
- **Sternohyoid muscle:** After the hyoid bone has been elevated during swallowing, the sternohyoid muscle then depresses the hyoid bone.
- **Sternothyroid muscle:** Depresses the larynx and hyoid bone. Surgeons may incise the sternothyroid muscle in order to remove the thyroid. Sternothyroid division may cause post-operative pain and possibly non-neurogenic dysphonia, as the strap musculature may contribute to voice production, though evidence is mixed.[1,2]

Clinical Relevance: The extrinsic laryngeal strap muscles include the sternohyoid, sternothyroid, and omohyoid muscles; they supply vertical motion to the larynx, important for phonation, yawning, respiration, singing, and swallowing.[3] Acupuncture at ST 10 may benefit patients with dysphonia by helping normalize muscle tension in the infrahyoid musculature.

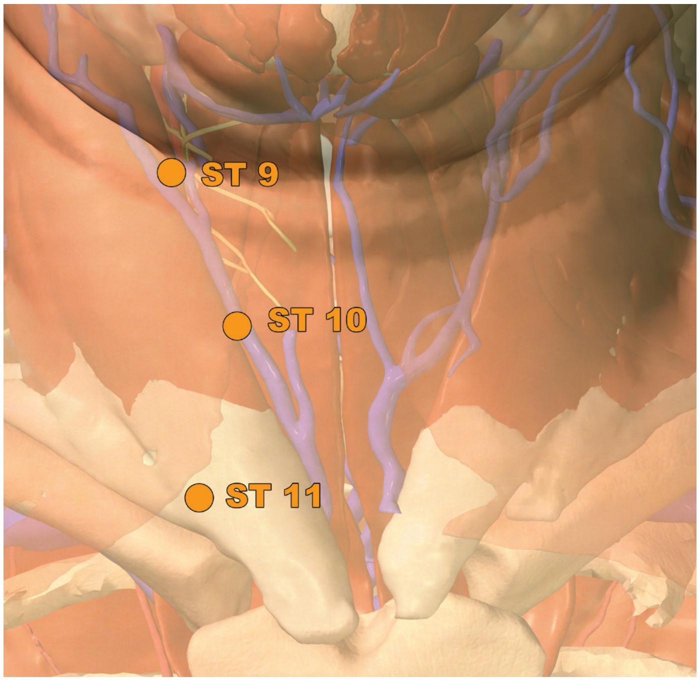


Figure 3-29. The ST points on the anterior neck all relate to the SCM and roughly follow the jugular veins.

Nerves

- **Facial nerve, cervical branch (CN VII):** Innervates the platysma muscle.
- **Transverse cervical nerve (C2, C3):** Supplies the skin of the anterior triangle.
- **Ansa cervicalis (C1-C3 motor fibers):** A nerve loop that supplies the infrahyoid muscles in the anterior cervical triangle, including the sternothyroid muscle.
- **Vagus nerve (CN X):** Sensory to the inferior pharynx, larynx, thoracic organs, abdominal organs; taste sensation from the root of the tongue and taste buds on the epiglottis; motor supply to the soft palate, pharynx, the palatoglossus muscle, and the intrinsic laryngeal muscles (which are responsible for phonation); proprioceptive to the aforementioned musculature; parasympathetic supply to the thoracic and abdominal viscera.
- **Recurrent laryngeal nerve (from CN X):** Provides sensory innervation to the larynx inferior to the glottis, as well as motor supply to the larynx. The recurrent laryngeal nerve may be injured during surgery; patients may suffer transient or long-term voice changes. The nerve courses on the dorsolateral surface of the trachea.
- **Spinal accessory nerve (CN XI):** Innervates the SCM and trapezius muscles.
- **Sympathetic trunk (C8-T5):** The sympathetic trunks in the neck are associated with three cervical sympathetic ganglia (superior, middle, and inferior) which receive presynaptic fibers from the superior thoracic spinal nerves and associated white rami communicantes via the sympathetic trunk. From these ganglia, postsynaptic fibers pass to splanchnic nerves to the spinal nerve in the cervical region via gray rami communicantes, or they proceed as direct visceral branches, or splanchnic nerves. Sympathetic branches destined to reach the head and neck viscera travel with the arteries (vertebral and carotid).
- **Stellate ganglion:** Also known as the cervicothoracic or inferior cervical ganglion, this sympathetic ganglion represents a fusion of the inferior cervical and first thoracic ganglia. Located at C7, ventral to the C7 transverse process and neck of the first rib, the stellate ganglion sits just caudal to the subclavian artery. Though several centimeters superficial to the stellate ganglion, stimulation of ST 10 through acupuncture, massage, or laser

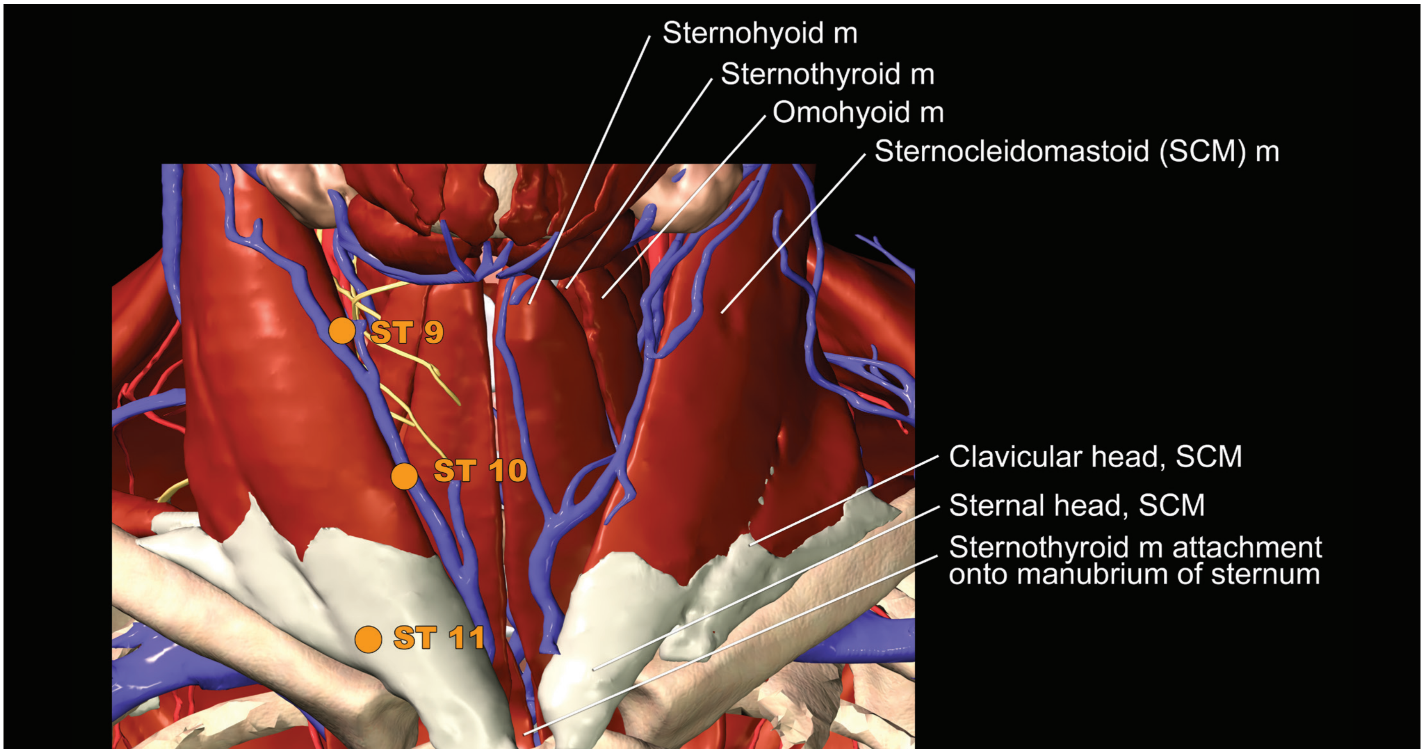

Sternohyoid m
Sternothyroid m
Omohyoid m
Sternocleidomastoid (SCM) m
ST 9
ST 10
ST 11
Clavicular head, SCM
Sternal head, SCM
Sternothyroid m attachment onto manubrium of sternum

Figure 3-30. ST 10 falls equidistant between ST 9 and ST 11, but remains on the medial (anterior) border of the SCM with ST 9.

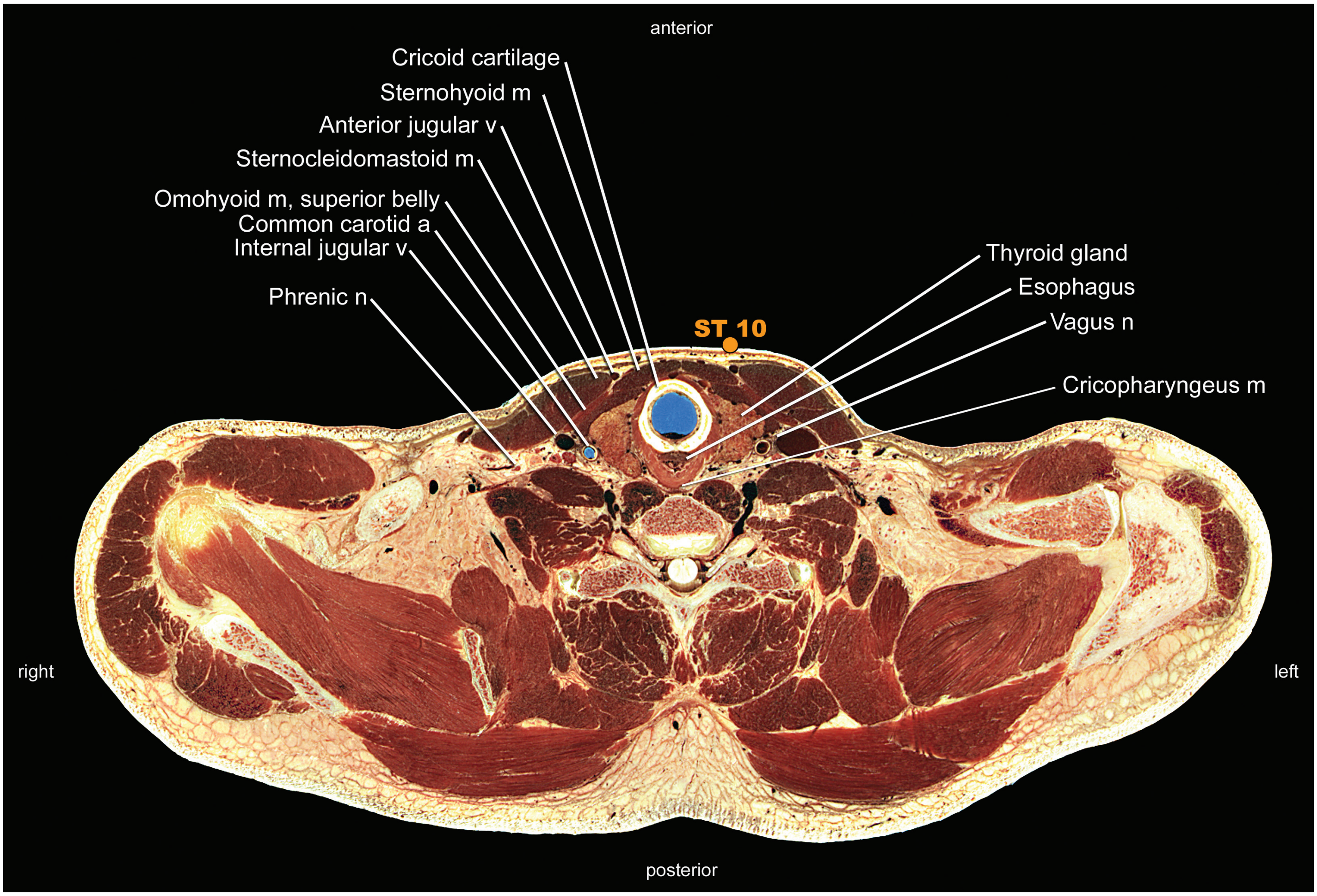

anterior
Cricoid cartilage
Sternohyoid m
Anterior jugular v
Sternocleidomastoid m
Omohyoid m, superior belly
Common carotid a
Internal jugular v
Phrenic n
ST 10
Thyroid gland
Esophagus
Vagus n
Cricopharyngeus m
right
left
posterior

Figure 3-31. The descriptive term for ST 10, "Water Prominence", designates the place where one can palpate the carotid artery, like a "gentle splash of water". (Ellis A, Wiseman N, and Boss K. Grasping the Wind. Brookline, MA: Paradigm Publications, 1989. P. 65.) Note the anatomical proximity of ST 10 to several large vessels in the ventral cervical region as well as the thyroid gland, the trachea, and the recurrent largyngeal nerve (not shown) that courses along the trachea's dorsolateral aspect.

therapy has the potential to neuromodulate local autonomic structures, including the stellate ganglion.

Clinical Relevance: States of sympathetic hyperarousal may respond to blockade, sympathectomy, or other neuromodulatory interventions such as acupuncture and related techniques. For this reason, conditions such as Raynaud's phenomenon, hyperhydrosis (extreme sweating) of the hands, and post-traumatic stress disorder (PTSD)[4] may respond to activation of ST 10. Proximity of the recurrent laryngeal nerve to ST 10 justifies its inclusion in needling protocols for dysphonia.

Vessels

- **Anterior jugular vein:** Arises near the hyoid bone as the superficial submandibular veins join, and drains into either the external jugular vein or subclavian vein.
- **Internal jugular vein (IJV):** Usually the largest vein in the neck, the IJV receives blood from the brain, anterior face, deep cervical muscles, and cervical viscera.
- **Common carotid artery:** Ascends within the carotid sheath, along with the internal jugular vein and vagus nerve. Divides into the internal and external arteries at the level of the superior border of the thyroid cartilage.

Clinical Relevance: Presence of several large vessels within reach of ST 10 warrants caution.

Indications and Potential Point Combinations

- **Pharyngitis:** ST 10, LI 10, LI 11.
- **Goiter:** ST 10, ST 9, CV 22, CV 23
- **Dysphonia:** ST 10, ST 9, CV 22, CV 23, LI 4, LU 7

References

1. Kalmovich LM, Cote V, Sands N, et al. Thyroidectomy: exactly how painful is it? J Otolaryngol Head Neck Surg. 2010;39(3):277-283.
2. Henry LR, Solomon NP, Howard R, et al. The functional impact on voice of sternothyroid muscle division during thyroidectomy. Annals of Surgical Oncology. 2008;15(7):2027-2033.
3. Lesnik DJ and Randolph GW. Management of the laryngeal nerves and voice. Endocrine Surgery. 2009; Springer Specialist Surgery Series, 2009, 1, 195-211, DOI: 10.1007/978-1-84628-881-4_14
4. Hicky A, Hanling S, Pevney E, et al. Stellate ganglion block for PTSD. Am J Psychiatry. 2012;169(7):760.

ST 11

Qi She "Qi Abode"

At the superior border of the sternal end of the clavicle, between the sternal and clavicular heads of the sternocleidomastoid muscle.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1] (Note the relationship between ST 11 and the lung in Figure 3-33.) An anatomical study of the acupuncture safety of ST 11 and CV 22 revealed that the needle tip may injure the pleural cupula, large local veins, and the vagus nerve.[2]

Gland

- **Inferior aspect of the thyroid gland:** The body's largest endocrine gland, producing thyroid hormone (which controls metabolic rate) and calcitonin (which controls calcium metabolism).

Clinical Relevance: As the "Qi Abode", ST 11 lives close to anatomical structures that give deeper insight into the ancient Chinese view of "Qi". Not as metaphysical energy, but as intersecting blood vessels ferrying dissolved gases (oxygen, carbon dioxide), nutrients, and in this case, hormones synthesized by the thyroid. Witness the vascular expressway in Figure 3-32 and note the presence of the vagus nerve and sympathetic trunk as well, making its way into the thoracic cage.

Muscles

- **Platysma muscle:** Helps depress mandible and participates in the grimace expression.
- **Sternocleidomastoid (SCM) muscle:** Tilts head in a lateral direction. Flexes and rotates the neck so that the face turns up and to the opposite side. When activated bilaterally, the SCM flexes the neck and thrusts the chin forward.
- **Sternohyoid muscle:** After the hyoid bone has been elevated during swallowing, the sternohyoid muscle then depresses the hyoid bone.
- **Sternothyroid muscle:** Depresses the larynx and hyoid bone.

Clinical Relevance: The extrinsic laryngeal strap muscles include the sternohyoid, sternothyroid, and omohyoid muscles; they supply vertical motion to the larynx, important for phonation, yawning, respiration, singing, and swallowing.[3] Acupuncture at ST 10 may benefit patients with dysphonia by helping normalize muscle tension in the infrahyoid musculature. Massage, acupuncture or other neuromodulatory approaches may improve the appearance of the anterior neck through its effects on the platysma muscle.

Trigger points in the SCM may refer to the sternum (CV 22, CV 21, CV 20 territory), the angle of the mandible, the chin, the occiput, the vertex, the TMJ, the cheek, and the eyebrow and frontal sinus zones.

Nerves

- **Facial nerve, cervical branch (CN VII):** Innervates the platysma muscle.
- **Transverse cervical nerve (C2, C3):** Supplies the skin of the anterior triangle.
- **Ansa cervicalis (C1-C3 motor fibers):** A nerve loop that supplies the infrahyoid muscles in the anterior cervical triangle.
- **Medial branch of the supraclavicular nerve (C3, C4):** Supplies the skin of this portion of the neck. See below for further discussion on the supraclavicular nerves.
- **Supraclavicular nerves (C3, C4):** Supply the skin of the neck, cranioventral thorax, and and shoulder. The supraclavicular nerve, a strictly sensory structure, arises from the superficial cervical plexus and divides into medial, intermediate, and lateral branches. The medial branch, closest to ST 11, courses caudal to the SCM to the clavicle where it crosses the platysma to provide sensation to the sternal notch. The intermediate branches travels along the lateral border of the SCM and continues in a caudal direction past the medial third of the clavicle. It then traverses the platysma muscle to reach the skin of the cranioventral thorax. The lateral branch meanders over the pectoralis major muscle and anterior part of the deltoid toward the second rib and scapular spine. However, three anatomic variants

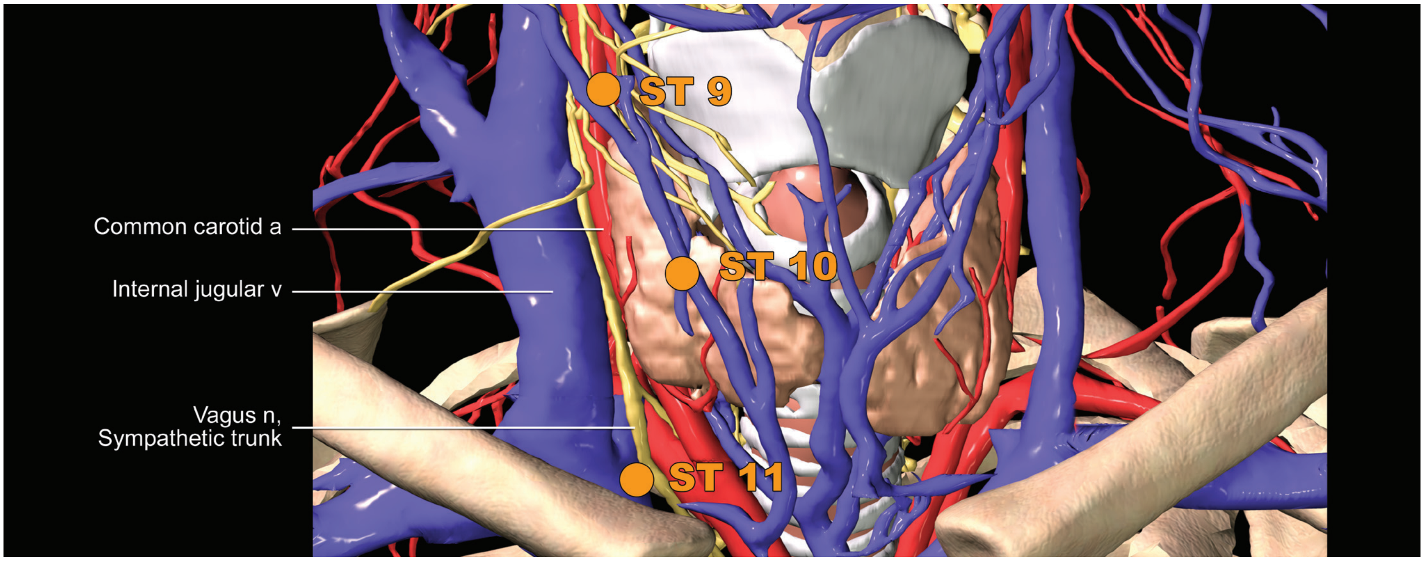


Figure 3-32. The applications for ST 11 resemble those of ST 9 and ST 10, given shared neurovascular anatomy. This figure highlights its proximity to the vagus nerve and sympathetic trunk.

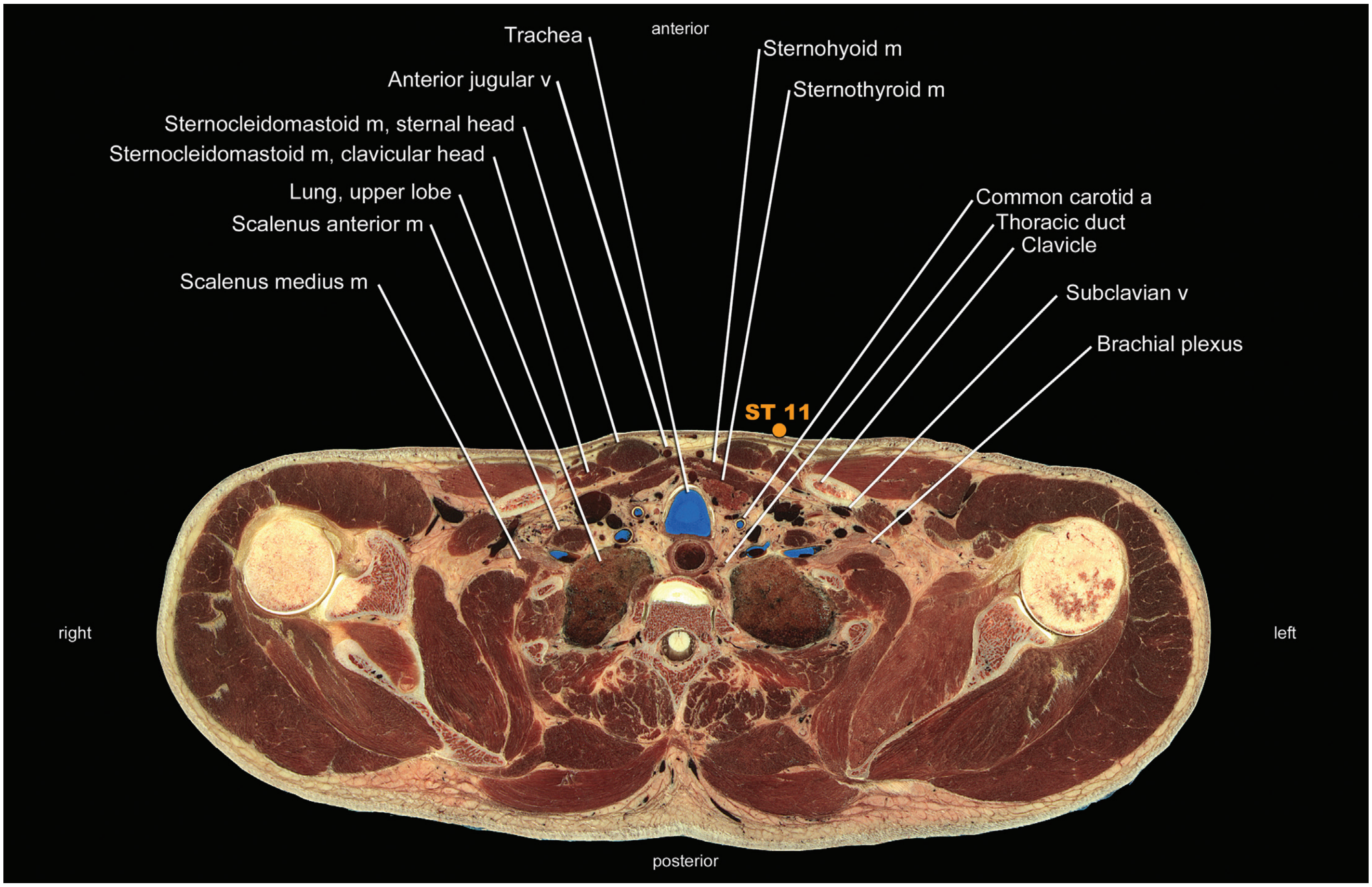


Figure 3-33. The cross section shows the superficial muscular and deeper neurovascular layers beneath ST 11. Note that deep needling of ST 11 might injure not only major vessels, but it also the lung, leading to pneumothorax.

pose the possibility of nerve entrapment of the supraclavicular nerve.[4] Sources of compression include fibrous bands, muscles, tendons, or bone. Identification of the source of entrapment may require computed tomography, but neuropathic pain and non-bony sources of compression may respond to acupuncture.

- **Vagus nerve (CN X):** Sensory to the inferior pharynx, larynx, thoracic organs, abdominal organs; taste sensation from the root of the tongue and taste buds on the epiglottis; motor supply to the soft palate, pharynx, the palatoglossus muscle, and the intrinsic laryngeal muscles (which are responsible for phonation); proprioceptive to the aforementioned musculature; parasympathetic supply to the thoracic and abdominal viscera.
- **Phrenic nerve (C3-C5):** Supplies motor, sympathetic and sensory information for the thoracic diaphragm. Also supplies the mediastinal pleura and pericardium.

Clinical Relevance: The proximity of ST 11 to the vagus nerve and sympathetic trunk highlights the effects of ST 11 on the autonomic nervous system (see Figure 3-32). Deep needling of ST 11 may injure the phrenic nerve. Pain in the sternomanubrial region may respond to neuromodulation of the medial branch of the supraclavicular nerve if the nerve is suffering entrapment.

Vessels

- **Anterior jugular vein:** Arises near the hyoid bone as the superficial submandibular veins join, and drains into either the external jugular vein or subclavian vein.
- **Internal jugular vein (IJV):** Usually the largest vein in the neck, the IJV receives blood from the brain, anterior face, deep cervical muscles, and cervical viscera.
- **Common carotid artery:** Ascends within the carotid sheath, along with the internal jugular vein and vagus nerve. Divides into the internal and external arteries at the level of the superior border of the thyroid cartilage.

Clinical Relevance: Superficial needling of ST 11 will affect mostly the platysma, sternohyoid and sternothyroid muscles as illustrated in the cross section of Figure 3-33. However, several large veins lurk beneath this layer, warranting caution with needling.

Indications and Potential Point Combinations

- **Neck pain or restriction related to the SCM:** ST 11, ST 10, ST 12, GB 20.
- **Hypertension:** ST 9, ST 11, LI 4, ST 36.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.
2. Chen Y, Wu BH, Xie YC, et al. Clinical anatomy study on the acupuncture safety of tiantu (CV 22) and Qishe (ST 11). *Zhongguo Zhen Jiu*. 2007;27(2):120-122.
3. Lesnik DJ and Randolph GW. Management of the laryngeal nerves and voice. *Endocrine Surgery*. 2009; Springer Specialist Surgery Series, 2009, 1, 195-211, DOI: 10.1007/978-1-84628-881-4_14
4. Douchamps F, Courois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome. *Joint Bone Spine*. 2012;79:88-89.

ST 12

Que Pen (ancient Chinese word for supraclavicular fossa)[1]

"Empty (or Broken) Basin"

On the supraclavicular fossa, at the midclavicular line, approximately 4 cun lateral to the midline.

Note: On the left side, ST 12 coincides with Virchow's node, also called a "signal" or "sentinel" lymph node. Finding an enlarged, firm lymph node here warrants suspicion of metastasis of a malignancy in the thorax or abdomen.

ST 12 is also one of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) where deep needling can cause pneumothorax.[2] Needling deeply behind the clavicle may traumatize the subclavian vessels or the lung.

Muscles

- **Platysma muscle:** Helps depress mandible and participates in the grimace expression.

Clinical Relevance: Easing myofascial restrictions of the platysma muscle at its attachment onto the scapula may assist in an acupressure/acupuncture facelift. Pressure here may also benefit neck pain with anterior tension.

Nerves

- **Facial nerve, cervical branch (CN VII):** Innervates the platysma muscle.
- **Supraclavicular nerves (C3, C4):** Supply the skin of the neck, cranioventral thorax, and and shoulder. The supraclavicular nerve, a strictly sensory structure, arises from the superficial cervical plexus and divides into medial, intermediate, and lateral branches. The medial branch, closest to ST 11, courses caudal to the SCM to the clavicle where it crosses the platysma to provide sensation to the sternal notch. The intermediate branches travels along the lateral border of the SCM and continues in a caudal direction past the medial third of the clavicle. It then traverses the platysma muscle to reach the skin of the cranioventral thorax. The lateral branch meanders over the pectoralis major muscle and anterior part of the deltoid toward the second rib and scapular spine. However, three anatomic variants pose the possibility of nerve entrapment of the supraclavicular nerve.[4] Sources of compression include fibrous bands, muscles, tendons, or bone. Identification of the source of entrapment may require computed tomography, but neuropathic pain and non-bony sources of compression may respond to acupuncture.
- **Supraclavicular branches of brachial plexus:** Includes the dorsal scapular nerve (C5, possibly also C4; supplies the rhomboid muscles); the long thoracic nerve (C5-C7; supplies the serratus anterior muscle); the nerve to the subclavius (C5, possibly C4 and C6; supplies the subclavius muscle); and the suprascapular nerve (C5, C6, possibly C4; supplies the supraspinatus and infraspinatus muscles; articular branches supply the glenohumeral joint and joint capsule).
- **Phrenic nerve (C3-C5):** Supplies motor, sympathetic and sensory information for the thoracic diaphragm. Also supplies the mediastinal pleura and pericardium.

Clinical Relevance: Deep needling of ST 12 or ST 11 may injure the phrenic nerve and result in respiratory distress.[5] In Figure 3-35, note the location of the left phrenic nerve, not far from where ST 12 would land (shown here only on the right side of the body).

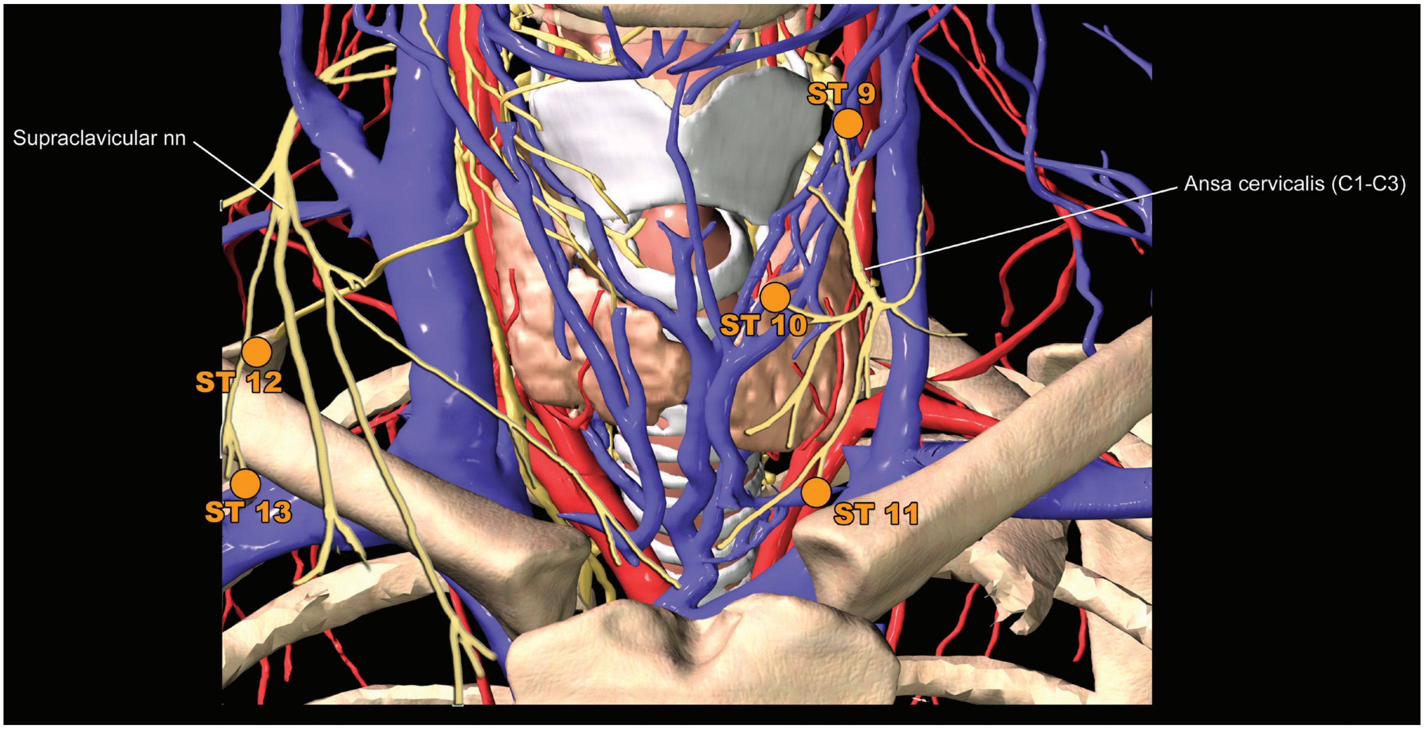


Figure 3-34. The name "Empty Basin" for ST 12 refers to the supraclavicular fossa, that forms behind the clavicle. This image reveals the relationship between the supraclavicular nerve branches and ST 11, ST 12, and ST 13. Clinical applications of these acupuncture points include myofascial restriction causing entrapment syndromes.

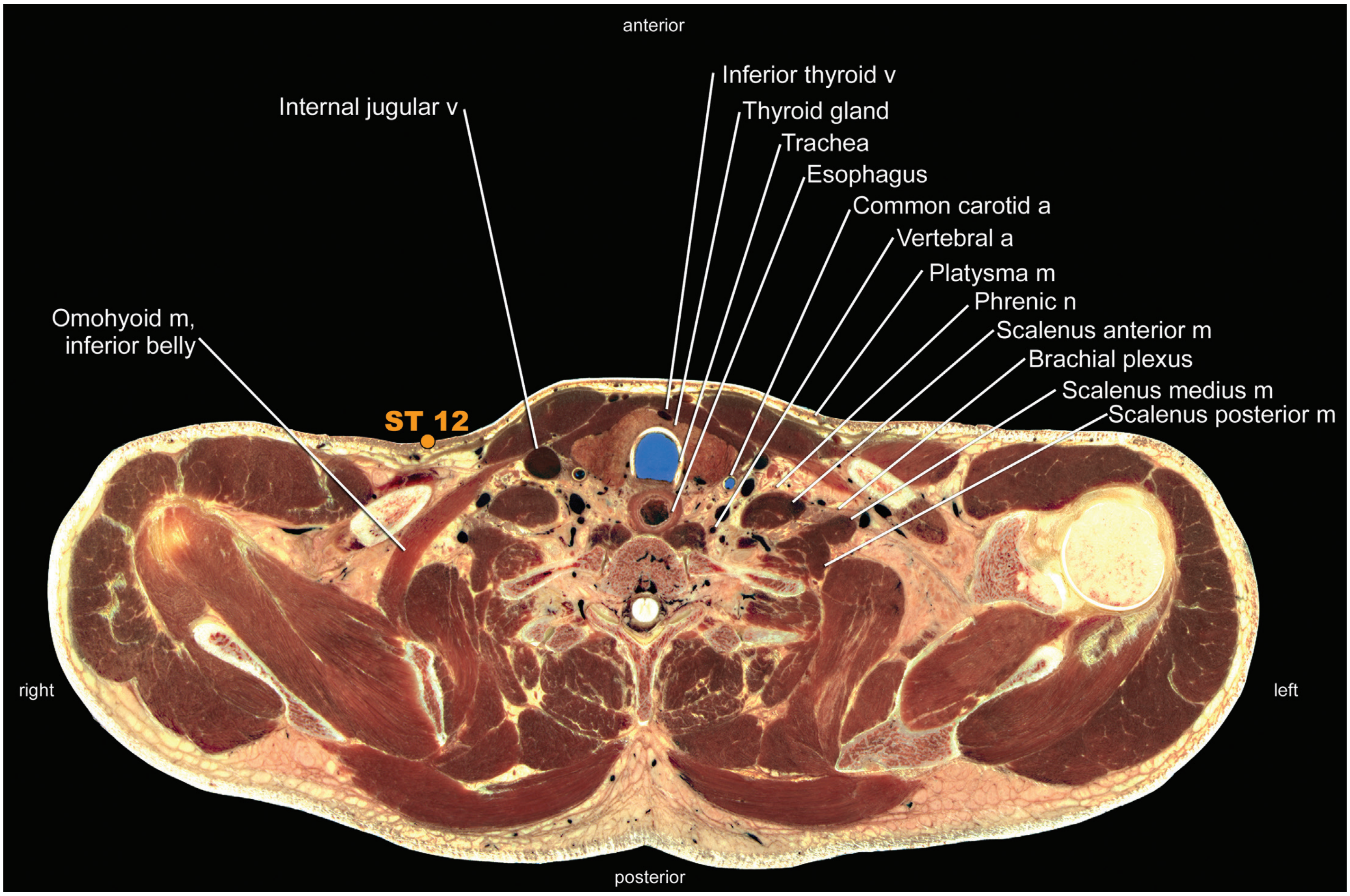


Figure 3-35. This cross section reveals the vital neurovascular structures within reach of a needle entering ST 12. This emphasizes the need for caution as well as portrays opportunities to influence respiratory function and blood supply to the head and neck.

Vessels

- **Transverse cervical artery:** Also known as transverse artery of the neck; originates from the thyrocervical trunk, which is a branch of the subclavian artery. The artery sends branches to muscles in the posterior cervical triangle, and the trapezius and rhomboid muscles. It crosses the phrenic nerve and anterior scalene muscle at nearly a 90 degree angle, 2-3 cm above the clavicle and then passes through the brachial plexus trunks, to which it supplies vasa nervorum. Damage to the transverse cervical artery may lead to adherence between the phrenic nerve and vessel. This may then cause vascular compression of the phrenic nerve following traumatic or iatrogenic injuries, including chiropractic manipulation of the neck. If this occurs, the patient may experience paralysis of the thoracic diaphragm.[6]
- **Suprascapular artery (from thyrocervical trunk):** Supplies muscles on the posterior scapula.

Clinical Relevance: Freeing myofascial restriction of the local vasculature may improve diaphragmatic excursion if mechanical compression from tissue adherence is resulting in phrenic nerve dysfunction.

Indications and Potential Point Combinations

- **Pain in supraclavicular fossa, supraclavicular nerve entrapment:**[3] ST 12, ST 13, LI 17.
- **Neck pain:** ST 12, ST 11, GB 21 acupressure.[7]
- **Shoulder pain involving the clavicle:** ST 12, ST 13, LI15, TH 14, LU 1, local trigger points.

References

1. Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications*. Stuttgart: Thieme, 2007. P. 25.
2. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.
3. Jelev L and Surchev L. Study of variant anatomical structures (bony canals, fibrous bands, and muscles) in relation to potential supraclavicular nerve entrapment. *Clinical Anatomy*. 2007;20:278-285.
4. Douchamps F, Courois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome. *Joint Bone Spine*. 2012;79:88-89.
5. Guirguis M, Karroum R, Abd-Elsayed AA, et al. Acute respiratory distress following ultrasound-guided supraclavicular block. *The Ochsner Journal*. 2012;12:159-162.
6. Kaufman MR, Willekes LJ, Elkwood AI, et al. Diaphragm paralysis caused by transverse cervical artery compression of the phrenic nerve: The Red Cross syndrome. *Clinical Neurology and Neurosurgery*. 2012;114:502-505.
7. Chen XY, Jia WH, Liu MJ. Observation on therapeutic effect of digital acupoint pressure for treatment of the nerve root type of cervical spondylosis. *Zhongguo Zhen Jiu*. 2009;29(8):659-662.

ST 13

Qi Hu "Qi Door"

On the inferior border of the clavicle, along the midclavicular line, directly inferior to ST 12.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (clavicular part):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The clavicular head flexes the humerus, whereas the sternocostal head extends the humerus once it is flexed.
- **Subclavius muscle:** Depresses and anchors the clavicle, which helps stabilize it during arm movements.

Clinical Relevance: Tension in these structures flexes the upper back ventrally and rounds the shoulders. Releasing restriction facilitates fuller range of motion and better posture. Trigger points in the clavicular section of the pectoralis major muscle refer strongly to the deltoid and shoulder. Trigger points in the subclavius muscle, small as the structure is, refer along the caudal clavicle, along the biceps and the radial aspect of the antebrachium to the palmar surface of the first three digits of the hand. The trajectory of the subclavius referred pain pattern resembles the LU channel course.

Nerves

- **Supraclavicular nerves (C3, C4):** Supply the skin of the neck, cranioventral thorax, and and shoulder. The supraclavicular nerve, a strictly sensory structure, arises from the superficial cervical plexus and divides into medial, intermediate, and lateral branches. The medial branch, closest to ST 11, courses caudal to the SCM to the clavicle where it crosses the platysma to provide sensation to the sternal notch. The intermediate branches travels along the lateral border of the SCM and continues in a caudal direction past the medial third of the clavicle. It then traverses the platysma muscle to reach the skin of the cranioventral thorax. The lateral branch meanders over the pectoralis major muscle and anterior part of the deltoid toward the second rib and scapular spine. However, three anatomic variants pose the possibility of nerve entrapment of the supraclavicular nerve.[2] Sources of compression include fibrous bands, muscles, tendons, or bone. Identification of the source of entrapment may require computed tomography, but neuropathic pain and non-bony sources of compression may respond to acupuncture. ST 13 affects the intermediate branches of the supraclavicular nerves.
- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head.
- **Nerve to the subclavius (C5 and C6):** Supplies the subclavius muscle.

Clinical Relevance: Entrapment of the nerves coursing through this region may irritate the axons and predispose the muscles to chronic pain and tension, stemming from neuropathic abnormalities.

Vessels

- **Thoracoacromial artery:** Supplies the breast and clavipectoral region.
- **Subclavian artery:** Supplies the arm, neck, and brain.

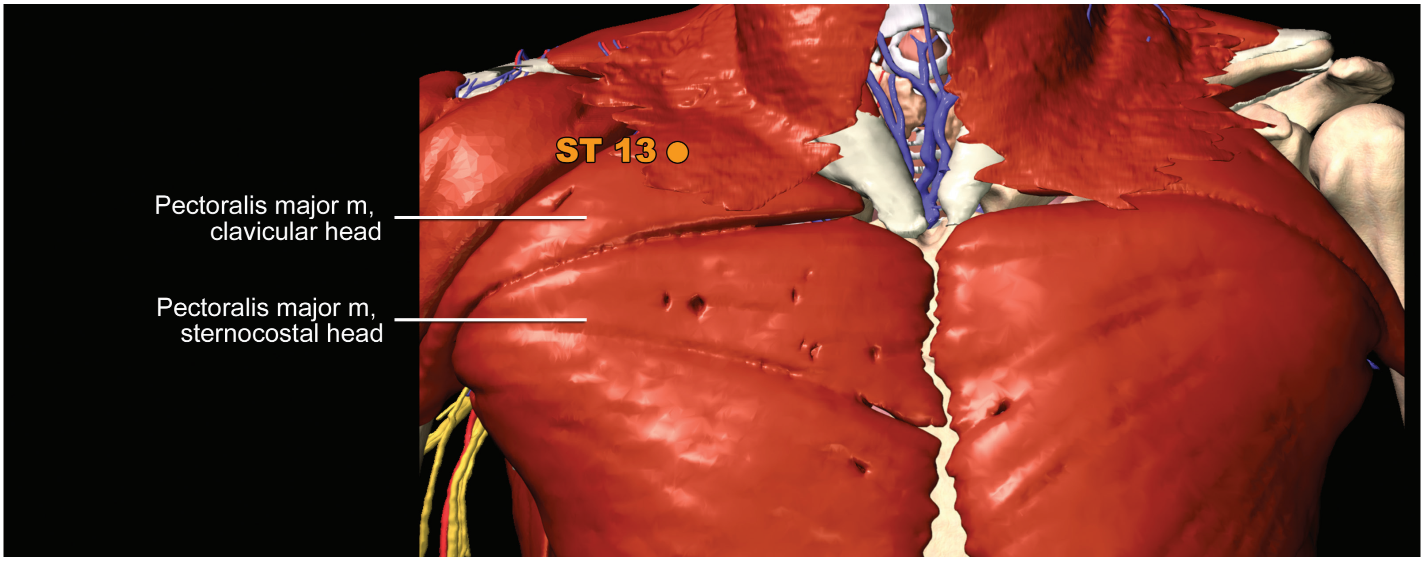

ST 13
Pectoralis major m, clavicular head
Pectoralis major m, sternocostal head

Figure 3-36. ST 13 lies inferior to the clavicle, atop the subclavius muscle. This muscle shortens with a "hunched up" or rounded shouldered position. This posture may be acquired from habit, work type, or organic causes of structural dysfunction. For example, patients with Scheuermann's disease (spinal osteochondrosis; juvenilekyphoscoliosis) may experience thoracic outlet syndrome/brachial plexopathy and migraine headache. The myofascial basis for these secondary afflictions relates to the thoracic kyphosis produced by this condition. Shortening of the anterior shoulder girdle musculature can lead to costoclavicular venous compression and brachial plexopathy. While acupuncture in this region will not reverse the spinal abnormalities, relaxing the regional muscle tension around these structures may offset the vascular compromise. That is, by relaxing the subclavius muscle, this will lessen compression of the subclavian vein against the anterior scalene muscle on the first rib. (Collins JD, Saxton EH, Miller TQ, et al. Scheuermann's disease as a model displaying the mechanism of venous obstruction in thoracic outlet syndrome and migraine patients: MRI and MRA. *J Natl Med Assoc.* 2003;95:298-306.)

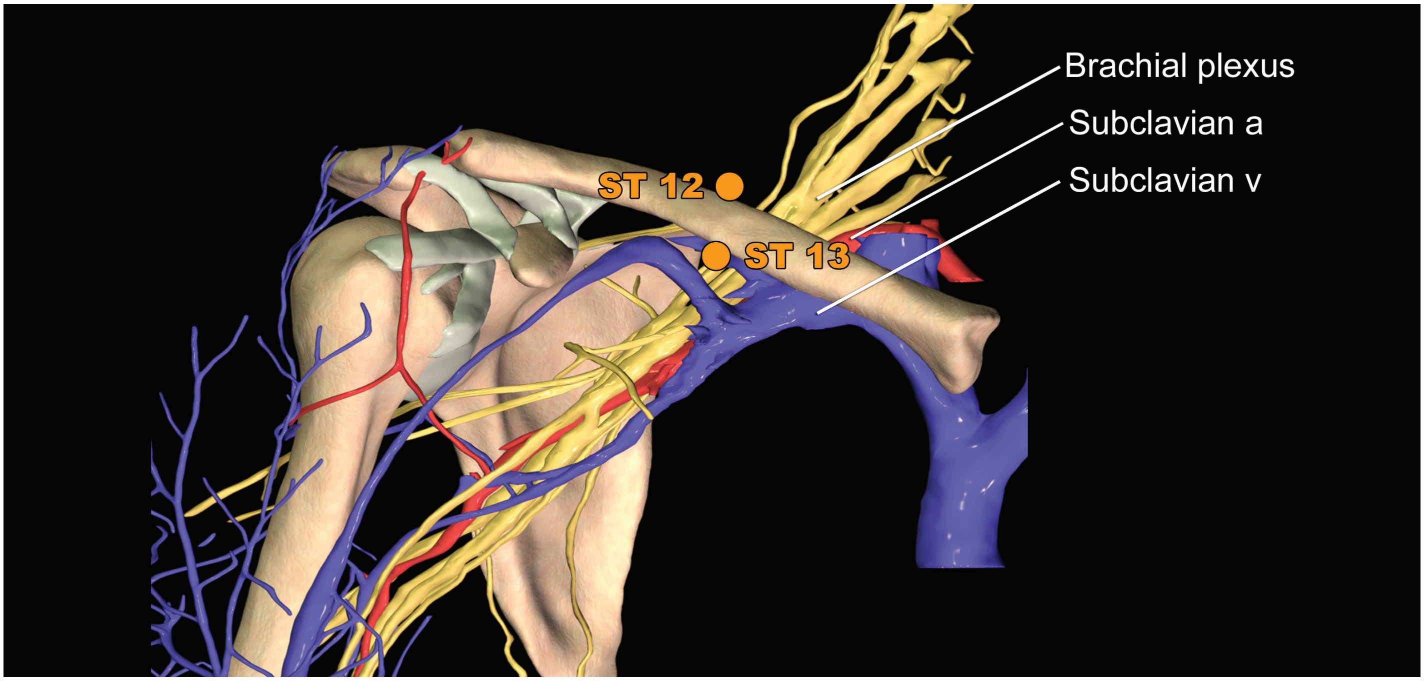

Brachial plexus
Subclavian a
Subclavian v
ST 12
ST 13

Figure 3-37. This image depicts the neurovascular structures vulnerable to compression by tension and bony impingement.

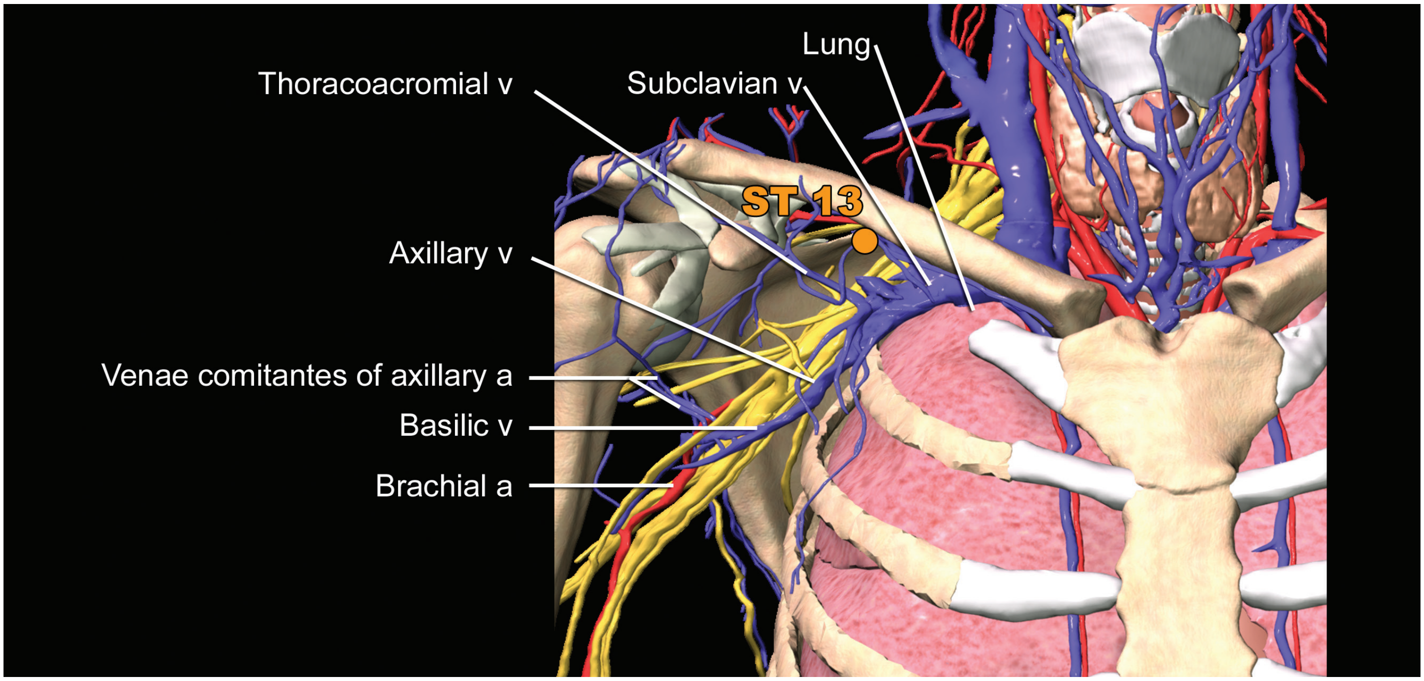

Lung
Thoracoacromial v
Subclavian v
ST 13
Axillary v
Venae comitantes of axillary a
Basilic v
Brachial a

Figure 3-38. The Chinese name for the point ST 13, "Qi Door", bespeaks its location near the source for Qi as vital air, the lung.

- **Subclavian vein:** Joins with the internal jugular vein to form the brachiocephalic vein, a union called the "venous angle." This is where, on the left side, the thoracic duct drains lymph into the venous circulation; on the right side, the right lymphatic duct drains the lymph.

Clinical Relevance: Compressive myofascial restriction limits blood flow, facilitating neural sensitization and cultivating trigger point dysfunction.

Indications and Potential Point Combinations

- **Thoracic outlet syndrome:** ST 13, ST 12, ST 11, GB 21, LI 17. Local trigger points.
- **Supraclavicular nerve entrapment syndrome:** ST 11, ST 12, ST 13, local trigger points.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Douchamps F, Courois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome. *Joint Bone Spine.* 2012;79:88-89.

ST 14

Ku Fang “Storehouse” or “Storeroom”

In the first intercostal space on the midclavicular line. To find the first intercostal space, locate the sternal angle. This will link to the second rib. The first intercostal space lies above the second rib.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (clavicular or sternocostal head):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The clavicular head flexes the humerus, whereas the sternocostal head extends the humerus once it is flexed.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: Trigger points in the pectoralis muscle refer to the deltoid from the clavicular section and to the left breast/pectoral region and medial elbow from the sternocostal section. Tension in the region of the first and second ribs increases the likelihood of nerve entrapment and brachial plexopathy. Note the nerves and vessels coursing beneath ST 14 in Figure 3-39. The muscles in this region shorten when an individual recruits the accessory muscles of inspiration, or AMI (e.g., the pectoralis and trapezius muscles). This occurs when the demand for oxygen exceeds the pumping ability of the thoracic diaphragm. Patients with chronic obstructive pulmonary disease (COPD) and asthma often utilize their AMI. Intense exercise also activates the AMI; their muscle contraction coincides with that of the diaphragm during inspiration.[2]

Nerves

- **Intermediate and lateral supraclavicular nerves (C3, C4):** Supply the skin over the shoulder and clavicle.
- **Supraclavicular nerves (C3, C4):** Supply the skin of the neck, cranioventral thorax, and and shoulder. The supraclavicular nerve, a strictly sensory structure, arises from the superficial cervical plexus and divides into medial, intermediate, and lateral branches. The medial branch, closest to ST 11, courses caudal to the SCM to the clavicle where it crosses the platysma to provide sensation to the sternal notch. The intermediate branches travels along the lateral border of the SCM and continues in a caudal direction past the medial third of the clavicle. It then traverses the platysma muscle to reach the skin of the cranioventral thorax. The lateral branch meanders over the pectoralis major muscle and anterior part of the deltoid toward the second rib and scapular spine. However, three anatomic variants pose the possibility of nerve entrapment of the supraclavicular nerve.[3] Sources of compression include fibrous bands, muscles, tendons, or bone. Identification of the source of entrapment may require computed tomography, but neuropathic pain and non-bony sources of compression may respond to acupuncture. ST 14 affects the lateral branches of the supraclavicular nerves.
- **Ventral ramus of the 1st intercostal nerve:** The superior part of the ventral ramus joints the brachial plexus, whereas the inferior part becomes the 1st intercostal nerve. Supplies the local skin and musculature.
- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head.

Clinical Relevance: Tension in the upper thoracic musculature limits blood and oxygen delivery to local nerve supply. This perpetuates trigger point dysfunction and pain.

Vessels

- **Thoracoacromial artery and vein:** Supplies and drains, respectively, the breast and clavipectoral region.
- **1st anterior intercostal artery (from internal thoracic artery):** Distributes to intercostal muscles, the overlying skin, and the parietal pleura.

Clinical Relevance: Reduced blood supply from muscle tension and connective tissue fibrosis reduces arterial blood supply and venous and lymphatic drainage. This can compromise health of the regions supplied, including breast health.

Indications and Potential Point Combinations

- **Use if tender for relieving sadness and stress of an emotional shock:** ST 14, CV 17, HT 7.
- **Lung or bronchial problems: bronchitis, dyspnea, fullness and pain in the chest, cough, COPD:** ST 14, LU 1, LU 2, BL 13, BL 23.

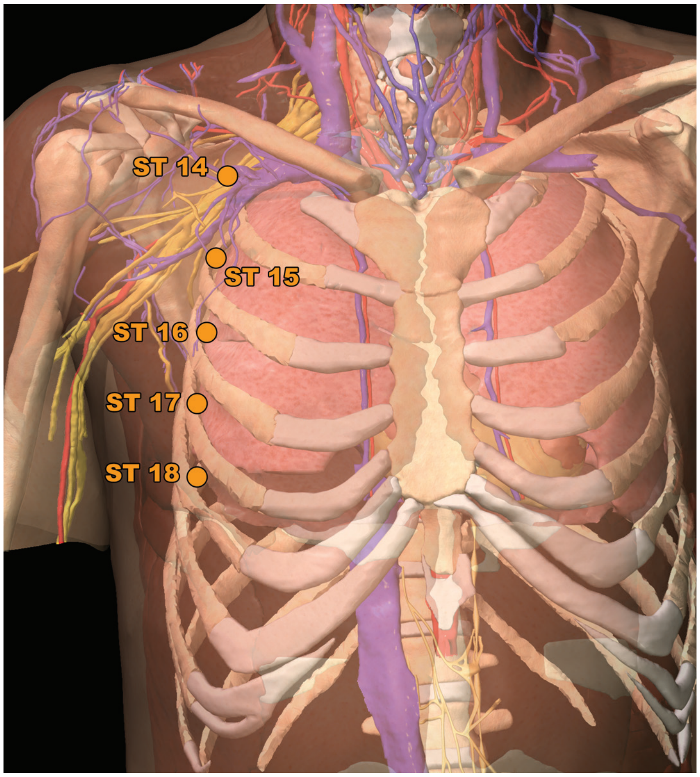


Figure 3-39. Treatment of myofascial restrictions and other sources of somatic dysfunction at ST 14 may improve movement of the thoracic cage. That is, by reducing tension in the pectoralis major, an accessory muscle of inspiration, a fuller incursion of air may result. This explains the point’s descriptive title, “Storehouse” of Qi (meaning vital air).

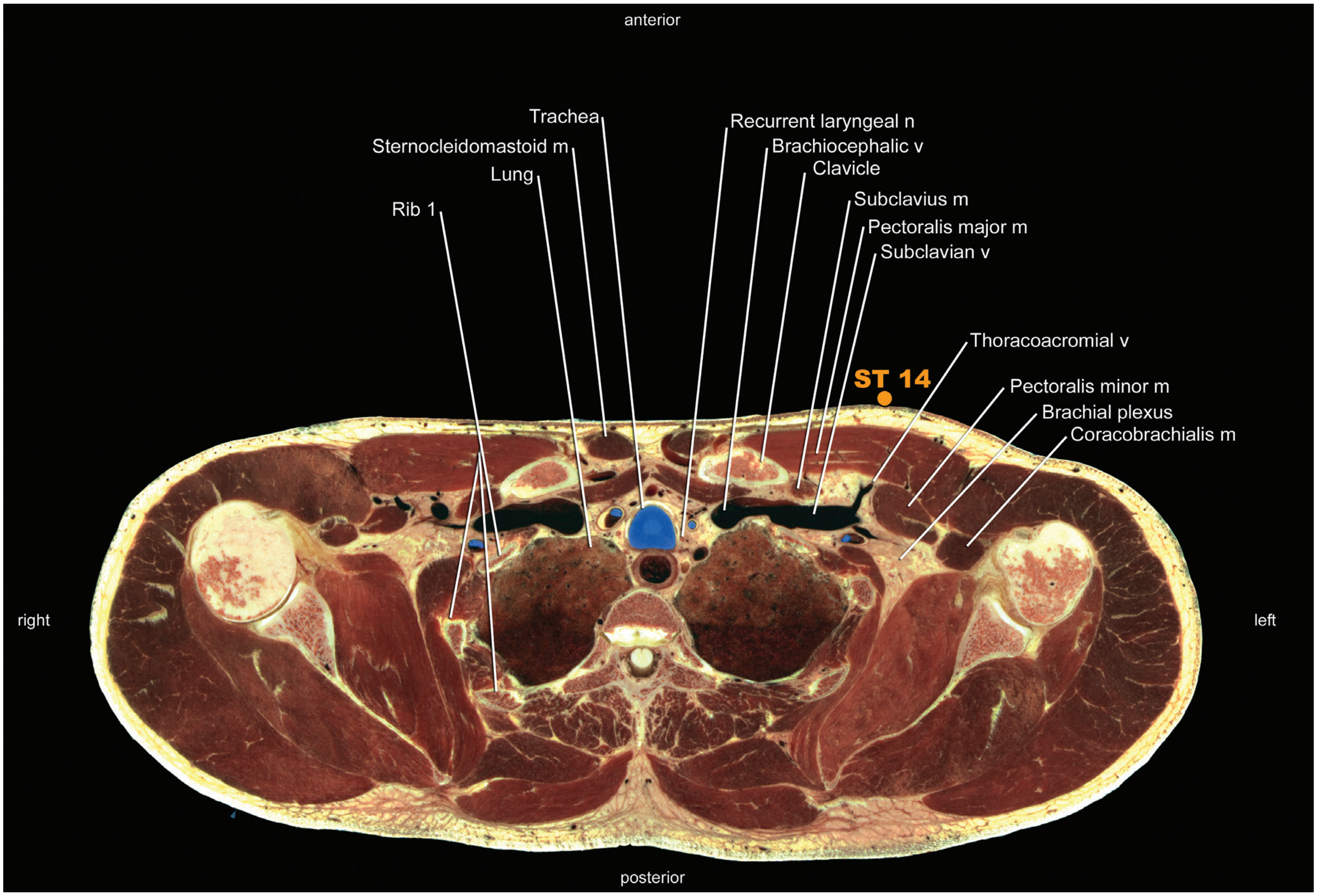

anterior
Trachea
Sternocleidomastoid m
Lung
Rib 1
Recurrent laryngeal n
Brachiocephalic v
Clavicle
Subclavius m
Pectoralis major m
Subclavian v
Thoracoacromial v
ST 14
Pectoralis minor m
Brachial plexus
Coracobrachialis m
right
left
posterior

Figure 3-40. The centrality of the ST 14 atop the pectoralis major becomes apparent here. Note the location of the subclavius muscle deep to the pectoralis, as well as the adjacent pool of venous blood in the subclavian and the nearby brachial plexus.

- **Local pain:** ST 14 and other pectoralis major trigger points.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.
2. Charlton CG, Crowell B, and Benson R. Identification of motor neurons for accessory muscles of inspiration and expiration, pectoralis, trapezius and external oblique: Comparison with non-respiratory skeletal muscle. *Synapse*. 1988;2:219-224.
3. Douchamps F, Courois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome. *Joint Bone Spine*. 2012;79:88-89.

ST 15

Wu Yi "Room Screen" or "Roof"

On the pectoral region, in the second intercostal space, on the midclavicular line. To find the second intercostal space, locate the sternal angle. This will indicate the level of the second rib.

The second intercostal space lies below the second rib. One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (sternocostal head):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The clavicular head flexes the humerus, whereas the sternocostal head extends the humerus once it is flexed.
- **Pectoralis minor muscle:** By drawing the scapula anteriorly and inferiorly against the thoracic wall, the pectoralis minor muscle helps stabilize the scapula.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: The muscles in this region shorten when an individual recruits the accessory muscles of inspiration, or AMI (e.g., the pectoralis and trapezius muscles). This occurs when the demand for oxygen exceeds the pumping ability of the thoracic diaphragm. Patients with chronic obstructive pulmonary disease (COPD) and asthma often utilize their AMI. Intense exercise also activates the AMI; their muscle contraction coincides with that of the diaphragm during inspiration.

Trigger points in the pectoralis major muscle, sternocostal head, refer to the breast region, the medial brachium, medial elbow, and ulnar aspect of the hand, palmar surface, echoing the Heart (HT) and Pericardium (PC) channels. Pectoralis minor trigger points refer diffusely over the entire pectoral region, the deltoid muscle, and the medial brachium, ulnar surface of the antebrachium, and ulnar aspect of the palm and fingers, reminiscent as well of the PC and HT channels, like the pectoralis major muscle.

Nerves

- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head. The medial pectoral nerve (C8, T1) innervates the pectoralis minor muscle.
- **T2 intercostal nerve:** Supplies the local skin and musculature.

Clinical Relevance: Deactivating trigger points in the shoulder and upper thoracic region in the vicinity of ST 15 and nearby locations may help "disinhibit" the chest and reduce thoracic tension, from both emotional and physical etiologies.

Vessels

- **Thoracoacromial artery:** Supplies the breast and clavipectoral region.
- **Second anterior intercostal artery (from internal thoracic artery):** Distributes to intercostal muscles, the overlying skin, and the parietal pleura.

Clinical Relevance: Local vessels supply and drain the breast and nearby region. Normal circulation supports healthy tissue.

Indications and Potential Point Combinations

- **Lung or bronchial problems: Bronchitis, dyspnea, allergic manifestations, fullness and pain in the chest, cough:** ST 15, CV 17, BL 13, LU 7.
- **Somatic pain in the cranial thorax:** ST 15, other local trigger points in the pectoral and upper back region, CV 17.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.

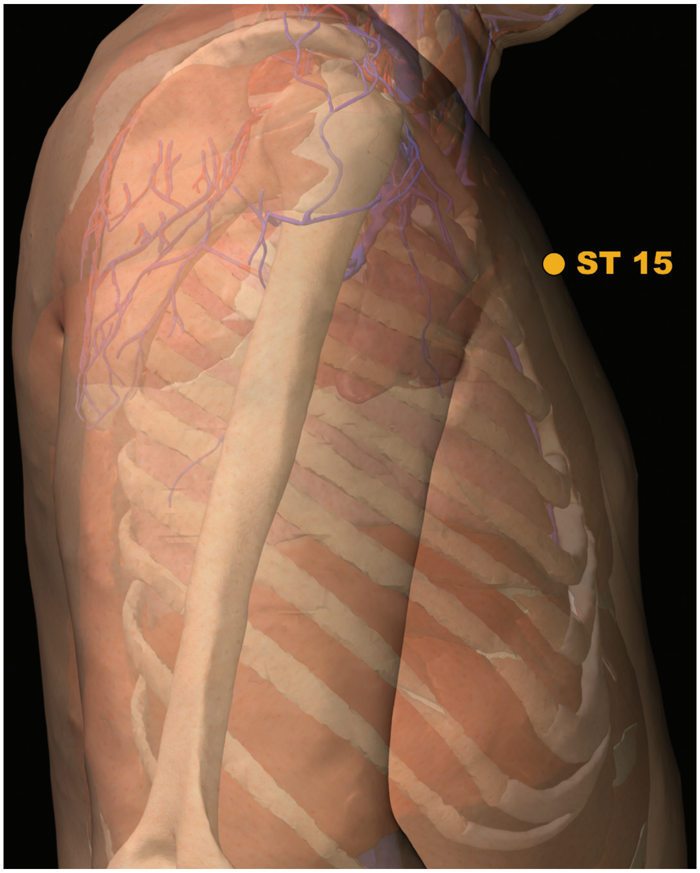


Figure 3-41. Deactivating trigger points in the shoulder and upper thoracic musculature in the vicinity of ST 15 and nearby locations may help "disinhibit" the chest and reduce thoracic tension from both emotional and physical etiologies.

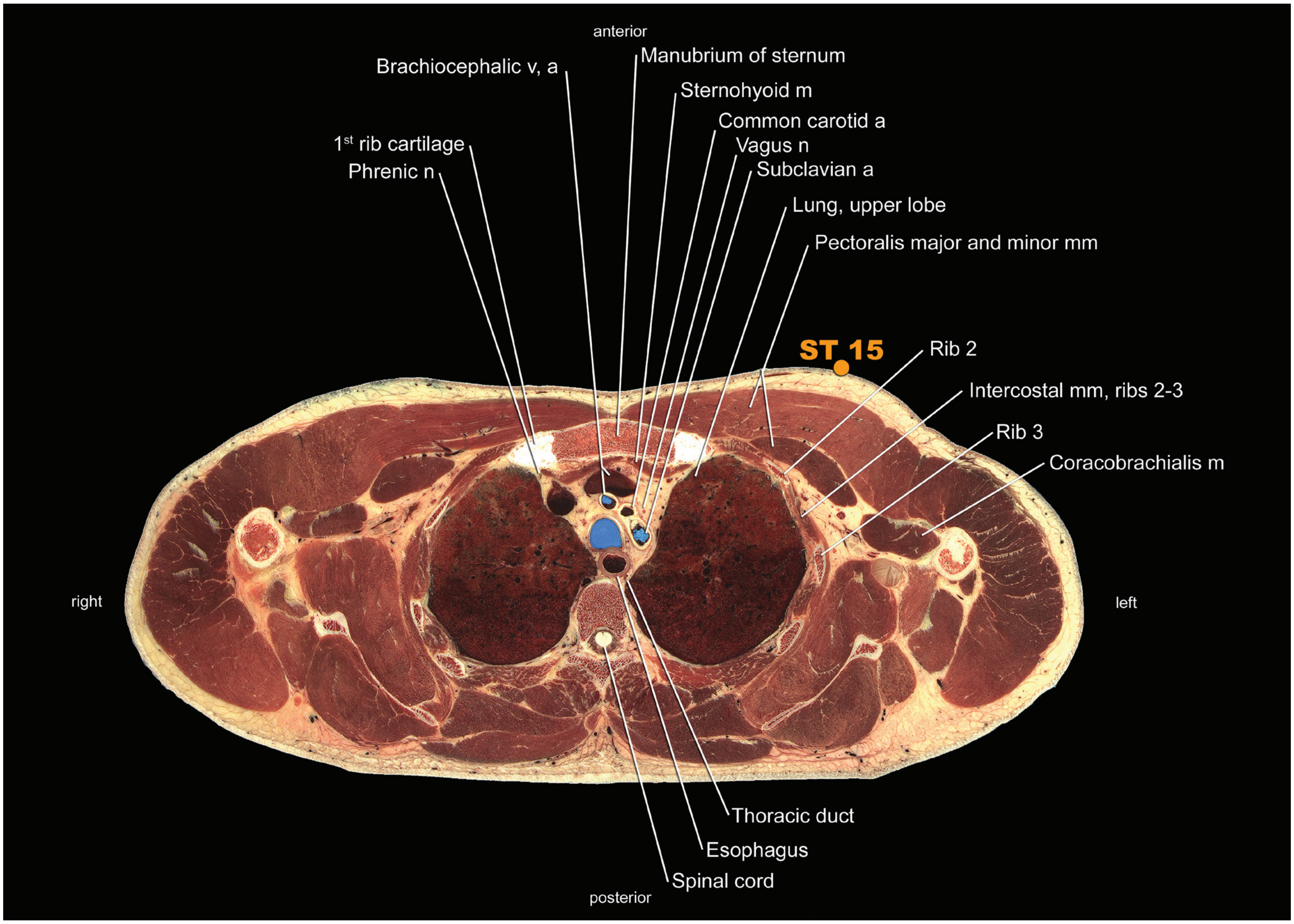

anterior
Brachiocephalic v, a
Manubrium of sternum
Sternohyoid m
Common carotid a
1st rib cartilage
Vagus n
Phrenic n
Subclavian a
Lung, upper lobe
Pectoralis major and minor mm
ST 15
Rib 2
Intercostal mm, ribs 2-3
Rib 3
Coracobrachialis m
right
left
Thoracic duct
Esophagus
Spinal cord
posterior

Figure 3-42. This cross section shows how ST 15 rests on the chest like a roof over the lungs, true to its name, “Room Screen”. That is, the pectoralis major and minor together form a substantial roof over the lungs in this well-muscled individual.

ST 16

Ying Chuang "Breast (or Chest) Window"

In the third intercostal space, midclavicular line. To find the third intercostal space, locate the sternal angle. This will link to the second rib. The second intercostal space lies below the second rib; the third intercostal space is one space below.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (sternocostal head):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The sternocostal head extends the humerus once it is flexed.
- **Pectoralis minor muscle:** By drawing the scapula anteriorly and inferiorly against the thoracic wall, the pectoralis minor muscle helps stabilize the scapula.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: Myofascial dysfunction in the pectoral muscles refer to the breast, deltoid, and medial arm, ulnar aspect of the antebrachium, and ulnar aspect of the palm as well as the middle, ring, and pinkie fingers.

Nerves

- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head.
- **T3 intercostal nerve:** Supplies the local skin and musculature.

Clinical Relevance: Trigger point dysfunction in the cranial thoracic musculature may make the nerves in supplying the local tissues to become neuropathic, causing pain and further tension.

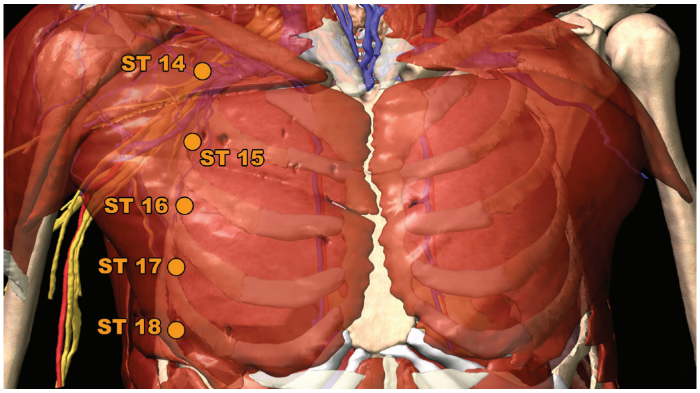


Figure 3-43. The transparent musculature in this image demonstrates the relationship of ST 16 to the third intercostal space and overlying pectoralis major muscle. The name "Chest Window" or "Breast Window", ST 16 connotes an entryway into either the breast or the lung itself. In the past, needling this site with an acupuncture needle may have promoted fuller respiration or lactation, thereby earning this point a reputation for benefiting breathing and milk let-down. Direct needling of the breast is less common with modern approaches.

Vessels

- **Thoracoacromial artery:** Supplies the breast and clavipectoral region.
- **Third anterior intercostal artery:** From the internal thoracic artery; supplies the intercostal muscles, overlying skin, and parietal pleura.

Indications and Potential Point Combinations

- **Intercostal pain, pectoralis trigger point: ST 16, other local tender points. Consider BL outer line points at same intercostal level.**

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.

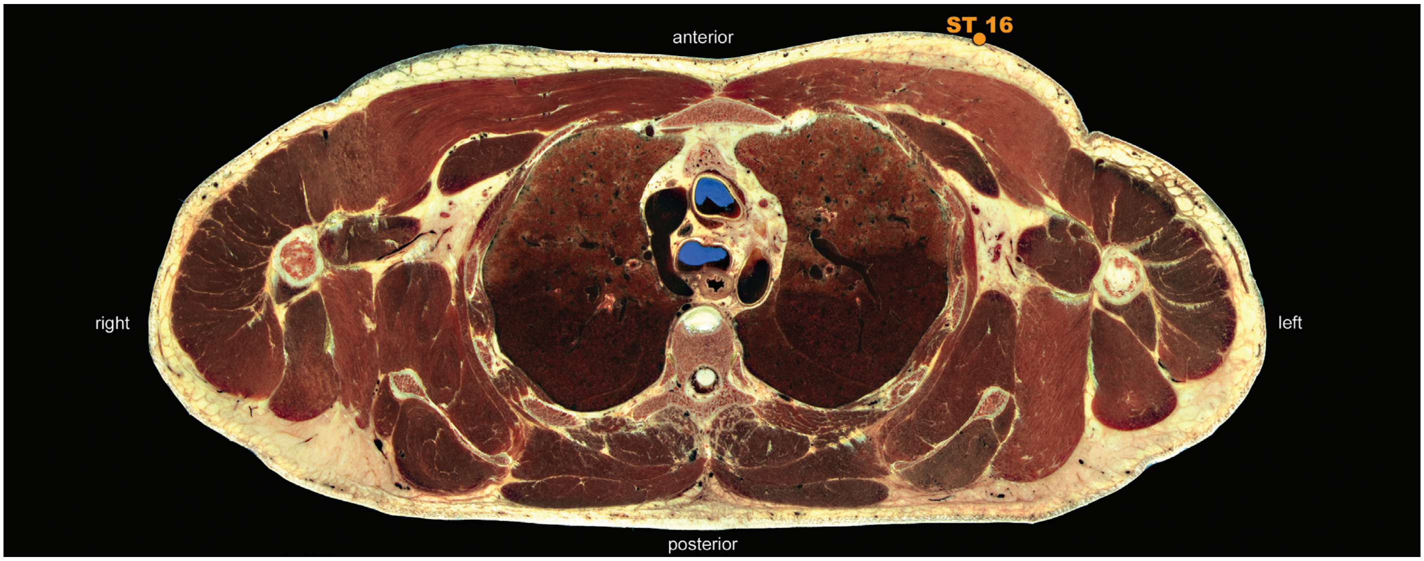


Figure 3-44. ST 16 sits upon the breast, which is not frequently needled. If attempting to deactivate a pectoralis trigger point, one should remain cognizant of the thickness of breast tissue that the needle must traverse. It would be wise to determine whether another method of resolving pectoralis tension (e.g., indirect needling or massage) might offer a better and safer approach.

ST 17

Ru Zhong "Breast Center"

On the pectoral region, in the fourth intercostal space, on the midclavicular line. In most males this location coincides with the nipple.

Acupuncture and moxibustion contraindicated.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (sternocostal head):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The clavicular head flexes the humerus, whereas the sternocostal head extends the humerus once it is flexed.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: Trigger points in the myofascial tissue deep to the breast are best approached with non-needle methods, given that needling through the nipple is not advised.

Nerves

- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head.
- **T4 intercostal nerve:** Supplies the local skin and musculature.

Clinical Relevance:

Vessels

- **Fourth anterior intercostal artery (from internal thoracic artery):** Distributes blood to the intercostal muscles, the overlying skin, and the parietal pleura.

Indications and Potential Point Combinations

- **This point serves as a landmark on the chest to determine the location of other points; it is not meant for needling.**

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.

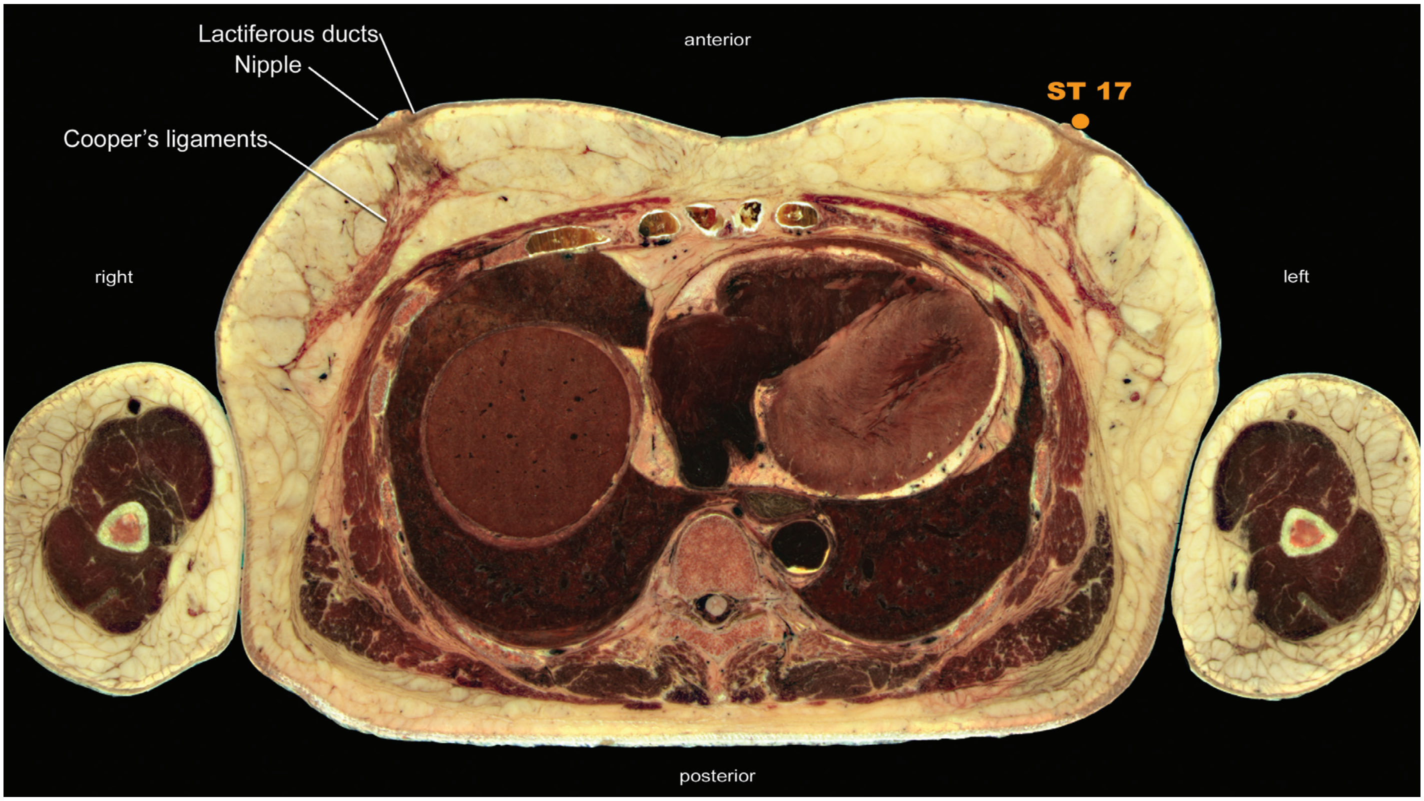


Figure 3-45. In this cross section from the Visible Woman, ST 17 centers on the nipple, explaining its name, "Breast Center". ST 17 serves as a landmark only, forbidden to needle.

ST 18

Ru Gen "Breast Root"

In the fifth intercostal space on the midclavicular line.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle (sternocostal head):** The pectoralis powerfully adducts the arm and medially rotates the humerus. The clavicular head flexes the humerus, whereas the sternocostal head extends the humerus once it is flexed.
- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: ST 18 lives at a busy intersection of muscular attachments where the pectoralis muscle terminates and the rectus abdominis begins. As such, patients may experience various pulls and twists below the breast and mistake pain in this vicinity as cardiogenic. Although pain in this area may indeed originate in the heart, stomach, other organs or myofascia, the latter should be included in the differential diagnosis.

Nerves

- **T5 intercostal nerve:** Supplies the local skin and musculature.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.
- **Lateral and medial pectoral nerves:** Supply the pectoralis major; the C5 and C6 portions innervate the clavicular head, whereas C7, C8, and T1 supply the sternocostal head.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery and vein:** Arises from the internal thoracic artery and vein to supply and drain the upper portion of the rectus abdominis muscle. Anastomose with the inferior epigastric artery and vein.
- **Fifth anterior intercostal artery and vein (from internal thoracic artery and vein):** Distributes to intercostal muscles, the overlying skin, and the parietal pleura.

Clinical Relevance: Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic, these superficial vessels on the abdominal wall provide collateral pathways for circulation.

Indications and Potential Point Combinations

- **Mastitis, problems with lactation:** ST 18, CV 17, SI 1.
- **Thoracic pain:** Locate source, ST 18 if tender or along dysfunctional intercostal segment. BL 15, BL 44, BL 14, BL 43, BL 16, BL 45.
- **Respiratory conditions:** cough, asthma: If rib cage restrictions prohibit full diaphragmatic excursion, palpate for trigger points and muscle tension; ST 18 if tender, along with associated regional trigger points, LI 4, ST 36, LU 7, GV 14, BL 13, ST 13.

Evidence-Based Indications

- A randomized, controlled clinical trial evaluated the effects of catgut embedded into acupuncture points for **"mammary gland hyperplasia"** in humans, as compared to an herbal patent medicine. Points employed were ST 18, ST 15, CV 17, SP 10, ST 36, and GB 34. The researchers reported value in acupuncture reducing hyperplastic lump size.[3]

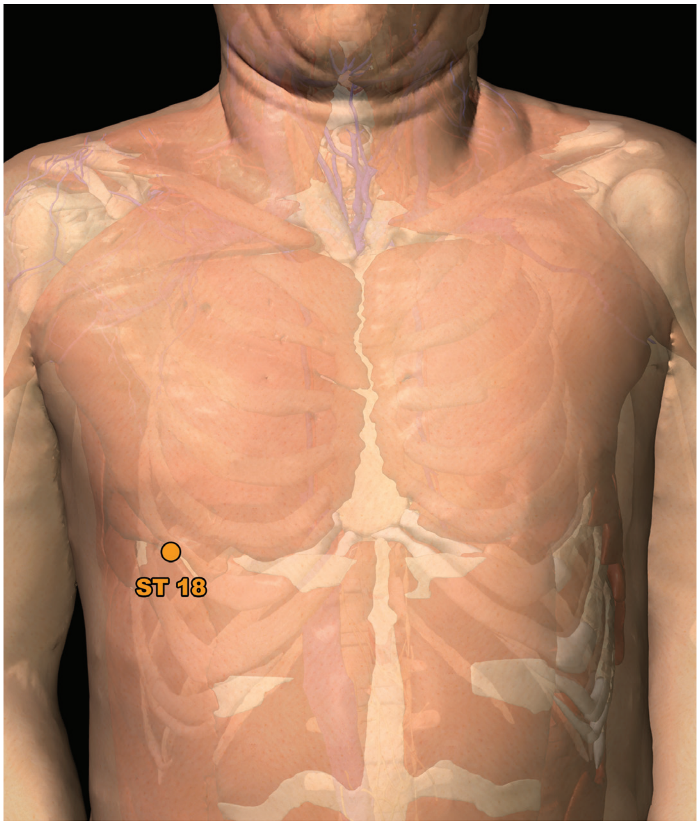


Figure 3-46. As the name "Breast Root" denotes, ST 18 resides below the breast, at its caudal "root".

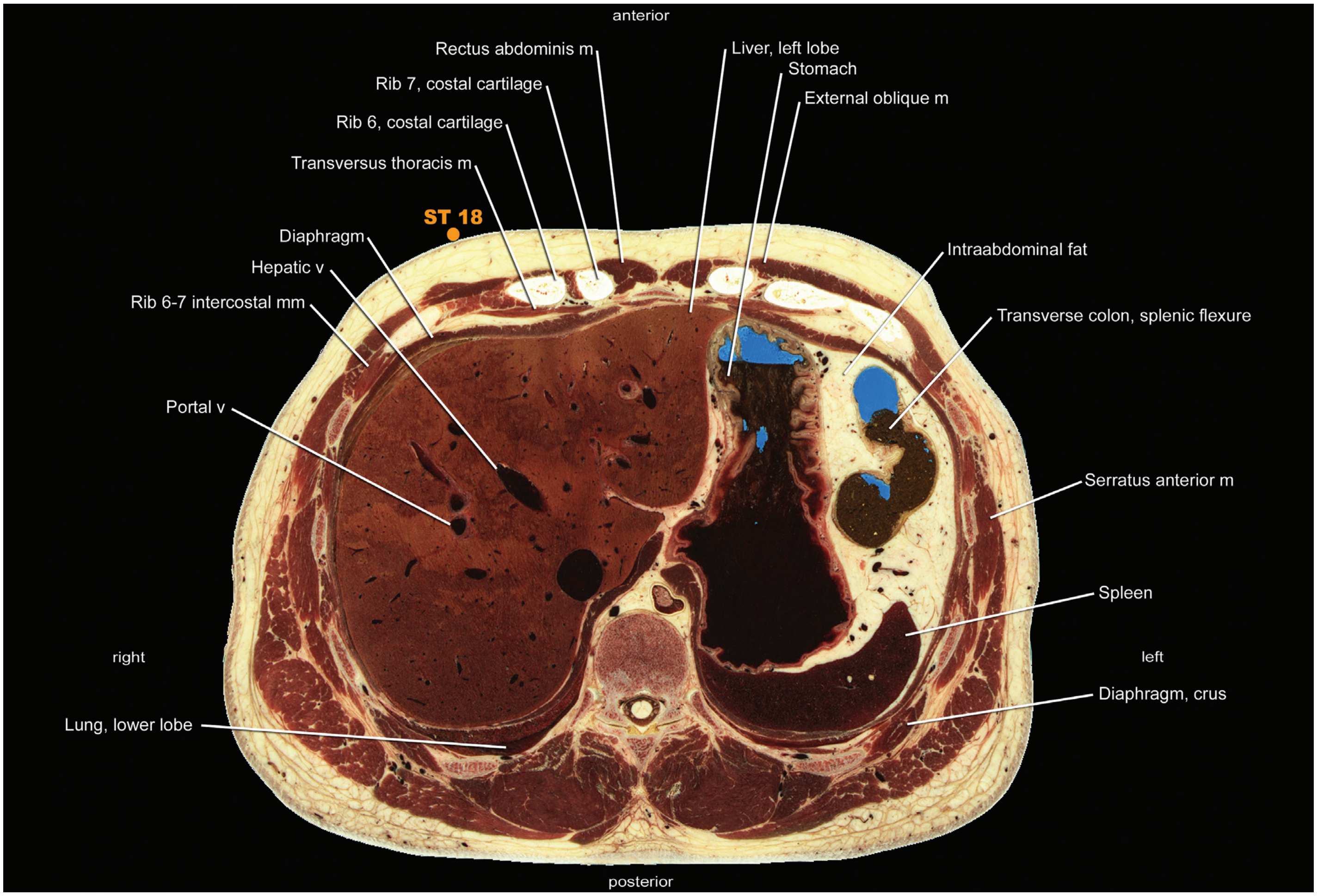

anterior
Rectus abdominis m
Liver, left lobe
Stomach
Rib 7, costal cartilage
External oblique m
Rib 6, costal cartilage
Transversus thoracis m
ST 18
Diaphragm
Intraabdominal fat
Hepatic v
Rib 6-7 intercostal mm
Transverse colon, splenic flexure
Portal v
Serratus anterior m
Spleen
right
left
Diaphragm, crus
Lung, lower lobe
posterior

Figure 3-47. ST 18 stimulation impacts several muscles involved in respiration; with overwork or cough, they may become tense and compress nerves coursing between and through the various layers. Muscles associated with respiration include the rectus abdominis, the external oblique, the diaphragm, and the serratus anterior muscles. Note the various slips of muscles underlying ST 18. The point's proximity to the breast supports its indications for mastitis and lactation disorders. Note, as well, that a deeply penetrating acupuncture needle at ST 18 on the right side of the body could enter the liver. ST 18 on the left lives close to the actual stomach organ, the channel's namesake.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.

2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

3. Zhou L, Lu X, Feng ZG, et al. Effect of acupoint-catgut-embedment on mammary gland hyperplasia. *Zhen Ci Yan Jiu.* 2011;36(1):52-56.

ST 19

Bu Rong "Not Contained"

Immediately inferior to the costal arch, 6 cun above the umbilicus. Approximately 2 cun lateral to the anterior midline. In the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 14 and KI 21.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing, straining to defecate, and sitting upright from a supine position.[1] The rectus abdominis can expand and contract up to nine of an individuals finger-breadths.
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels or cause somato-visceral discomfort such as a sense of abdominal fullness, nausea, and vomiting. Rectus abdominis myofascial dysfunction can be caused by internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can also produce visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery and vein:** Arises from the internal thoracic artery and vein to supply and drain the upper portion of the rectus abdominis muscle. Anastomose with the inferior epigastric artery and vein.

Clinical Relevance: Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic, these superficial vessels on the abdominal wall provide collateral pathways for circulation.

Indications and Potential Point Combinations

- **Problems with the diaphragm, esophagus, or upper digestive function: Nausea, vomiting, abdominal pain and distension, reflux esophagitis, hiatal hernia, poor appetite: ST 19, CV 12, CV 17, PC 6, ST 36.**

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.
2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

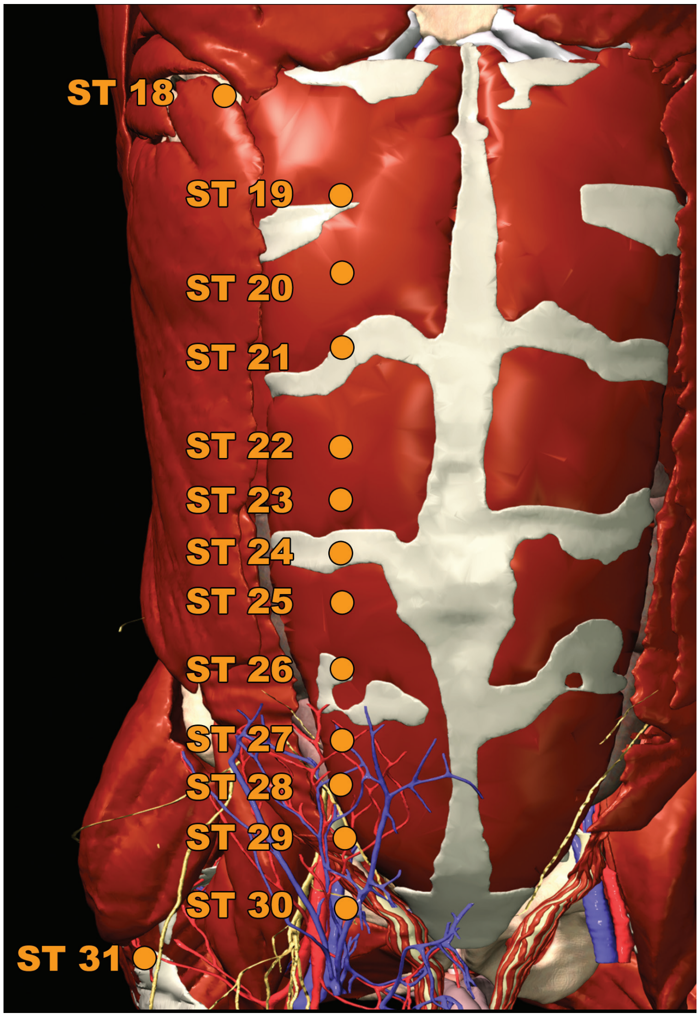


Figure 3-48. Note how the ST line moves toward the midline from ST 18 to ST 19.

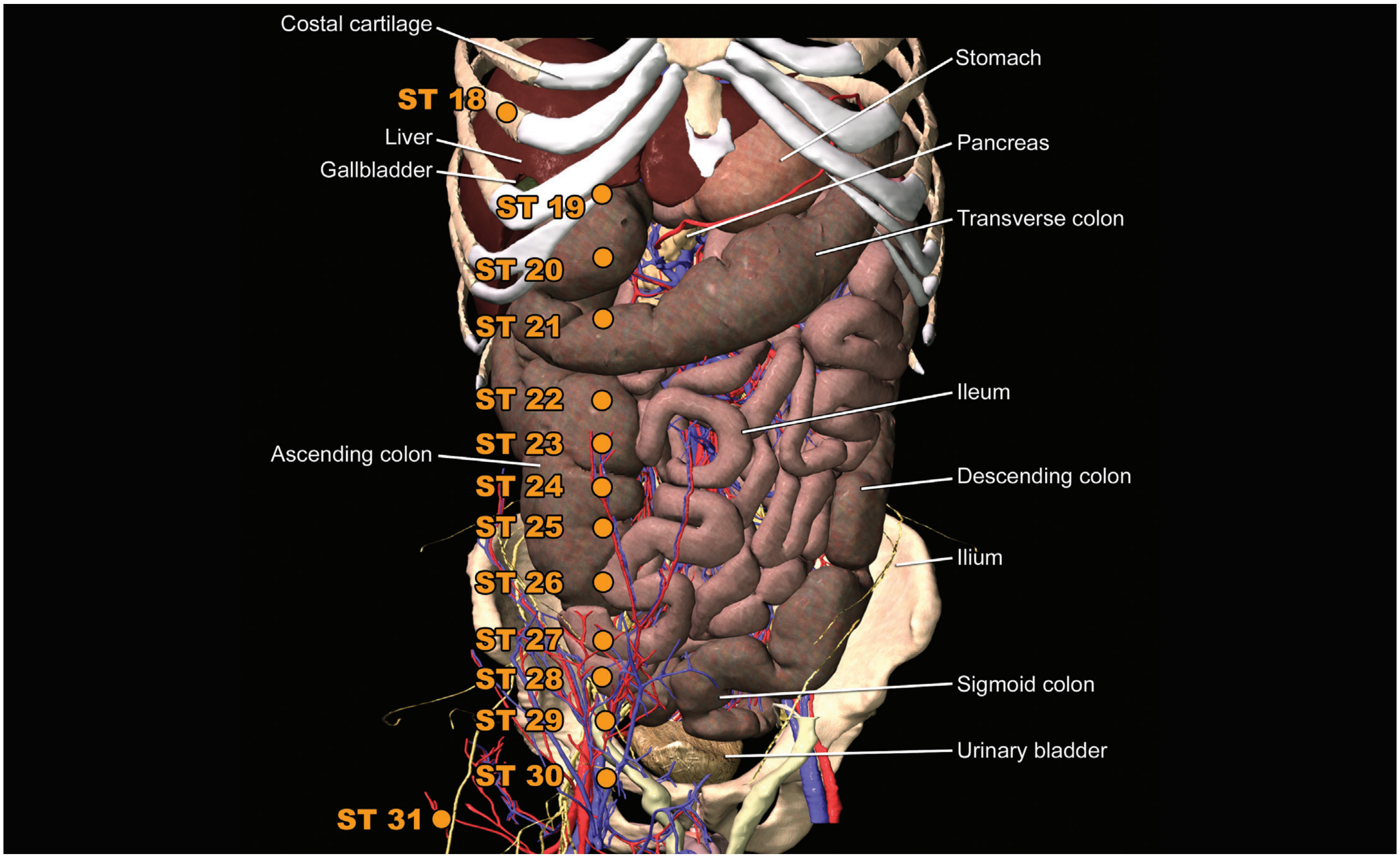

Costal cartilage
ST 18
Liver
Gallbladder
ST 19
ST 20
ST 21
ST 22
Ascending colon
ST 23
ST 24
ST 25
ST 26
ST 27
ST 28
ST 29
ST 30
ST 31
Stomach
Pancreas
Transverse colon
Ileum
Descending colon
Ilium
Sigmoid colon
Urinary bladder

Figure 3-49. ST 19 on the right side of the body overlies the colon and abuts the liver. On the left, ST 19 would sit atop the stomach (left ST 19 not shown here).

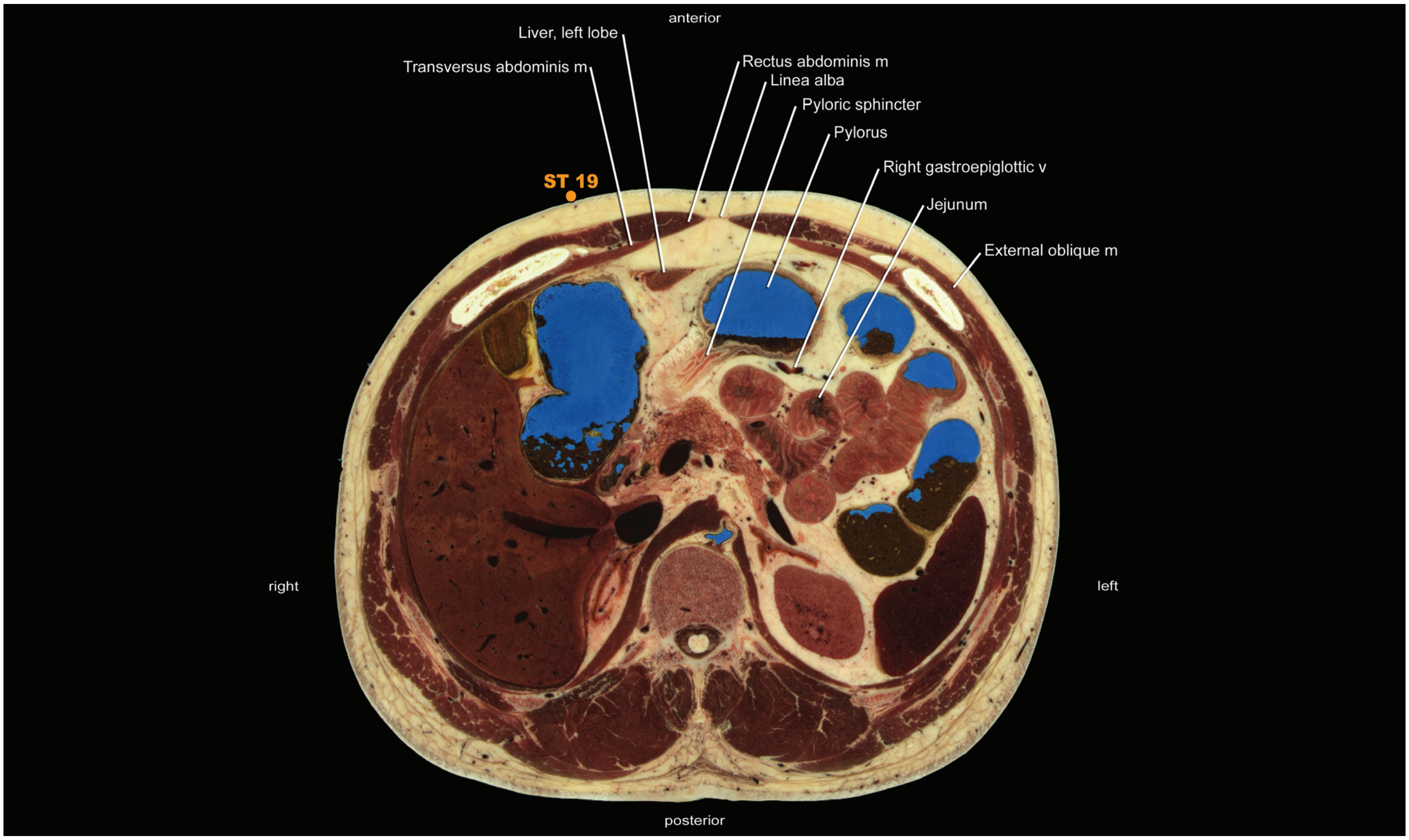

anterior
Liver, left lobe
Transversus abdominis m
Rectus abdominis m
Linea alba
Pyloric sphincter
Pylorus
Right gastroepiglottic v
Jejunum
External oblique m
ST 19
right
left
posterior

Figure 3-50. Note the numerous organs level with ST 19: the gallbladder, colon, liver, pylorus and pyloric sphincter, and jejunum. Unlabeled organs include the pancreas, kidney, adrenal gland, and spleen. Structures that share overlapping spinal cord segments possess neuroanatomic relationships capable of causing somatovisceral and viscerosomatic reflexes between acupuncture points on the trunk and internal organs.

ST 20

Cheng Man "Supporting (or Assuming) Fullness"

On the abdomen, 5 cun above the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 13 and KI 20.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery and vein:** Arises from the internal thoracic artery and vein to supply and drain the upper portion of the rectus abdominis muscle. Anastomose with the inferior epigastric artery and vein.
- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or

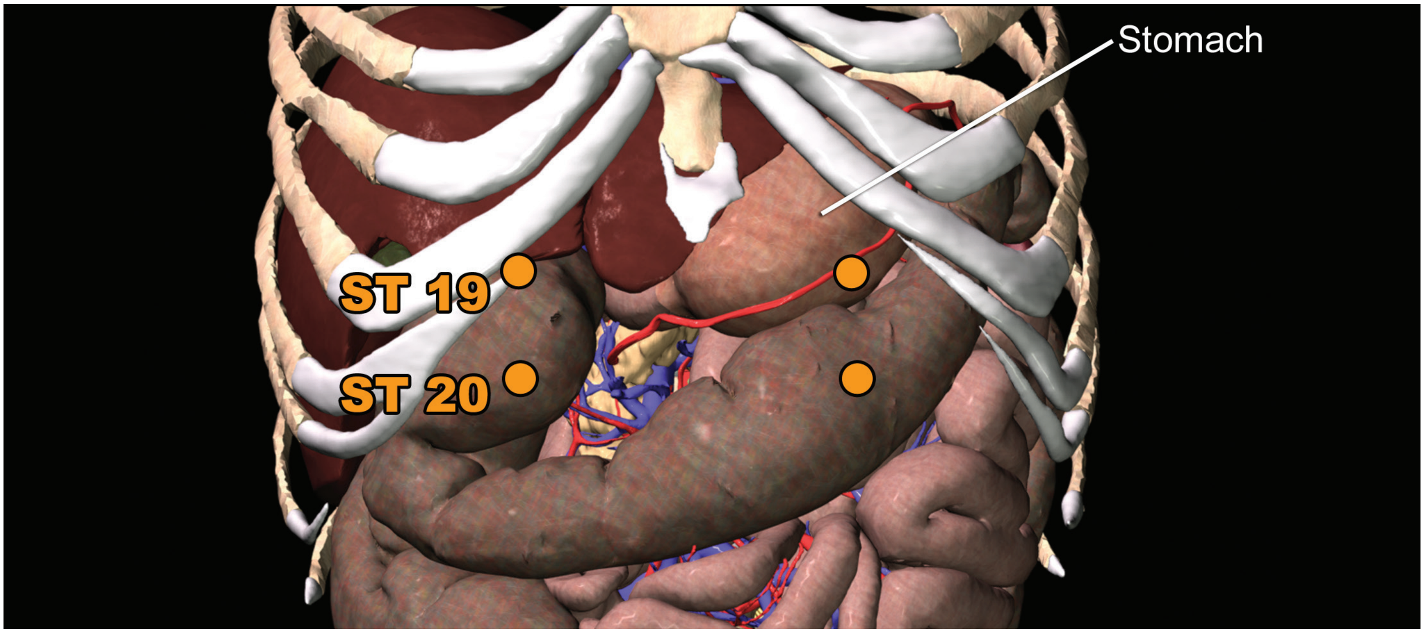


Figure 3-51. The "Supporting Fullness" point, ST 20, suggests the feeling of fullness (and perhaps tenderness) that one would experience at this point after eating a big meal. Both right- and left-sided ST 19 and ST 20 appear in this image.

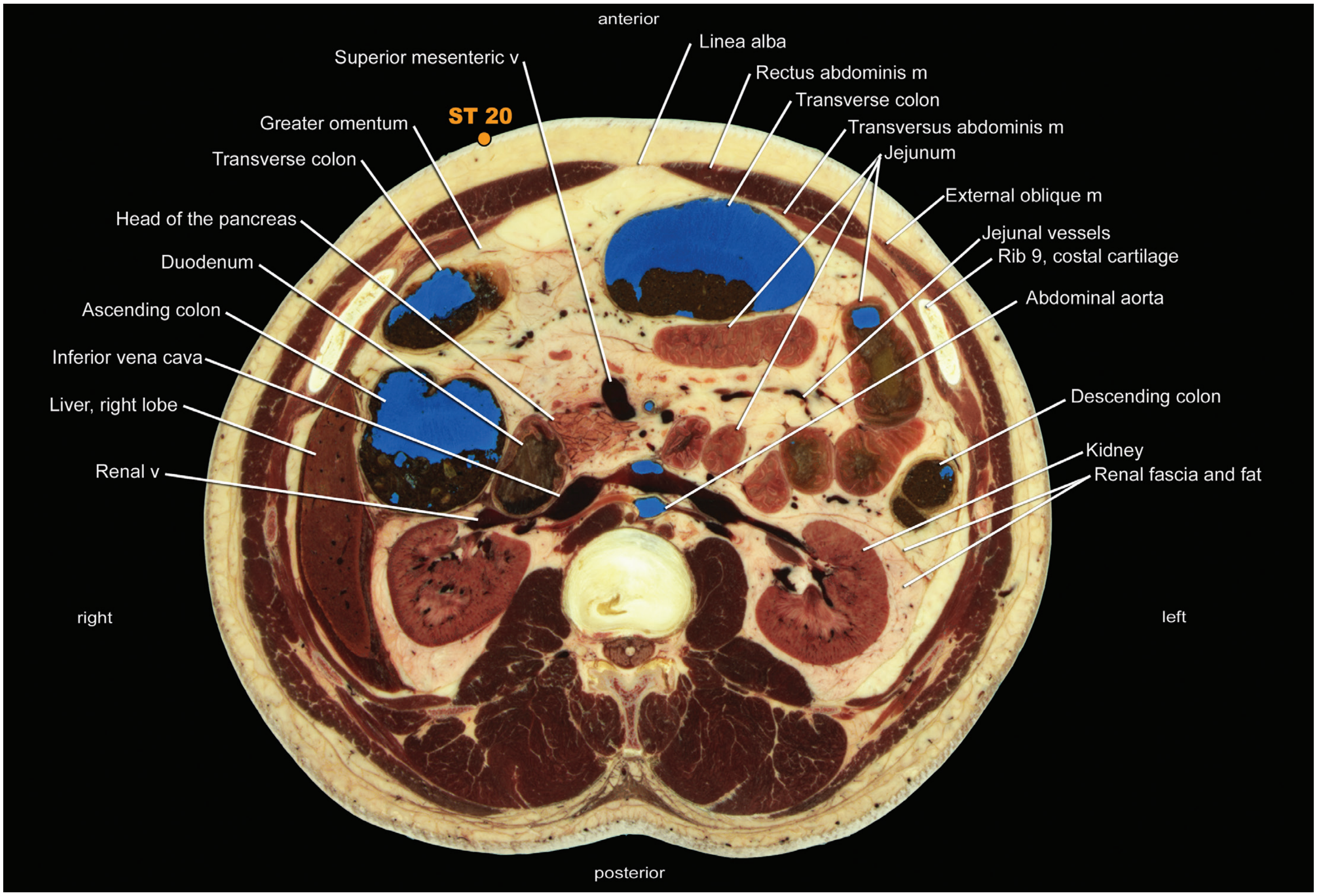

anterior
Superior mesenteric v
Linea alba
Rectus abdominis m
Transverse colon
Greater omentum
ST 20
Transversus abdominis m
Jejunum
Transverse colon
External oblique m
Head of the pancreas
Jejunal vessels
Rib 9, costal cartilage
Duodenum
Abdominal aorta
Ascending colon
Inferior vena cava
Liver, right lobe
Descending colon
Kidney
Renal fascia and fat
Renal v
right
left
posterior

Figure 3-52. The anatomy and indications for ST 20 resemble those of ST 19, based on their similar cranial abdominal locations. This cross section emphasizes the need for caution in needling, as deeply inserting needles over the abdomen may enter internal organs. For example, note the rather superficial location of the transverse colon in the left medial hemi-abdomen.

anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Problems with the diaphragm, esophagus, or upper digestive function:** Nausea, vomiting, abdominal pain and distension, reflux esophagitis, hiatal hernia, poor appetite: ST 19, CV 12, CV 17, PC 6, ST 36.
- **Cranial abdominal wall discomfort:** ST 20, KI 20, CV 13, BL 20, BL 49 and local trigger points; modify according to level(s) of involvement.

Evidence-Based Applications

- Acupuncture at LU 7, ST 40, GB 20, and GV 20, as well as plum-blossom hammer tapping at GV 14, alleviated vertigo and related symptoms in a majority of patients in a case series of patients with **vertebrobasilar ischemic vertigo.**[5]

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.
2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.
5. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *J Trad Chin Med.* 2009;29(2):87-89.

ST 21

Liang Men "Beam Gate"

On the abdomen, 4 cun above the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 12 and KI 19.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle**: Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves. See Figure 3-55 to examine the abdominal wall in cross section at the locus of ST 21.

Vessels

- **Superior epigastric artery and vein:** Arises from the internal thoracic artery and vein to supply and drain the upper portion of the rectus abdominis muscle. Anastomose with the inferior epigastric artery and vein.
- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

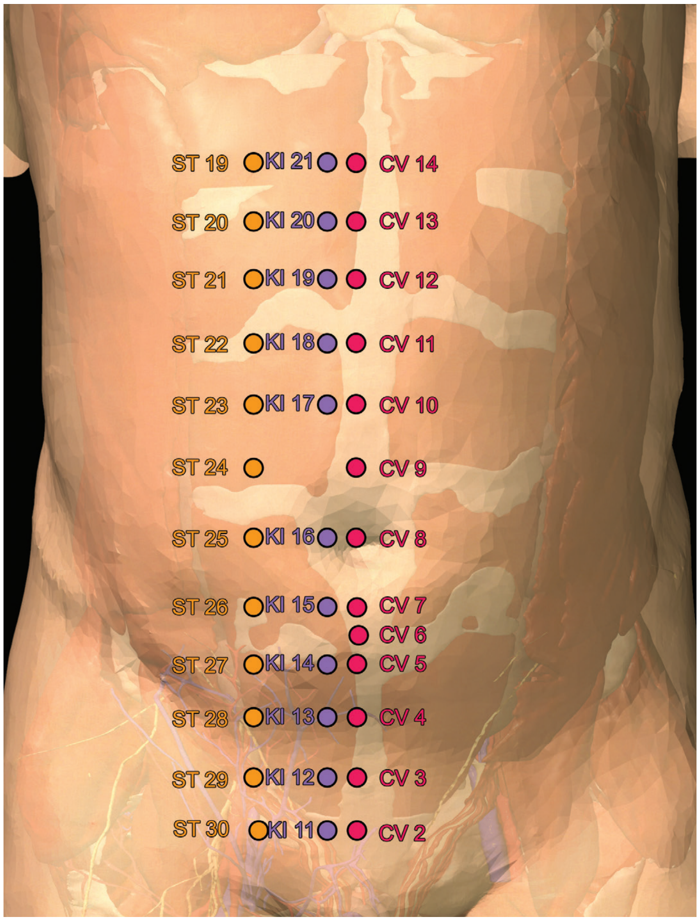


Figure 3-53. The ST, KI, and CV lines form a grid-like array on the abdomen. Note that each row of points corresponds to the same spinal nerve branch or dermatome.

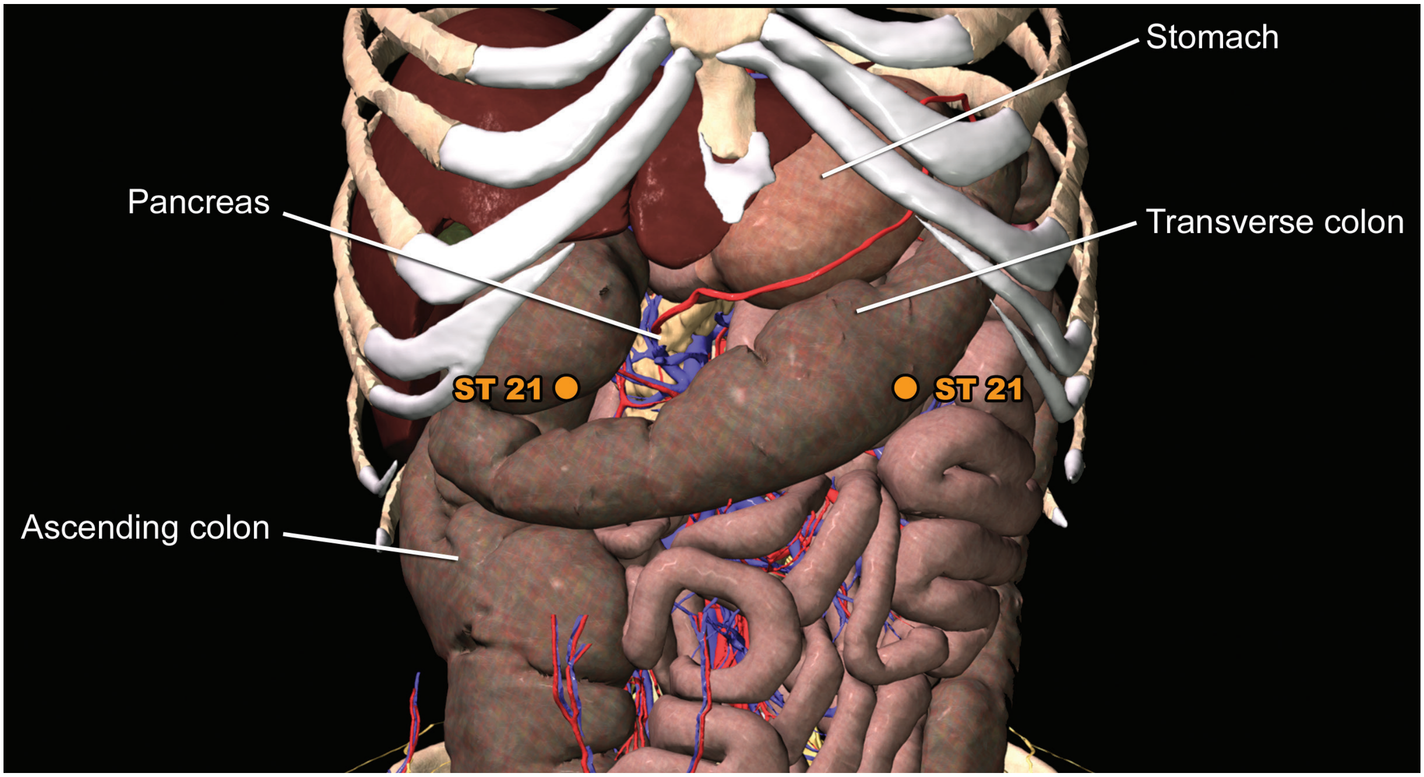


Figure 3-54. Most of the images in this text illustrate the points only on one side of the body, although all of the channels except for Governor Vessel (GV) and Conception Vessel (CV) are bilateral. The left sided points were usually omitted in order to allow unobstructed visualization of the anatomy. However, this image shows ST 21 bilaterally to illustrate the different organs the right and left points overlie. Chinese medicine refers to ST 21 as the "Gateway between the Upper and Lower Heaters". This organ layer reveals how ST 21 demarcates the transition between the upper and lower abdominal organs. Furthermore, the descriptive term "Beam Gate" harkens back to a condition called "deep-lying beam" in the *Classic of Difficulties* (Nan Jing) [See Ellis et al, *Grasping the Wind*, pp. 74-75]. One can imagine how a full and impacted, or possibly tumorous transverse colon may have given the impression that a "deep-lying beam" was occupying the cranial abdomen from ST 21 to ST 21, as shown in this image. Ellis et al describe this malady "as a condition in which a palpable mass the size of an arm located in the upper abdomen causes irritability and insomnia".

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Gastrointestinal problems:** lack of appetite, indigestion, diarrhea, gastric ulcer, gastritis, vomiting: ST 21, CV 12, and ST 36. Add PC 6 for nausea/vomiting or gastritis; SP 6 for diarrhea.
- **Cranial abdominal wall discomfort:** ST 21, KI 19, CV 12, BL 21, BL 50 and local trigger points; modify according to level(s) of involvement.

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.
2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.
5. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

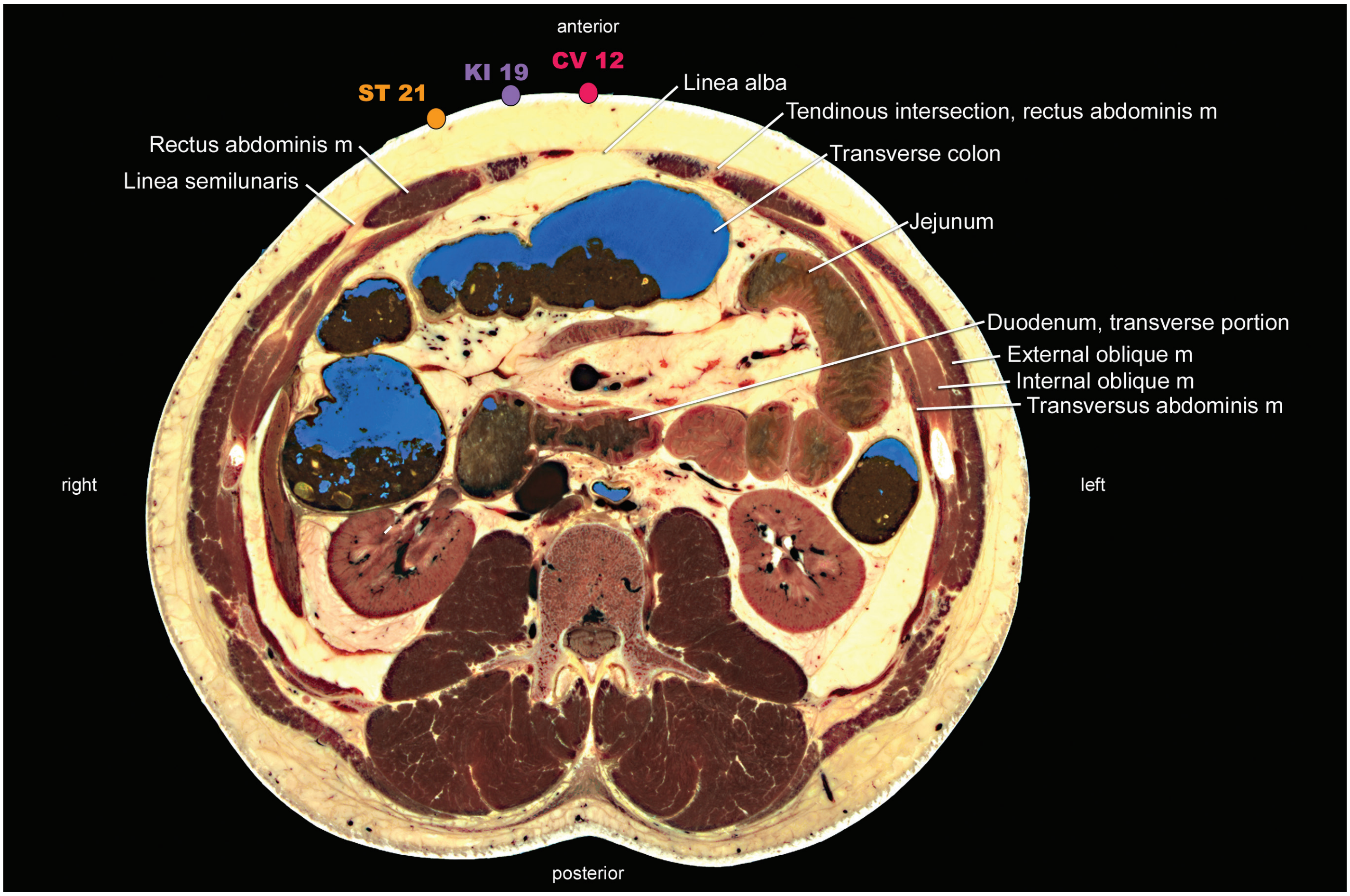

anterior
CV 12
KI 19
ST 21
Linea alba
Tendinous intersection, rectus abdominis m
Rectus abdominis m
Transverse colon
Linea semilunaris
Jejunum
Duodenum, transverse portion
External oblique m
Internal oblique m
Transversus abdominis m
right
left
posterior

Figure 3-55. Note how a needle entering ST 21, KI 19, and CV 12 would impact different portions of the rectus abdominis and surrounding connective tissue. This becomes clinically important if the patient is experiencing abdominal wall discomfort from nerves undergoing compression or irritation from myofascial restriction. According to Applegate, "The thoracoabdominal nerves, which terminate as the cutaneous nerves, are anchored at six points: 1) the spinal cord; 2) the point at which the posterior branch originates; 3) the point at which the lateral branch originates; 4) the point at which the anterior branch makes a nearly 90° turn to enter the rectus channel; 5) the point from which accessory branches are given off in the rectus channel; and 6) skin." The right angled turn made by the ventral branch takes place at the KI channel; the ventral rami branch at the KI points, sending one branch to the midline at the CV point and one toward the ST point. Thus, although the three points share a dermatome, each point has a particular relationship with unique anatomical sites along the ramus that may or may not be experiencing pressure from myofascial dysfunction on the abdominal wall.

ST 22

Guan Men "Pass Gate" or "Closed Gate"

On the abdomen, 3 cun above the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 11 and KI 18.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery and vein:** Arises from the internal thoracic artery and vein to supply and drain the upper portion of the rectus abdominis muscle. Anastomose with the inferior epigastric artery and vein.
- **Inferior epigastric artery and vein:** Terminal medial branch of

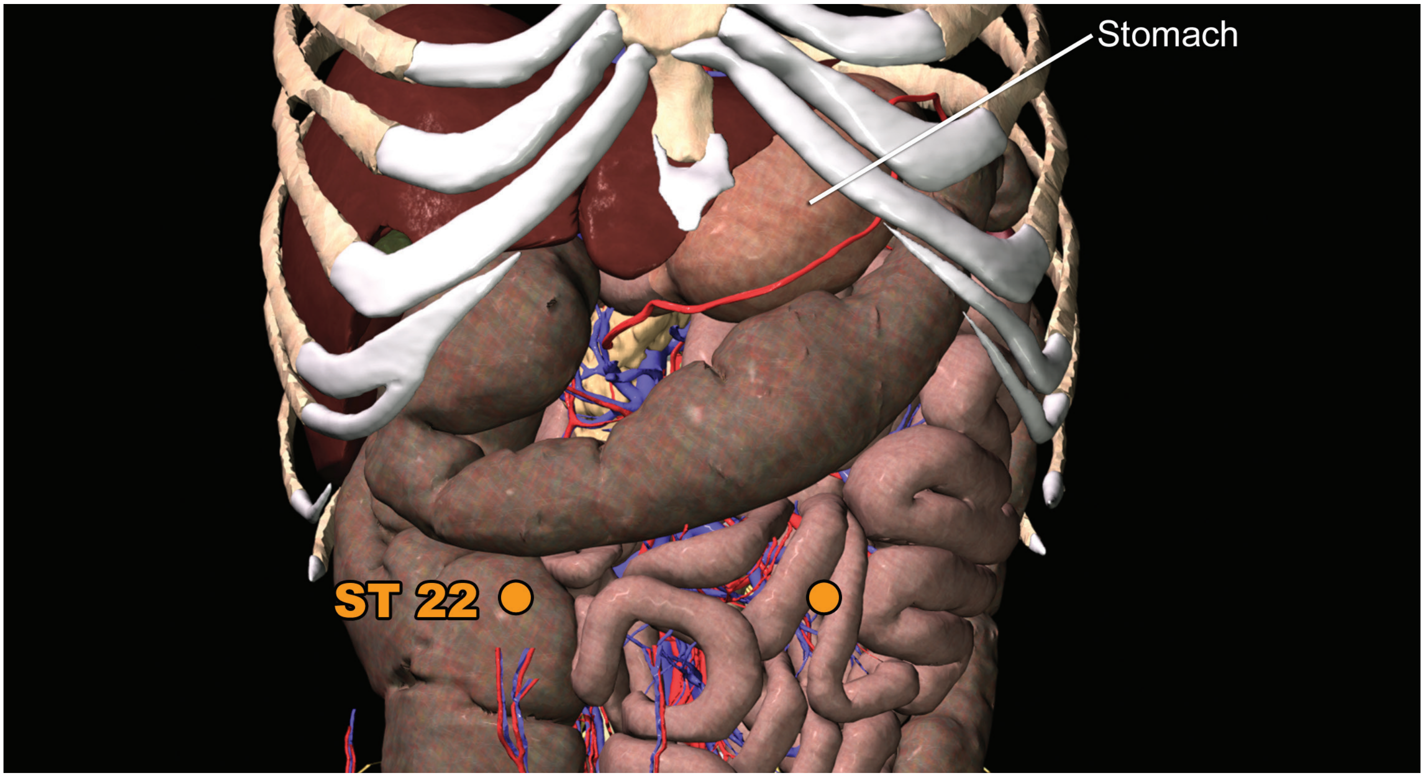


Figure 3-56. The name "Pass Gate" for ST 22 may apply to the junctures between the transverse colon and the ascending and descending colon on the right and left sides, respectively. Here, the right ST 22 resides near the right, or hepatic flexure where the colon makes a sharp turn. In cases of constipation or impaired motility, the alternative name of "Closed Gate" may seem more reasonable.

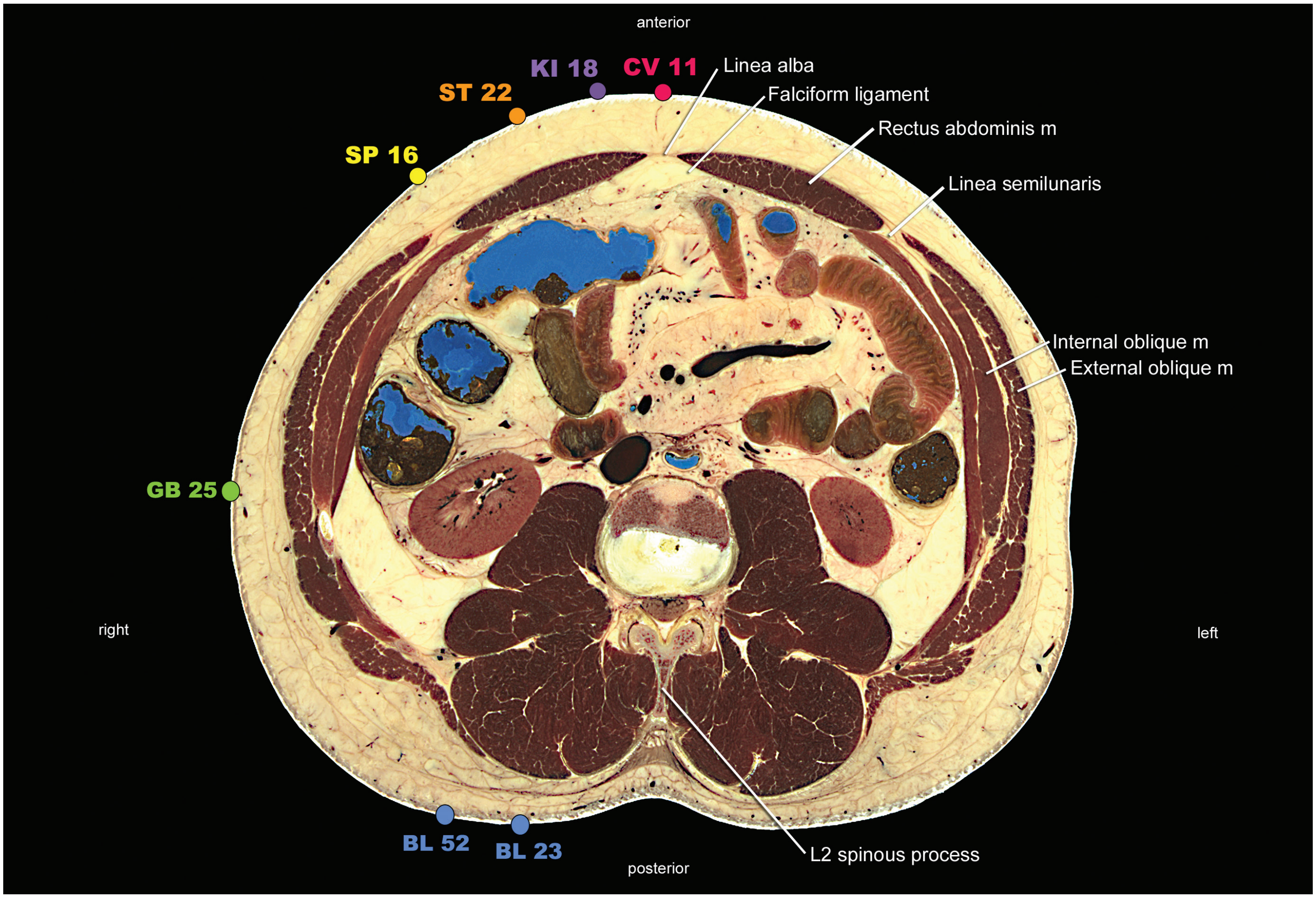


Figure 3-57. The L2/L3 level of the trunk demonstrates the co-existence of digestive and renal structures and points. For example, ST 22 ("Pass Gate") sits adjacent to KI 18, "Stone Pass".

the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath. Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Gastrointestinal indications: abdominal distension, dyspepsia, diarrhea, poor appetite:** ST 22, ST 36, PC 6, CV 12.
- **Cranial abdominal wall discomfort:** ST 22, KI 18, CV 11, BL 22, BL 51 and local trigger points; modify according to level(s) of involvement.

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.

2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 23

Tai Yi "Supreme Unity" or "Supreme Intestines of a Fish"

On the abdomen, 2 cun above the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 10 and KI 17.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami

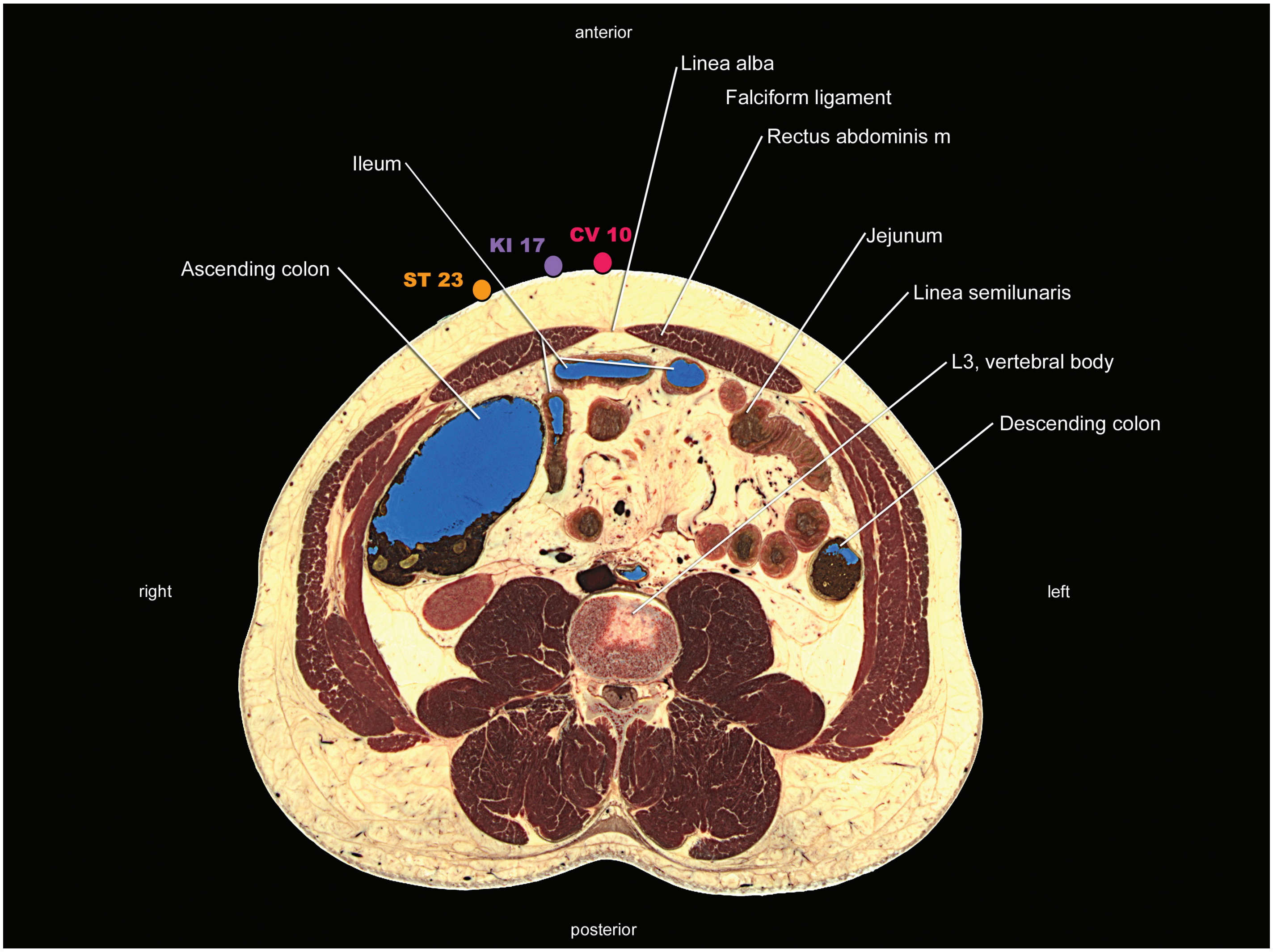


Figure 3-58. The original meaning of "Yi" in "Tai Yi" referred to the intestines of a fish. The bulk of bowel loops bolsters the anatomic basis of this name.

has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Gastrointestinal indications:** stomach pain and indigestion: ST 23, ST 36, PC 6.
- **Abdominal wall discomfort:** ST 23, KI 17, CV 10, BL 23, BL 52 and local trigger points; modify according to level(s) of involvement.

References

1. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

2. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 24

Hua Rou Men "Slippery Flesh Gate"

On the abdomen, 1 cun above the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 9.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such

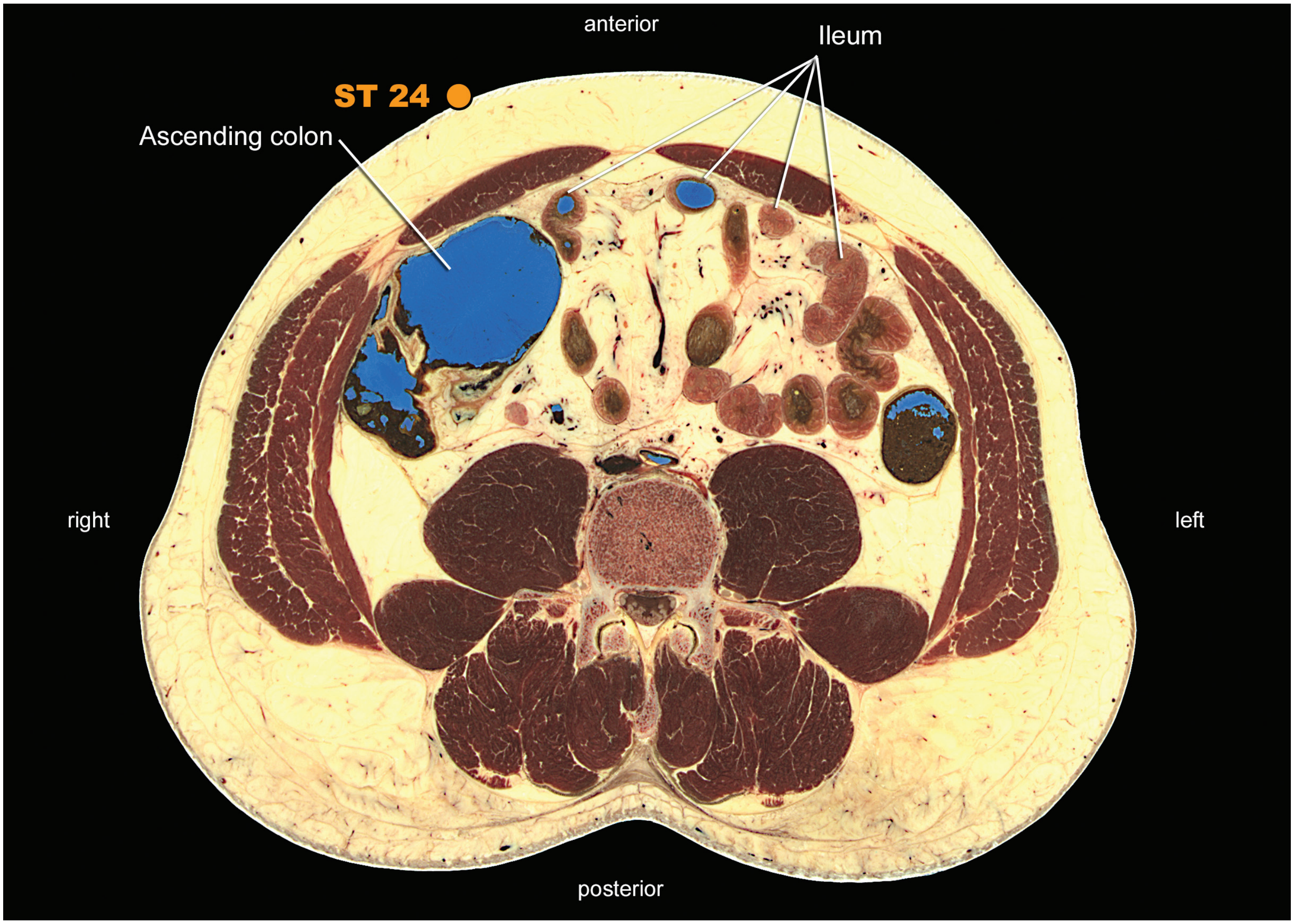


Figure 3-59. The descriptive name for ST 24, "Slippery Flesh Gate" refers to digested food that becomes slimy as it travels through the digestive tract. Note the proximity of both the ascending colon and the ileum to the point on the individual's right and left side, respectively; both contain the aforementioned slimy material. (See Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications.* Stuttgart: Thieme, 2007, p. 30.)

as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves. See Figure 3-55 to examine the abdominal wall in cross section at the locus of ST 21.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath. Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Gastrointestinal indications:** stomach pain and indigestion: ST 24, ST 36, PC 6.
- **Nausea and vomiting:** ST 24, PC 6.
- **Constipation:** ST 24, ST 36, ST 37.
- **Stomach pain:** ST 24, CV 12.
- **Psychological disorders:** ST 24, ST 36, GV 20.
- **Abdominal wall discomfort:** ST 24, KCV 9, BL 23, BL 52 and local trigger points; modify according to level(s) of involvement.

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery*. 1954;139(1):90-94.
2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.
3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.
4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

ST 25

Tian Shu "Celestial Pivot"

On the abdomen, approximately 2 cun lateral to the umbilicus in the rectus abdominis muscle, midway between its lateral border (linea semilunaris) and the linea alba. Level with CV 8 and KI 16.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[8]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

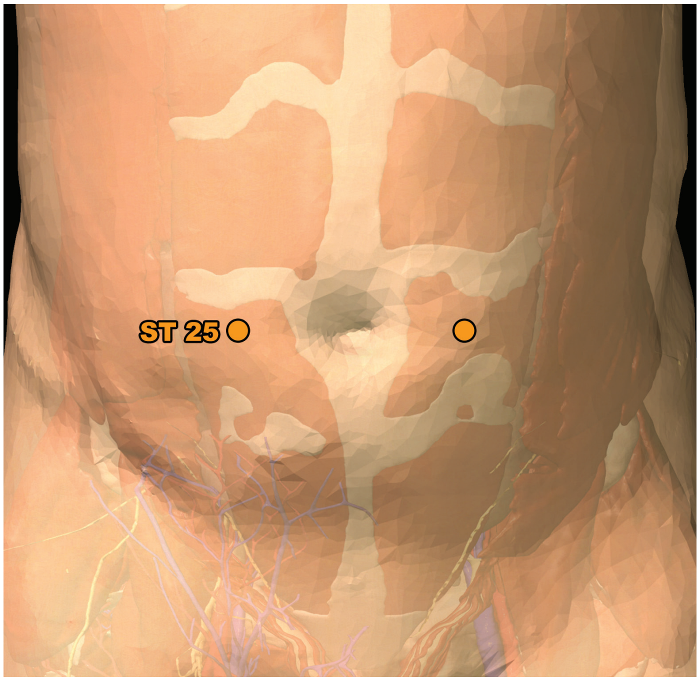


Figure 3-60. The Chinese phrase describing ST 25, "Celestial Pivot", connotes the pivot between Heaven and Earth, or in bodily terms, the difference between food absorption and elimination.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath. Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[10] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[11]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Common applications include: diarrhea, dysentery, gastritis, colitis, intestinal cramping, constipation, atonic bowel, abdominal distension, borborygmi, irregular menstruation, and anorexia:**[1] ST 25, ST 36, ST 37, BL 25.

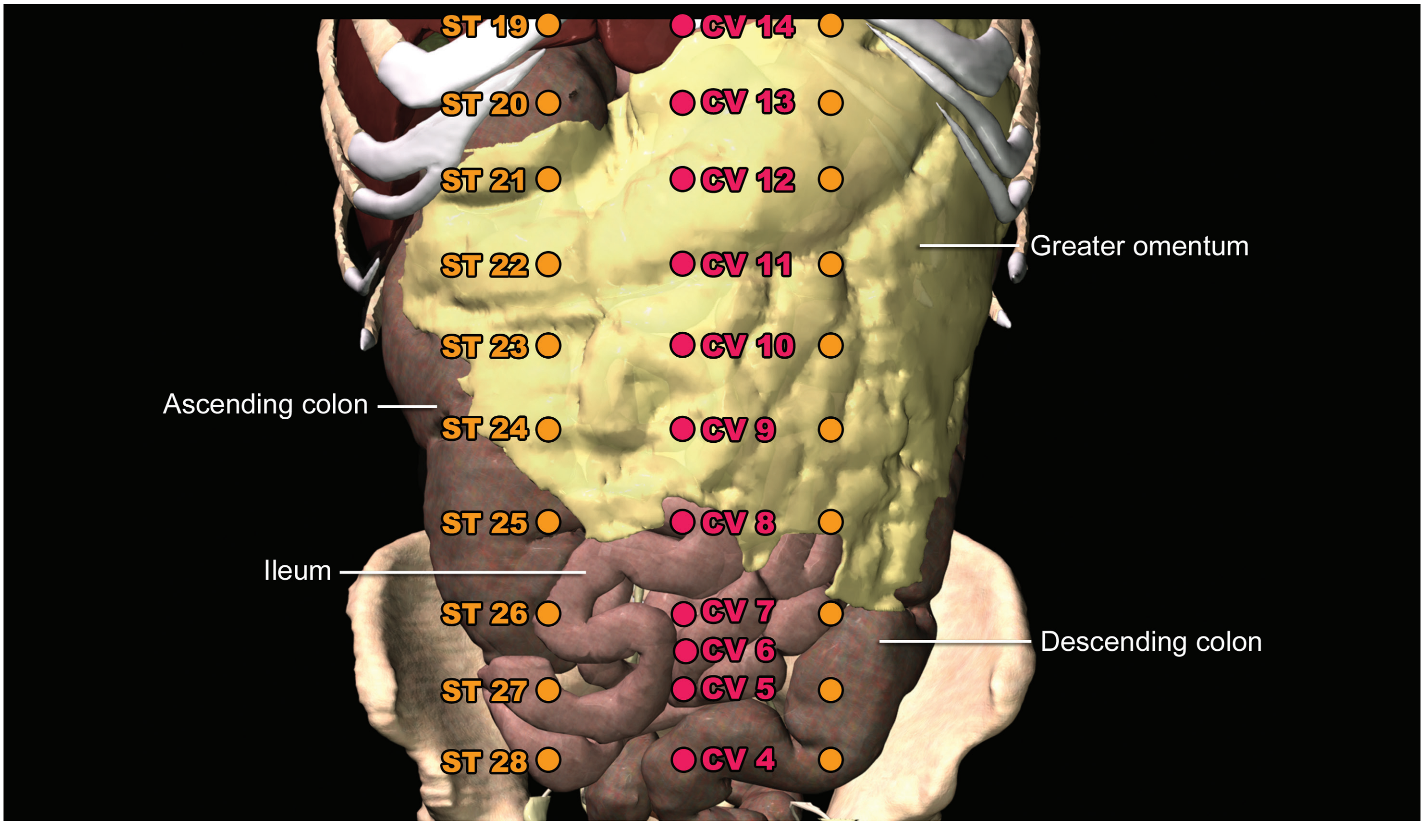

ST 19
CV 14
ST 20
CV 13
ST 21
CV 12
ST 22
CV 11
Greater omentum
ST 23
CV 10
Ascending colon
ST 24
CV 9
ST 25
CV 8
Ileum
ST 26
CV 7
CV 6
Descending colon
ST 27
CV 5
ST 28
CV 4

Figure 3-61. This view explores the relationships between the ST line (right points labeled, left unlabeled), CV points, and the greater omentum draping as an apron would over the abdominal organs. The omentum, dubbed "policeman of the abdomen", will trap and encapsulate inflammation in its defense against infection. (Liebermann-Meffert D. The greater omentum -- anatomy, embryology, and surgical applications. *Surgical Anatomy and Embryology.* 2000;80(1):275-293.)

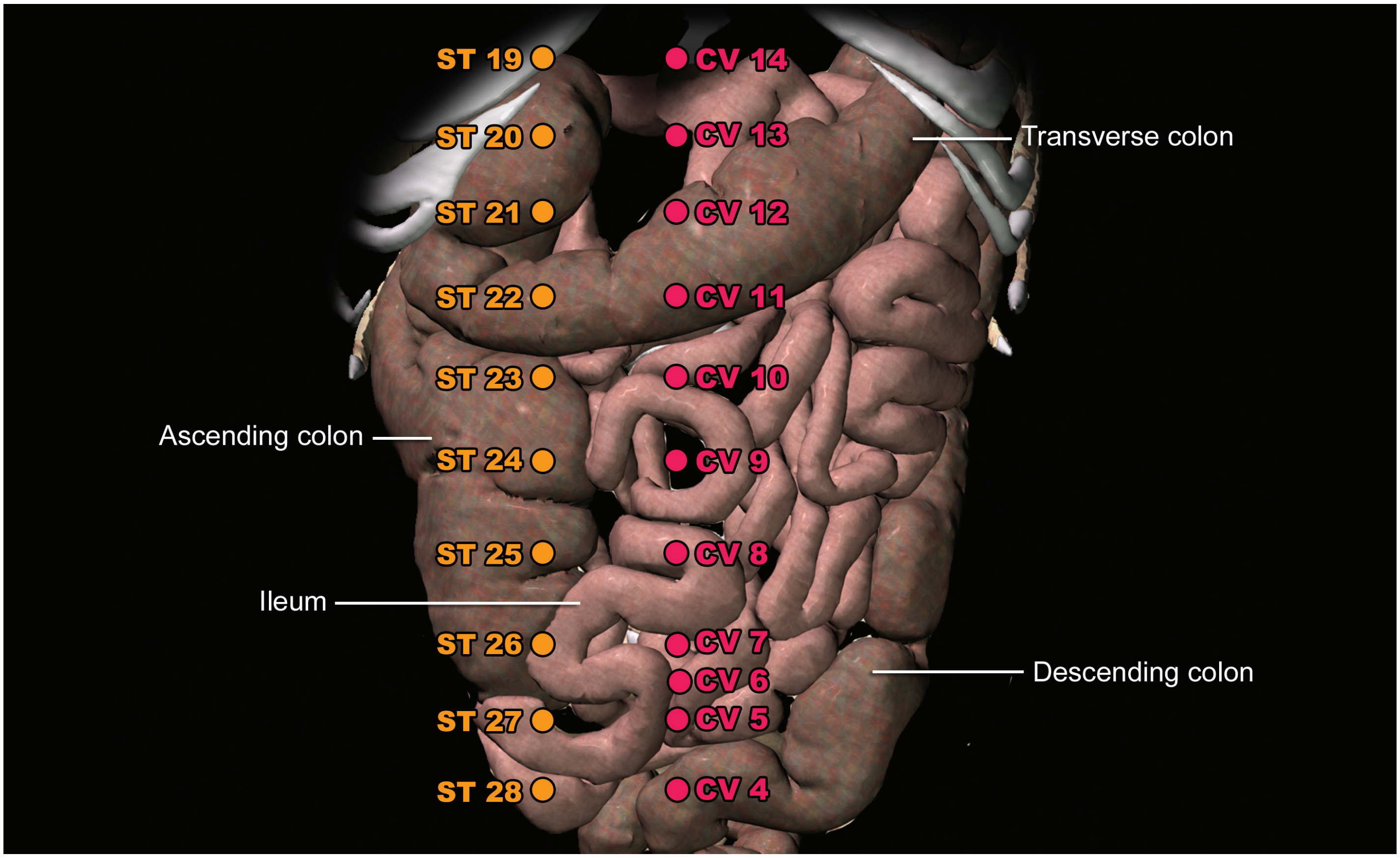

ST 19
CV 14
ST 20
CV 13
Transverse colon
ST 21
CV 12
ST 22
CV 11
ST 23
CV 10
Ascending colon
ST 24
CV 9
ST 25
CV 8
Ileum
ST 26
CV 7
CV 6
Descending colon
ST 27
CV 5
ST 28
CV 4

Figure 3-62. The right ST lines course parallel to the ascending colon while the left ST line (not shown) follows the descending colon. In Chinese medicine, ST 25 is associated with the large intestine. This image as well as 3-63 illustrates the close relationship between ST 25 and the colon.

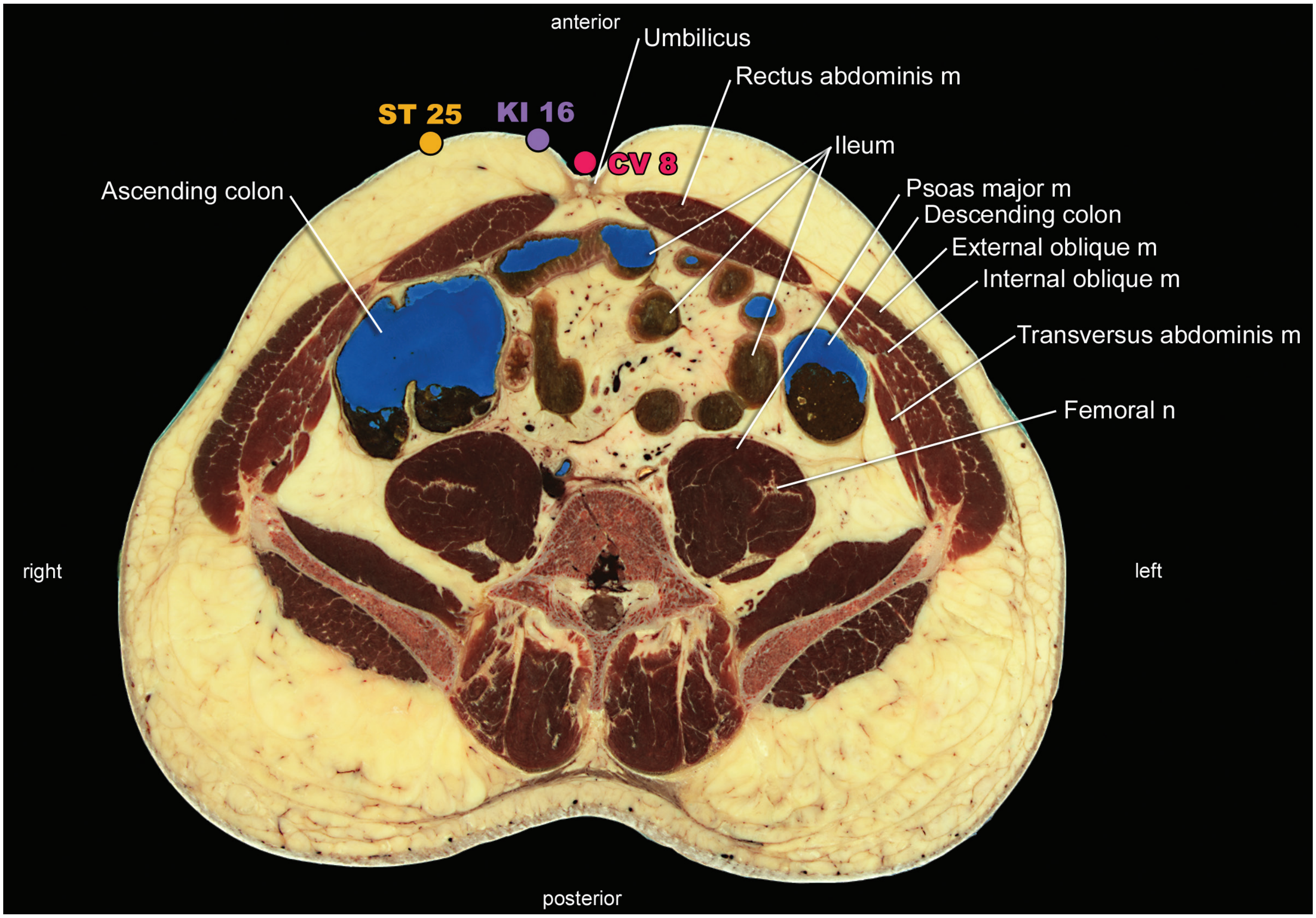


Figure 3-63. ST 25, KI 16, and CV 8 all sit level with the umbilicus. SP 15, not shown in this image, would land on the lateral border of the rectus abdominis.

Evidence-Based Applications

- **Acupuncture at CV 4, BL 23, BL 25, and ST 25 offers an alternative to pharmacologic sedation and analgesics in patients receiving extracorporeal shockwave lithotripsy who are unable to tolerate medication.[2]**
- **Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with irritable bowel syndrome.[3]**
- **Daily electroacupuncture in obese women at LI 4, LI 11, ST 25, ST 36, ST 44, and LR 3 decreased total serum cholesterol, low-density lipoprotein (LDL), and triglyceride levels compared to control groups, possibly by increasing serum beta endorphin.[4]**
- **Moxibustion (using Artemisia vulgaris) at CV 12, ST 25, and ST 36 was effective in preventing acute gastric lesions induced by indomethacin in rats.[5]**
- **Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific ulcerative colitis in a case series.[6]**
- **A case series reported that acupuncture and moxibustion at ST 25 and CV 4 effectively improved symptoms in patients with chronic colitis.**
- **Stimulation of afferent nerves of the abdomen and lower chest by manual twisting of acupuncture needles nearly always inhibits gastric motility, in comparison to stimulation of afferent fibers in the limbs, which tend to increase motility.[7] Acupuncture-like stimulation of points in these caudal truncal segments activates lower thoracic spinal nerves, which produces an increase in gastric sympathetic efferent nerve activity and a simultaneous inhibition of gastric motility.**

References

1. Cui S. Clinical application of acupoint Tianshu. *Journal of Traditional Chinese Medicine.* 1992;12(1):52-54.
2. Quatan N, Bailey C, Larking A, Boyd PJ, and Watkin N. Sticks and stones: use of acupuncture in extracorporeal shockwave lithotripsy. *Journal of Endourology.* 2003;17(10):867-870.
3. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.
4. Cabioglu MT. Electroacupuncture therapy for weight loss reduces serum total cholesterol, triglycerides, and LDL cholesterol levels in obese women. *American Journal of Chinese Medicine.* 2005;33(4):525-533.
5. Freire AO, Sugai GCM, Blanco MM, Tabosa A, Yamamura Y, and Mello LEAM. Effect of moxibustion at acupoint Ren-12 (Zhongwan), St-25 (Tianshu), and St-36 (Zuzanli) in the prevention of gastric lesions induced by indomethacin in Wistar rats. *Digestive Diseases and Sciences.* 2005;50(2):366-374.
6. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.
7. Sato A, Sato Y, and Uchida S. Reflex modulation of visceral functions by acupuncture-like stimulation in anesthetized rats. *International Congress Series.* 2002;1238:111-123.
8. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.
9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
10. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
11. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 26

Wai Ling "Outer Mound"

On the abdomen, 1 cun below the umbilicus, approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle. Level with CV 7.

Note: Deep needling may result in organ puncture.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[1]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

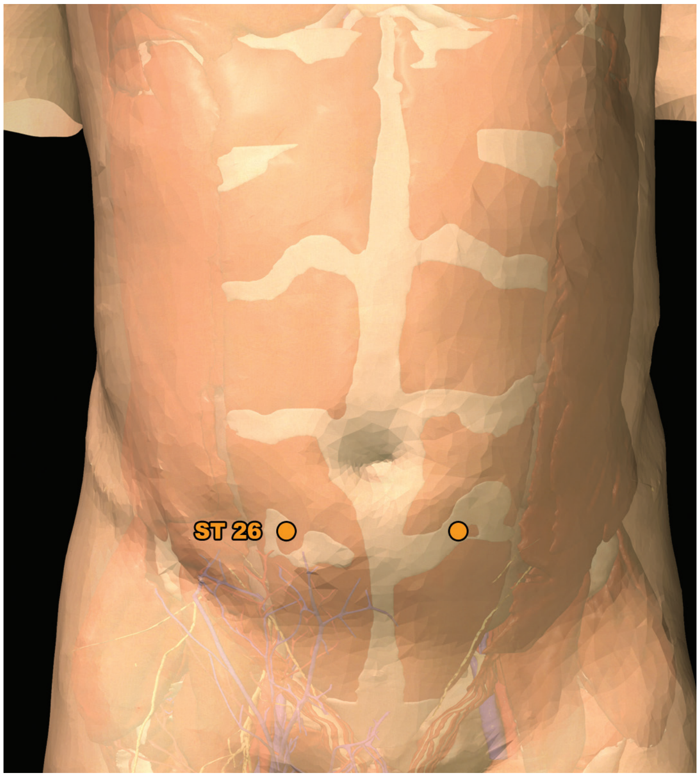


Figure 3-64. The "Outer Mound" name for ST 26 stands for the protruding lower belly.

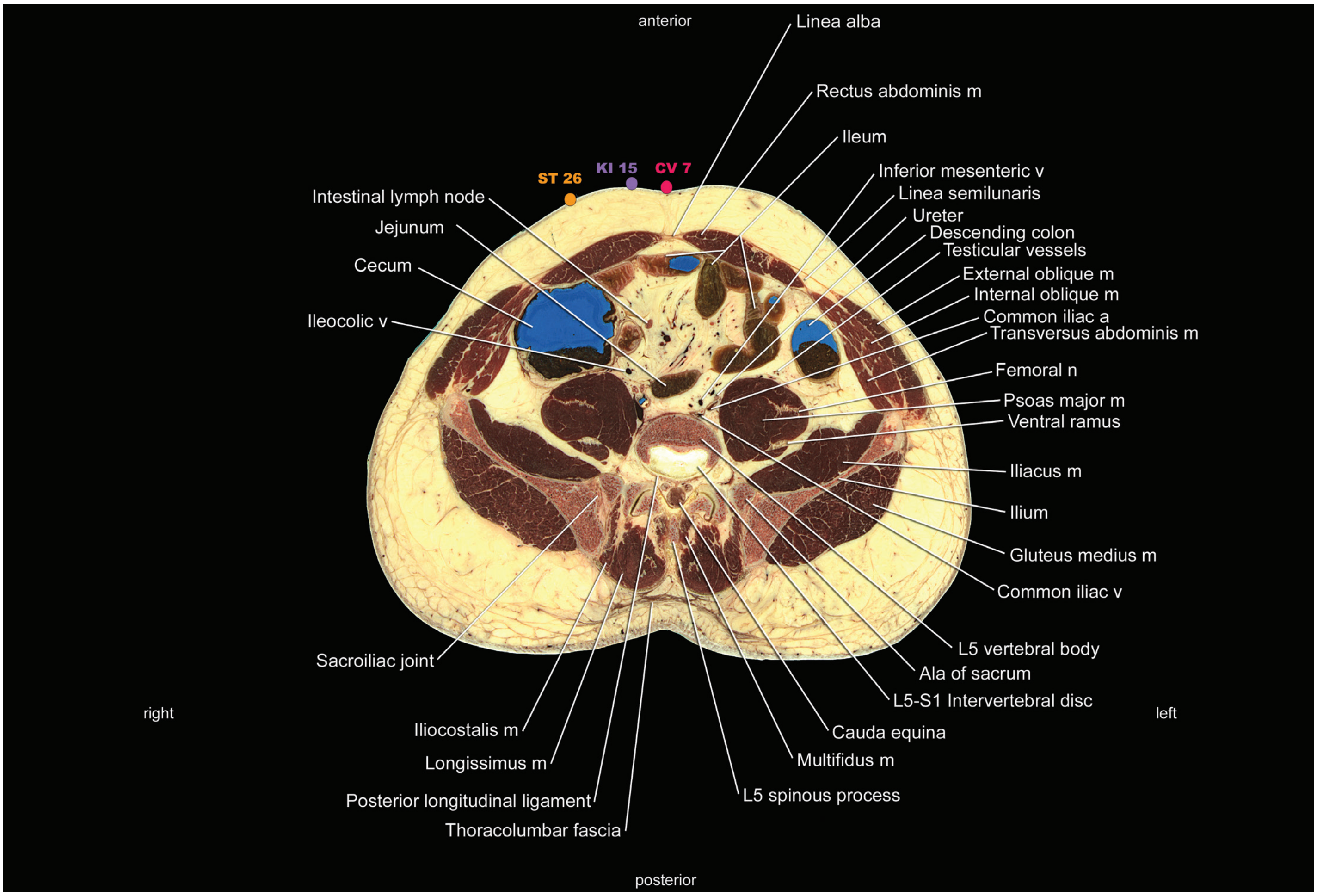

anterior
Linea alba
Rectus abdominis m
Ileum
ST 26
KI 15
CV 7
Inferior mesenteric v
Linea semilunaris
Intestinal lymph node
Jejunum
Ureter
Descending colon
Testicular vessels
Cecum
External oblique m
Internal oblique m
Common iliac a
Ileocolic v
Transversus abdominis m
Femoral n
Psoas major m
Ventral ramus
Iliacus m
Ilium
Gluteus medius m
Common iliac v
L5 vertebral body
Sacroiliac joint
Ala of sacrum
L5-S1 Intervertebral disc
right
left
Iliocostalis m
Cauda equina
Longissimus m
Multifidus m
L5 spinous process
Posterior longitudinal ligament
Thoracolumbar fascia
posterior

Figure 3-65. Note the greater amount of adipose tissue beneath ST 26,"Outer Mound", compared to more cranial ST points.

Indications and Potential Point Combinations

- **Ileus:** ST 26, ST 25, ST 36, ST 37, CV 12.
- **Dysmenorrhea:** ST 26, CV 4, SP 6.
- **Pseudo-appendicitis pain emanating from a myofascial trigger point on the lateral border of the right rectus abdominis muscle simulating appendicitis pain:** ST 26, SP 14, SP 15, GB 26, ST 36.

References

1. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.

2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 27

Da Ju "Great Gigantic"

On the abdomen, 2 cun below the umbilicus approximately 2 cun lateral from the anterior midline, in the rectus abdominis muscle. Level with CV 5.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, leading to exhalation. Like the muscles in the cheek on the face, the rectus abdominis does not lie on any supportive skeletal structure. This lack of bony attachment makes the rectus abdominis vulnerable to sudden strains, as occur with coughing or sitting upright from a supine position.[2]
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[3] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- Inferior epigastric artery and vein: Terminal medial branch of

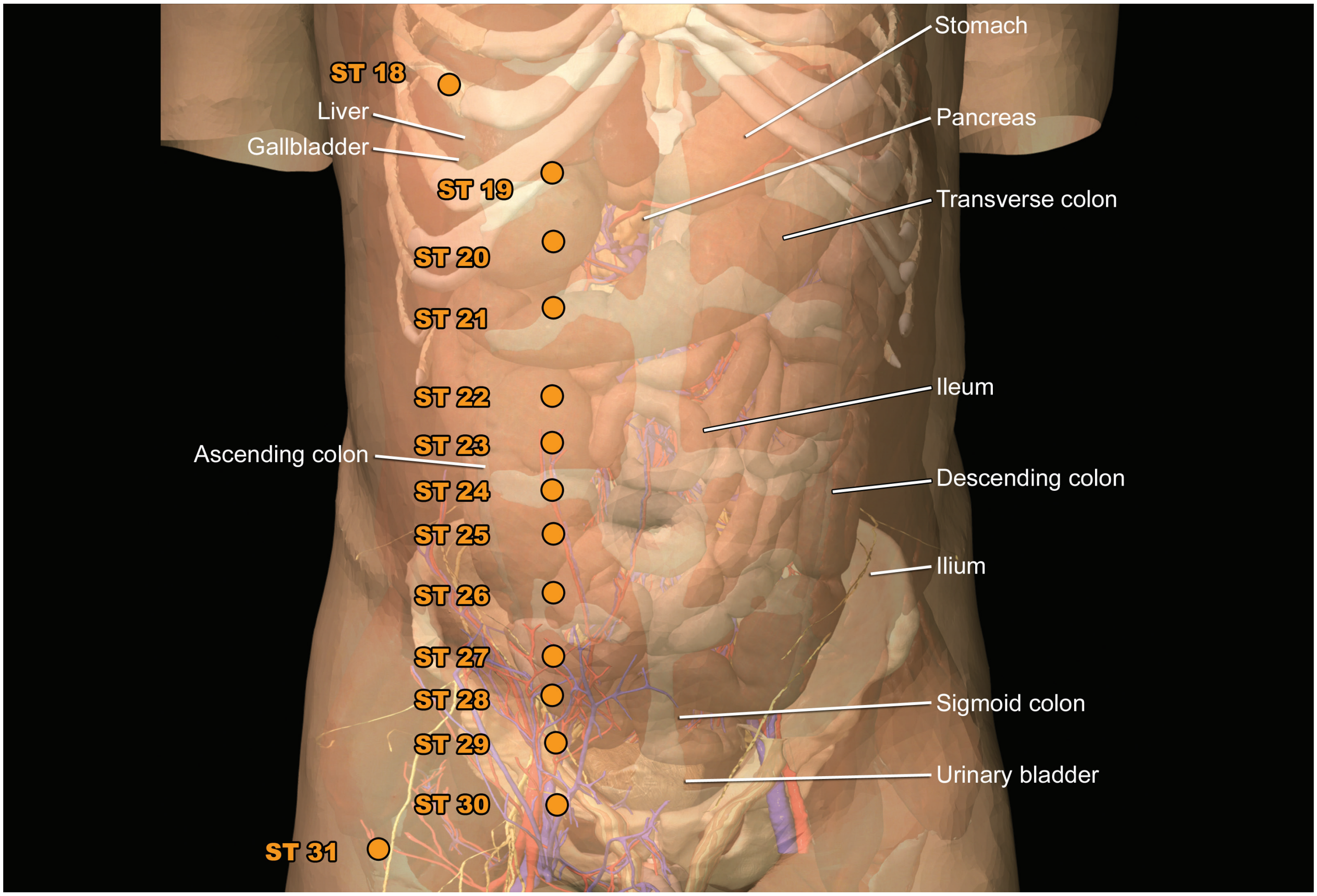


Figure 3-66. ST 27, "Great Gigantic", refers to the big bulge of the lower abdomen.

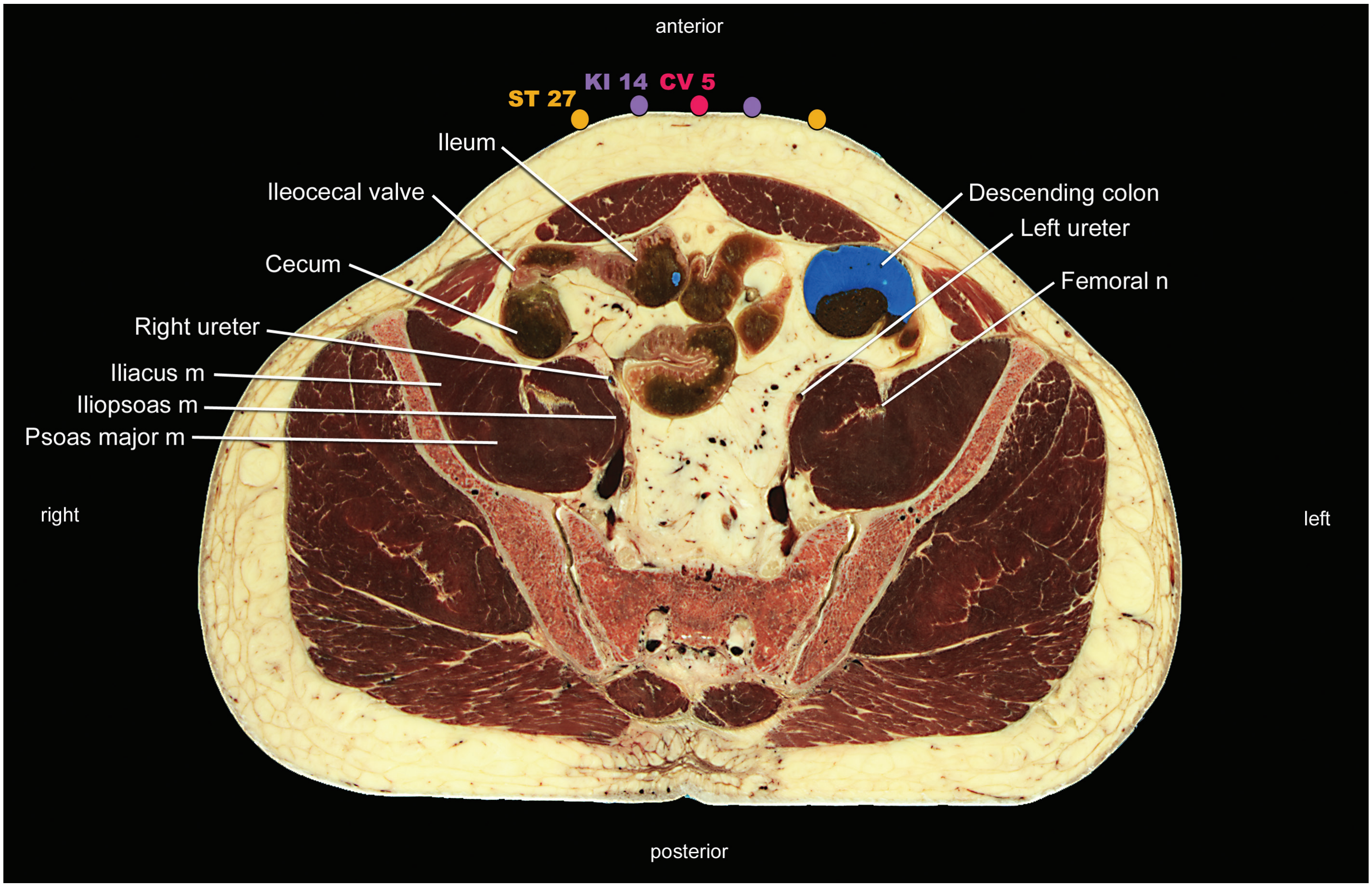


Figure 3-67. ST 27 indications include both digestive and urogenital conditions; note the presence of colonic structures and ureters at this level.

the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[4] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[5]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Abdominal distension. Colitis:** ST 27, ST 36, ST 37, SP 6.
- **Dysuria and urinary hesitancy:** ST 27, SP 6, KI 3, CV 3.

Evidence-Based Applications

- Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome.**[1]

References

1. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.

2. Murray SD and Burger RE. Rupture of the inferior epigastric vessels. *Annals of Surgery.* 1954;139(1):90-94.

3. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

4. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

5. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 28

Shui Dao "Waterway"

On the abdomen, 3 cun below the umbilicus approximately 2 cun lateral to the anterior midline, in the rectus abdominis muscle. Level with CV 4.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, resulting in exhalation.
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.
- **T11 intercostal nerve:** Supplies the skin and local musculature.
- **Subcostal (T12) nerve:** Supplies the skin over the anterior superior iliac spine (ASIS) and hip as well as the external oblique muscle.
- **Iliohypogastric (L1) nerve:** Supplies the skin of the hypogastric region and of the iliac crest region. Also innervates the internal oblique and transversus abdominis muscle.

Clinical Relevance: Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[2] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

Indications and Potential Point Combinations

- **Genitourinary conditions:** nephritis, orchitis, urinary retention, cystitis, infertility, menstrual conditions, uterine fibroid tumors: ST 28, CV 4, CV 3, BL 23, BL 28, KI 3, SP 6.
- **Edema:** ST28, SP6, SP9, KI27.
- **Lower abdominal distension and fullness:** ST 28, ST 25, CV 6.

Evidence-Based Applications

- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[1]

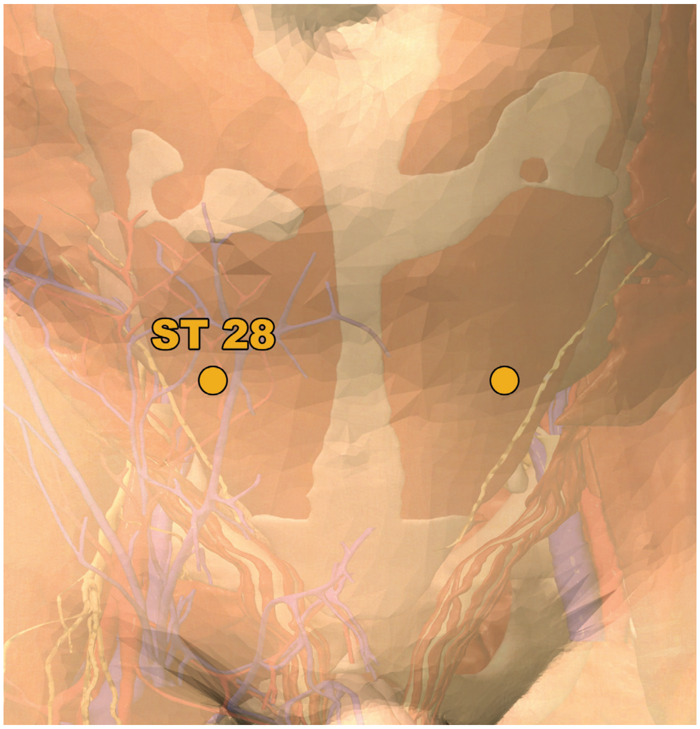


Figure 3-68. At ST 28, the focus of ST point applications shifts more definitively from digestive to urogenital, including micturition dysfunction, cystitis, menstrual issues, and orchitis.

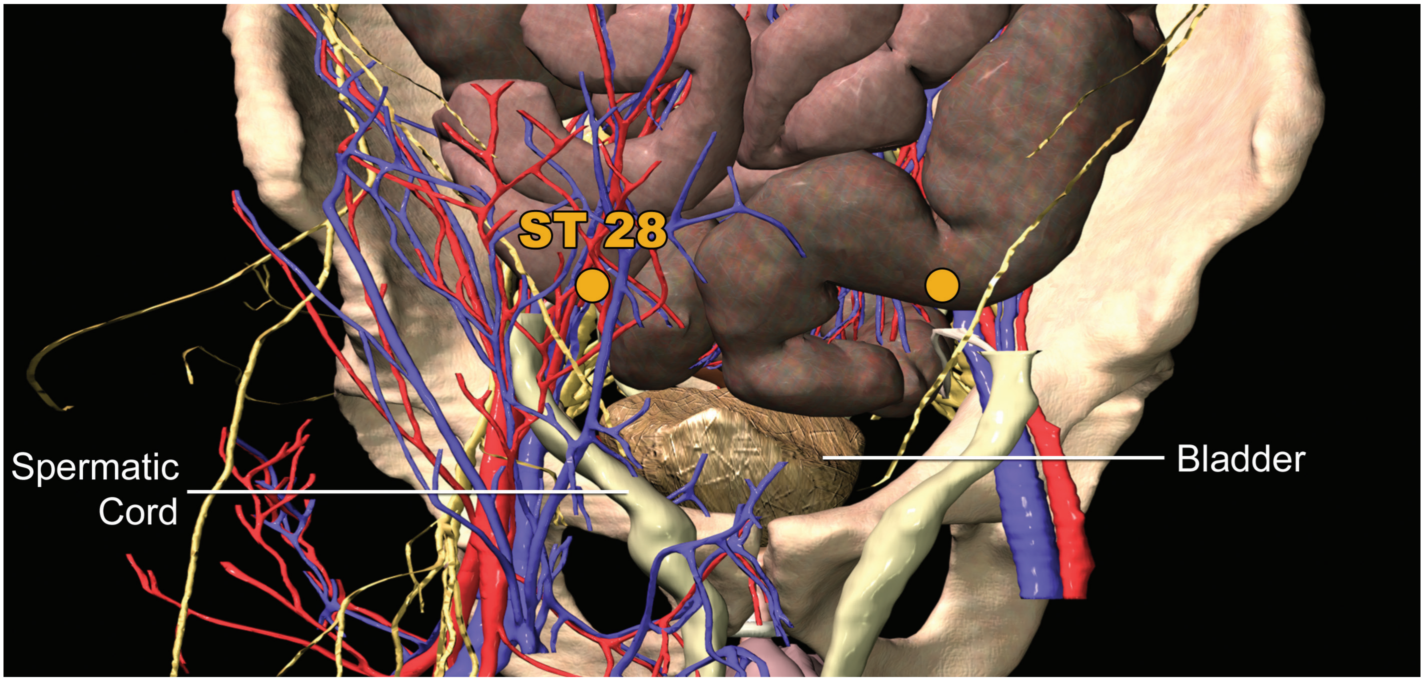

ST 28
Spermatic Cord
Bladder

Figure 3-69. The "Waterway" point, ST 28, is superimposed over or near several fluid channels, including vasculature coursing to and from the pelvis, the spermatic cord, and urinary bladder.

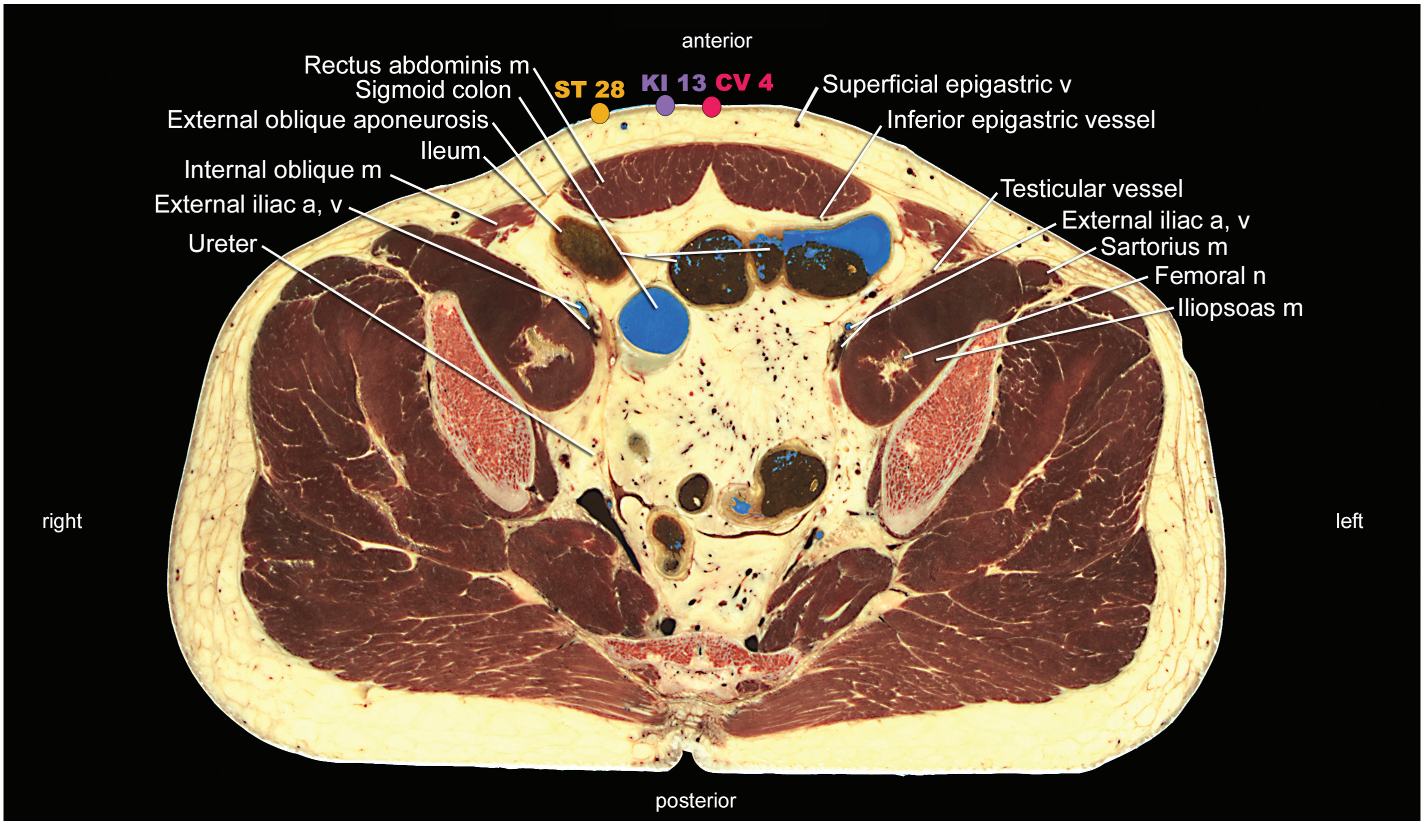

anterior
Rectus abdominis m
Sigmoid colon
ST 28
KI 13
CV 4
Superficial epigastric v
External oblique aponeurosis
Inferior epigastric vessel
Ileum
Internal oblique m
External iliac a, v
Ureter
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
right
left
posterior

Figure 3-70. The growing predominance of muscle evident in this cross section reflects the upcoming transition from segmental reflexes affecting visceral function to direct muscular benefits of the caudal ST points. ST points on the distal limb will also provide long-loop parasympathetic (e.g., ST 36, ST 37, and ST 39) and sympathetic (ST 44, ST 45) neuromodulation.

References

1. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine.* 2005;25(3):177-181.

2. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

ST 29

Gui Lai "Return"

On the lower abdomen, 1 cun above the pubic symphysis, approximately 2 cun lateral to the anterior midline, in the lateral border of the rectus abdominis muscle. Level with CV 3.

Spermatic Cord

Contents include

- Testicular artery
- Deferential artery
- Cremasteric artery
- Nerve to the cremaster (genital branch of the genitofemoral nerve)
- Testicular nerves (sympathetic nerves)
- Vas deferens (ductus deferens)
- Pampiniform plexus
- Lymphatic vessels
- Tunica vaginalis
- External spermatic fascia (an extension of the fascia that overlies the aponeurosis of the external oblique muscle)
- Cremasteric muscle and fascia (a continuation of the internal oblique muscle and fascia)
- Internal spermatic fascia (continuous with the transversalis fascia)

Clinical Relevance: Although one's acupuncture needle should not reach the spermatic cord, ST 29 overlies this important structure. As such, point activation with electroacupuncture, manual therapy, needle manipulation, or laser therapy may influence the function and blood supply of the cord's contents. That is, the vessels may dilate, the nerves may modulate, and myofascial elements relax. The result would likely lead to improved testicular function and reproductive capacity. See Figures 3-71 and 3-72 for two view of the anatomical relationships between ST 29 and the spermatic cord.

Muscles

- **Rectus abdominis muscle (lateral margin):** Flexes the trunk via flexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, resulting in exhalation.
- **External oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique muscle:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Aponeurosis of the transversus abdominis muscle:** The transversus abdominis muscle compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the

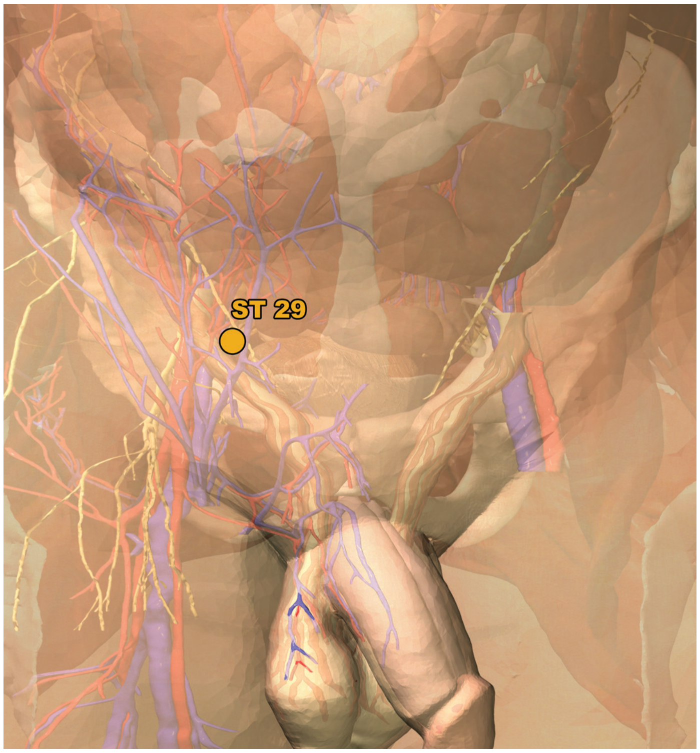


Figure 3-71. ST 29 resides close to the inguinal canal and spermatic cord,as seen here through semi-transparent skin. This helps to explain the ability of EA (10 Hz) to improve testicular artery blood flow when delivered to ST 29 but not ST 25, which does not share the same neurovascular supply. Impaired testicular artery blood flow may predispose men to reproductive organ dysfunction. Conditions impacted by reduced microcirculation in this artery include varicocele, reduced spermatogenesis, and infertility resulting from a prematurely aged testis. In another clinical scenario, the condition known as "acute scrotum", a syndrome afflicting neonates, children, and adolescents, involves torsion of the spermatic cord. Acute scrotum constitutes a surgical emergency; its after effects can compromise future fertility because prolonged periods of torsion damage tissue through generation of reactive oxygen species after reperfusion of the ischemic region. Given the aforementioned findings demonstrating improved testicular arterial blood flow following EA at ST 29, 10 Hz EA may maintain testicular function, at least in the contralateral testis while awaiting detorsion surgery for the ipsilateral organ. The singular vessel "Dai Mai", associated with L1 and the sympathetic/somatic activities of the iliohypogastric and ilioinguinal nerves, drops down in the front in the ST 29 region, draped like a belt around the caudal torso. As described elsewhere in the text, the neuroanatomic underpinnings of the Dai Mai "Vessel" relate not only to the subcostal artery and vein, but also to the autonomic activities overseen by the L! spinal cord segment. Specifically, this includes hemodynamics (specifically, vasoconstriction) to the buttocks, low back, and genitalia, as well as reproductive function and homeostasis.

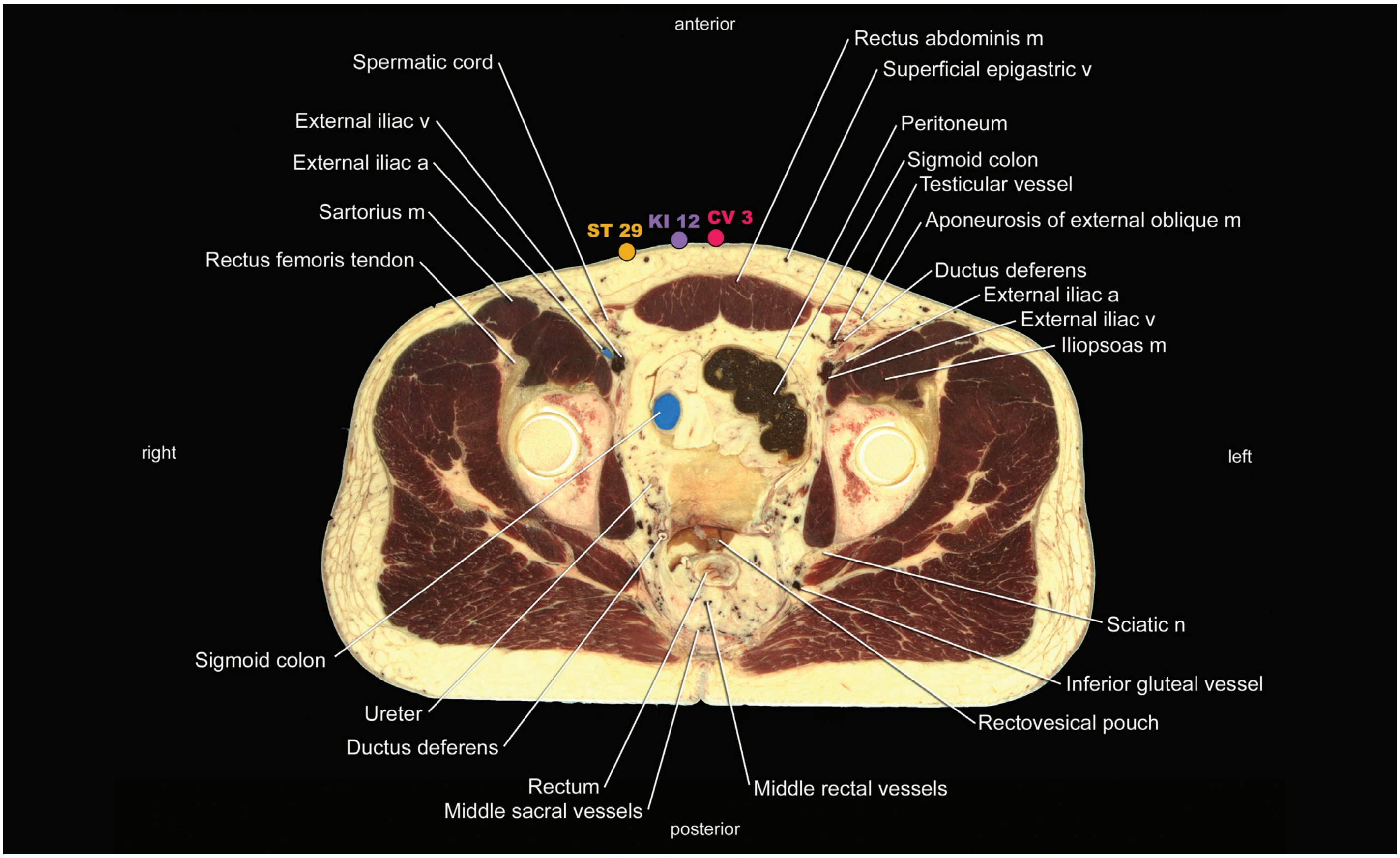

anterior
Spermatic cord
External iliac v
External iliac a
Sartorius m
Rectus femoris tendon
ST 29
KI 12
CV 3
Rectus abdominis m
Superficial epigastric v
Peritoneum
Sigmoid colon
Testicular vessel
Aponeurosis of external oblique m
Ductus deferens
External iliac a
External iliac v
Iliopsoas m
right
left
Sciatic n
Sigmoid colon
Inferior gluteal vessel
Ureter
Rectovesical pouch
Ductus deferens
Rectum
Middle rectal vessels
Middle sacral vessels
posterior

Figure 3-72. This cross section illustrates the proximity of ST 29 to the spermatic cord in males.

periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3):**[4] The iliohypogastric nerve is the first nerve of the lumbar plexus.[5] The lumbar plexus if formed from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or caudal to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.

A mixed sensory and motor nerve, the iliohypogastric supplies the skin of the hypogastric region, the iliac crest area, the internal oblique muscle and the transversus abdominis.

The iliohypogastric nerve communicates with the subcostal and ilioinguinal nerves. The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[6] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

- **Ilioinguinal nerve (L1):** Travels through the inguinal canal. Innervates the skin of the upper scrotum or labium majus, root of the penis, mons pubis, and nearby medial thigh. Also supplies the internal oblique and transversus abdominis muscles. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with the genitofemoral nerve (L1,L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[7]
- **Spermatic ganglion:** Connected to the caudal (inferior) mesenteric plexus, likely sympathetic, supplying, at least in part, the testicular artery.[8]

Clinical Relevance: Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Furthermore, abdominal surgery can injure nerves traveling through one or more planes of the abdominal wall. Paresis of the rectus abdominis muscle may result, and bulging of the abdominal wall may ensue.[10] Paresis of the abdominal wall may cause large swelling and mechanical complaints. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation, including treatment at ST 29. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also be addressed with neuromodulation,

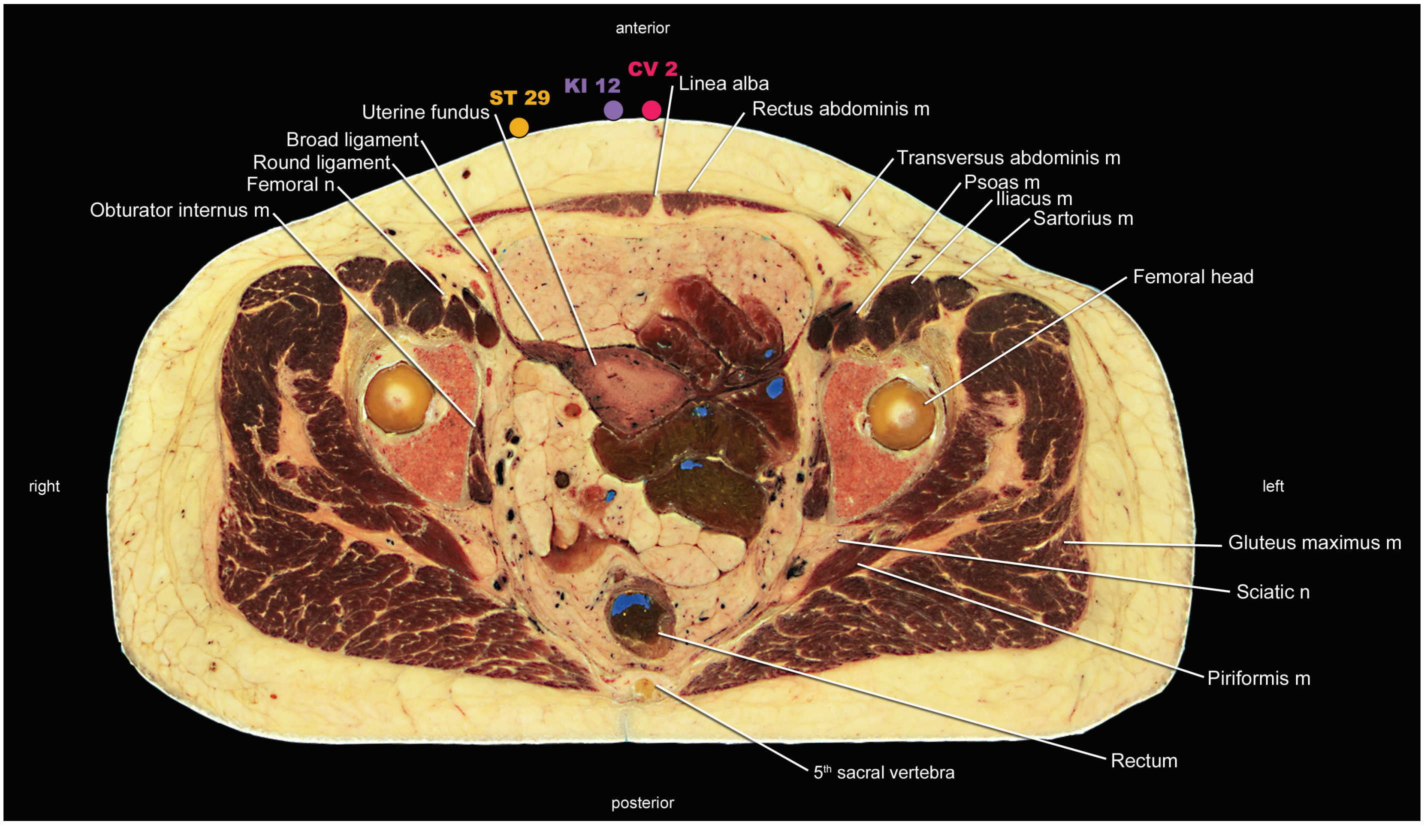


Figure 3-73. The descriptive name for this point, "Return" connotes the application of this point for uterine prolapse or restoration of menstruation in cases of amenorrhea. Note: this cross section depicts the female anatomy from the Visible Female project.

in addition to adjunctive abdominal support and multimodal analgesia.

The variability in spinal nerve origin for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy. Conversely, issues related to pain or dysfunction of somatic or visceral tissues served by the T12-L2 spinal segments may benefit from neuromodulation applied to ST 29, KI 12, and CV 3 (see Figure 3-72 for their placement on the caudal abdomen).

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Rupture of the inferior epigastric artery following coughing episodes can cause acute abdominal pain and rectus sheath hematoma.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[11] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[12]

Indications and Potential Point Combinations

- **Amenorrhea, irregular menses, endometritis, infertility, uterine prolapse:** ST 29, ST 30, CV 4, SP 4, PC 6, BL 23
- **Orchitis:** ST 29, CV 2, LR 5.
- **Male infertility:** ST 29, BL 22, CV 4, SP 6.
- **Hernia:** ST 29, ST 30, BL 22, BL 23, CV 2.
- **Penile and scrotal problems:** pain, inflammation, retraction: ST 29, BL 22, CV 2, SP 6.

Evidence-Based Applications

- Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an **effective analgesic during oocyte aspiration;** these analgesic effects equal those of conventional analgesics.[1] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[2]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in improvement in **sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[3]
- Electroacupuncture (EA) at 10 Hz, applied to ST 29, increased **testicular blood flow** whereas dry needling and 2 Hz stimulation did not. In contrast, EA at 10Hz applied to ST 25 did not change testicular blood flow significantly. This finding emphasizes the need to consider neurovascular supply to a dysfunctional organ and the neuromodulatory pathways to affect that supply in order to achieve clinically significant outcomes.[13]

References

1. Stener-Victorin E, Waldenström U, Nilsson L, Wikland M, Janson PO. A prospective randomized study of electro-acupuncture versus alfentanil as anaesthesia during oocyte aspiration in in-vitro fertilization. *Human Reproduction*. 1999;14(10):2480-2484.

2. Stener-Victorin E, Waldenström U, Wikland M, Nilsson L, Hägglund L, and Lundeberg T. Electro-acupuncture as a preoperative analgesic method and its effects on implantation rate and neuropeptide Y concentrations in follicular fluid. *Human Reproduction*. 2003;18(7):1454-1460.

3. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility*. 2005;84(1):141-147.

4. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy*. 2011;24:454-461.

5. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg*. 2010;76(3):253-262.

6. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves*. BC Decker, Inc.: London, England, 1997, p. 180.

7. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

8. Motoc A, Rusu MC, and Jianu AM. The spermatic ganglion in humans: an anatomical update. *Rom J Morphol Embryol*. 2010; 51(4):719-723.

9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

10. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

11. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

12. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

13. Cakmak YO, Akpinar IN, Ekinci G, et al. Point- and frequency-specific response of the testicular artery to abdominal electroacupuncture in humans. *Fertility and Sterility*. 2008;90(5):1732-1738.

ST 30

Qi Chong "Surging Qi"

Level with the pubic symphysis and CV2, 2 cun lateral to the midline, just superior to the inguinal ligament, on the medial side of the femoral artery.

Spermatic Cord

Contents include

- Testicular artery
- Deferential artery
- Cremasteric artery
- Nerve to the cremaster (genital branch of the genitofemoral nerve)
- Testicular nerves (sympathetic nerves)
- Vas deferens (ductus deferens)
- Pampiniform plexus
- Lymphatic vessels
- Tunica vaginalis
- External spermatic fascia (an extension of the fascia that overlies the aponeurosis of the external oblique muscle)
- Cremasteric muscle and fascia (a continuation of the internal oblique muscle and fascia)
- Internal spermatic fascia (continuous with the transversalis fascia)

Clinical Relevance: Although one's acupuncture needle should not reach the spermatic cord, ST 29 overlies this important structure. As such, point activation with electroacupuncture, manual therapy, needle manipulation, or laser therapy may influence the function and blood supply of the cord's contents. That is, the vessels may dilate, the nerves may modulate, and myofascial elements relax. The result would likely lead to improved testicular function and reproductive capacity. See Figures 3-75 and 3-76 for two views of the anatomical relationships between ST 30 and the spermatic cord.

Connective Tissues

- **Round ligament of the uterus (ligamentum teres uteri) in females:** Connects the uterus to each labium majus. Each ligament exits the pelvis through the deep inguinal ring, passing through the inguinal canal to reach the labia majora. There, the ligaments' fibers spread and mix with tissue comprising the mons pubis.
- **Superficial (external) inguinal ring, or exit from the inguinal canal:** This aperture between the diagonal fibers of the external oblique aponeurosis transmits either the spermatic cord in males or the round ligament of the uterus in females.

Clinical Relevance: Round ligament varicosities may develop during pregnancy, leading to groin swelling. The varicosities arise from veins that drain the inguinal canal and round ligament. Because flow in these veins increases during pregnancy but venous wall tone decreases, these varicosities become more common in pregnant women. Due to its clinical resemblance with an inguinal hernia, misdiagnosis is common and unnecessary surgery may result.[5] "Round ligament syndrome" refers to a painful condition in the groin of pregnant women. Uterine growth in pregnancy stretches the ligaments, producing pain.[6] Releasing soft tissue strain with acupuncture and manual therapy at and around ST 30 may ease the pull on these pelvic ligaments and thereby alleviate pain.

Muscles

- **Rectus abdominis muscle (lateral margin):** Flexes the trunk viaflexing the lumbar vertebrae; compresses abdominal organs. Is a diaphragm antagonist, resulting in exhalation.
- **Aponeurosis of the internal and external oblique muscles:** The muscles flex and rotate the trunk, as well as support and compress the abdominal organs. The inferior margin of the external oblique aponeurosis thickens and folds over onto itself to create the inguinal ligament, which attaches to the anterior superior iliac spine and pubic tubercle.
- **Aponeurosis of the transversus abdominis muscle:** The transversus abdominis muscle compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

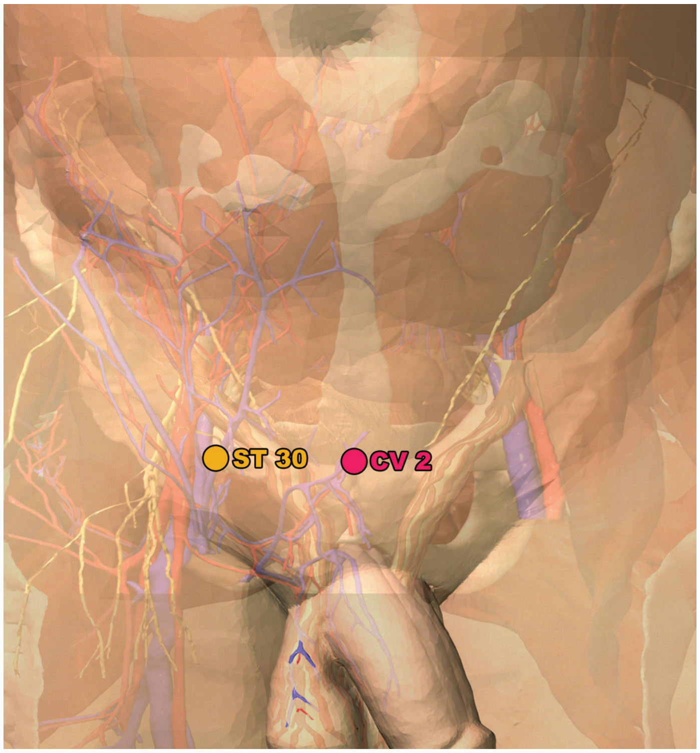


Figure 3-74. ST 30, "Qi Thoroughfare" or "Surging Qi", connotes the prominent neurovasculature ferrying blood and neural traffic, as seen through the transparent skin in this image.

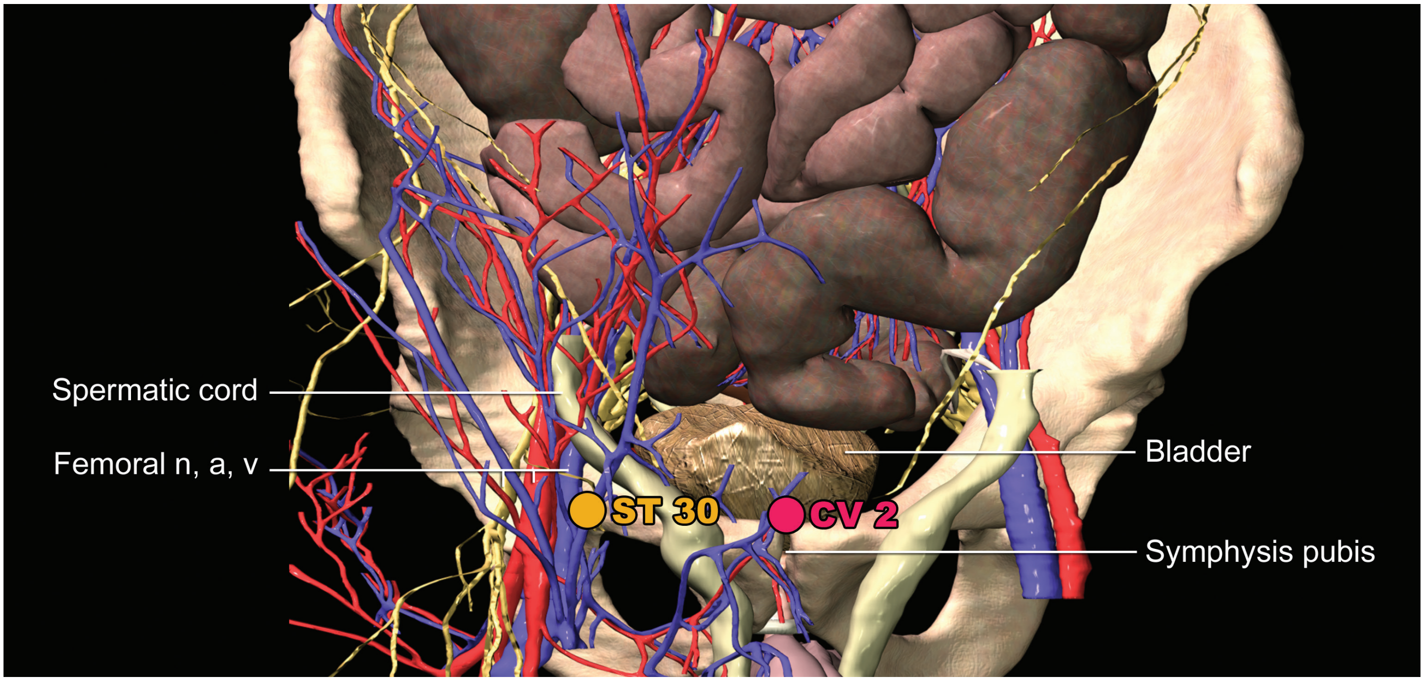


Figure 3-75. This neurovascular layer provides a clearer view of the femoral vein, artery, and nerve that reside close to ST 30. Note also the proximity of the spermatic cord.

Nerves

- **Genitofemoral nerve (L1, L2):** Provides afferent and efferent limbs of the cremasteric reflex. The ilioinguinal nerve (L1) helps with the afferent aspect. The genitofemoral nerve emerges on the ventral aspect of teh psoas major muscle. It divides into a femoral branch and a genital branch. The femoral branch supplies the skin over the femoral triangle. In males, the genital branch travels through the inguinal canal, accompanying the spermatic cord. It them supplies the skin of the scrotum and the cremaster muscle. In females, the genital branch of the genitofemoral nerve provides cutaneous sensation to the mons pubis and labia majora.

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[7]):** The iliohypogastric nerve is the first nerve of the lumbar plexus.[8] The lumbar plexus if formed from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or caudal to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.

A mixed sensory and motor nerve, the iliohypogastric supplies the skin of the hypogastric region, the iliac crest area, the internal oblique muscle and the transversus abdominis.

The iliohypogastric nerve communicates with the subcostal and ilioinguinal nerves.The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[9] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

- **Ilioinguinal nerve (L1):** Travels through the inguinal canal. Innervates the skin of the upper scrotum or labium majus, root of the penis, mons pubis, and nearby medial thigh. Also supplies the internal oblique and transversus abdominis muscles. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with the genitofemoral nerve (L1, L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[10]

- **Spermatic ganglion:** Connected to the caudal (inferior) mesenteric plexus, likely sympathetic, supplying, at least in part, the testicular artery.[11]

Clinical Relevance: Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[12] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Abdominal surgery can injure nerves traveling through one or more planes of the abdominal wall. Paresis of the rectus abdominis muscle may result, and bulging of the abdominal wall may ensue.[13] Paresis of the abdominal wall may cause large swelling and mechanical complaints. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation, including treatment at ST 29. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also

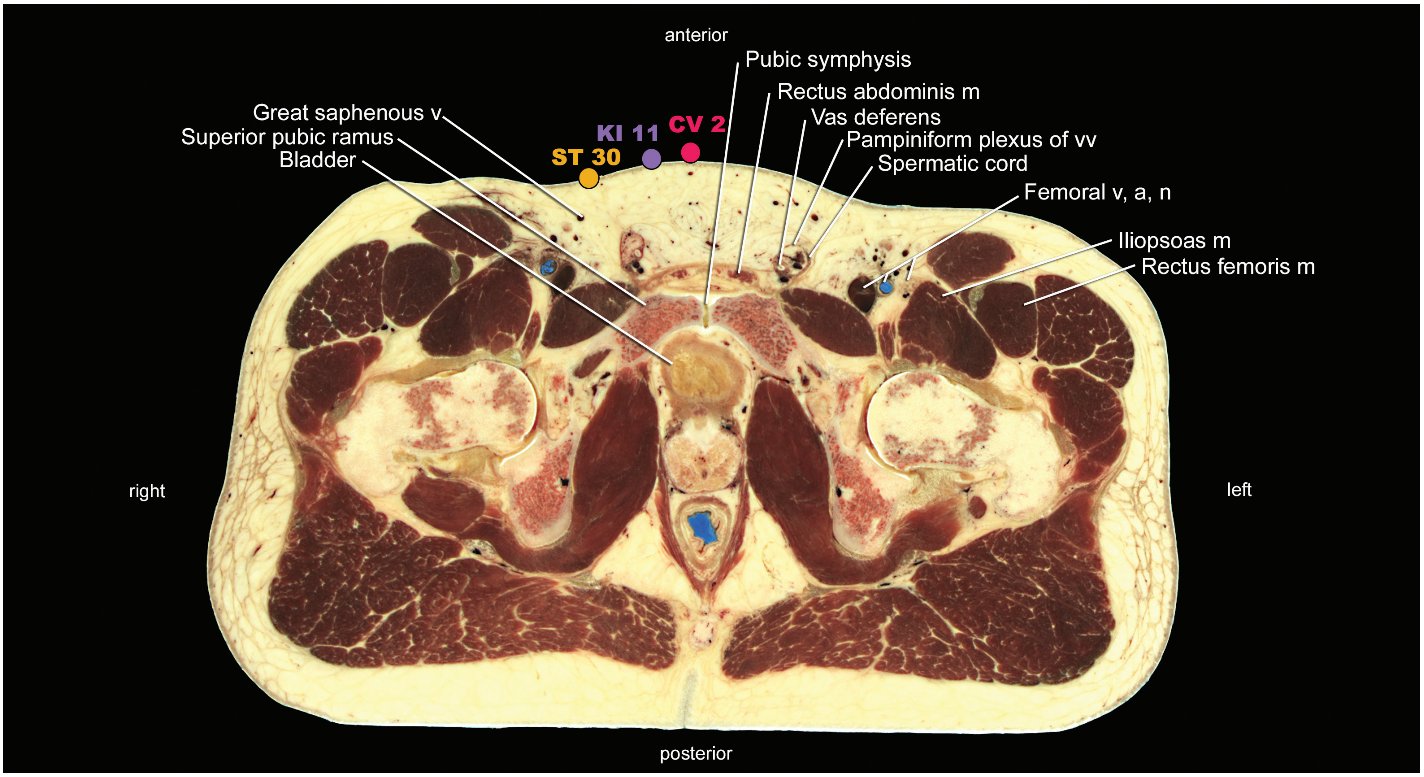


Figure 3-76. ST 30 in the male sits in a nook between the femoral vessels and the spermatic cord.

be addressed with neuromodulation, in addition to adjunctive abdominal support and multimodal analgesia.

The variability in spinal nerve origin for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy. Conversely, issues related to pain or dysfunction of somatic or visceral tissues served by the T12-L2 spinal segments may benefit from neuromodulation applied to ST 29, KI 12, and CV 3 (see Figure 3-72 for their placement on the caudal abdomen).

Neuromodulation to the territories supplied by the genitofemoral and pudendal nerves may offer analgesia for various types of pelvic pain. For example, transcutaneous electrical nerve stimulation (TENS) provided low cost, easily applied analgesia for primiparous puerpere post-episiotomy.[14]

Genitofemoral neuralgia, post-operative pain, and dyspareunia may occur following transobturator midurethal sling placement for stress urinary incontinence.[15] Although midurethral slings are mainstay treatments for stress urinary incontinence, postoperative pain may occur and require neuromodulation, trigger point injections, and other approaches for multimodal analgesia. Acupuncture applied to genitofemoral nerve territories may aid in the resolution of pain resulting from this condition.

Vessels

- **Inferior epigastric artery and vein:** Terminal medial branch of the external iliac artery; distributes blood to the rectus abdominis muscle and the medial part of the anterolateral abdominal wall. The inferior epigastric vessels send branches to the rectus abdominis, especially evident at the tendinous inscriptions. The vessels course along the retroperitoneal space until they enter the rectal sheath.

Lymphatic Tissue

- Superficial and deep lymphatic pathways course from the lateral heel to the inguinal lymph nodes.[16]

Indications and Potential Point Combinations

- **Genitourinary and reproductive problems:** ST 30, ST 36, SP 6, CV 3, CV 4, BL 23, BL 25, BL 28.

Evidence-Based Applications

- Acupuncture at ST 30 may impact reproductive function through its effects on afferent sensory signal transmission via the **ilioinguinal nerve**, which serves the roots of the penis and the scrotum.[1]
- A case series reported that massage at ST 30 effectively resolved **hydrocele**.[2]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia (OAT syndrome)**.[3]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[4]

References

1. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture*. [Undated.] Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05

2. Wang R. Treatment of 40 cases of hydroceles with massage at Qichong (ST 30). *Journal of Traditional Chinese Medicine*. 1998;18(3):218-219.

3. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.

4. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.

5. Leung JLY. Round ligament varicosities: a rare cause of groin swelling in pregnancy. *Hong Kong Med J*. 2012;18(3):256-257.

6. Salati SA. Round ligament varicosities mimicking inguinal herniae in pregnancy – a diagnostic dilemma. *African Journal of Reproductive Health*. 2011;15(2):163-164.

7. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy*. 2011;24:454-461.

8. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg*. 2010;76(3):253-262.

9. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves*. BC Decker, Inc. London, England, 1997, p. 180.

10. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

11. Motoc A, Rusu MC, and Jianu AM. The spermatic ganglion in humans: an anatomical update. *Rom J Morphol Embryol*. 2010; 51(4):719-723.

12. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

13. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

14. Pitangui ACR, de Sousa L, Gomes FA, et al. High-frequency TENS in post-episiotomy pain relief in primiparous puerpere: A randomized, controlled trial. *J Obstet Gynaecol Res*. 2012;38(7):980-987.

15. Parnell BA, Johnson EA, and Zolnoun DA. Genitofemoral and perineal neuralgia after transobturator midurethral sling. *Obstretics & Gynecology*. 2012;119:428-431.

16. Pan W-R, le Roux CM, and Levy SM. Alternative lymphatic drainage routes from the lateral heel to the inguinal lymph nodes: anatomic study and clinical implications. *ANZ J Surg*. 2011;81:431-435.

ST 31

Bi Guan "Thigh Joint"

On the anterior thigh, directly inferior to the anterior superior iliac spine (ASIS), in a depression lateral to the sartorius muscle when the thigh is flexed. Approximately level with the inferior margin of the pubic symphysis.

Muscles

- **Rectus femoris muscle:** Extends the leg at the knee, and steadies the hip joint. Helps the iliopsoas muscle flex the thigh.
- **Sartorius muscle:** Acts across two joints, serving to flex the hip and help flex the knee. The sartorius muscle laterally rotates the thigh and weakly abducts it. Both sartorius muscles, acting together, bring the lower extremities into the cross-legged position.
- **Tensor fasciae latae muscle:** Inserts onto the iliotibial tract after joining fibers from the gluteus maximus muscle. Acts as a flexor of the thigh, usually in conjunction with the iliopsoas muscle. Helps medially rotate the thigh in conjunction with the gluteus medius and gluteus minimus muscles. Contracts during hip abduction, most likely acting as a synergist or fixator muscle.

Clinical Relevance: ST 31 coincides coincides with a trigger point in the rectus femoris m. Myofascial dysfunction at this site can radiate pain to the knee, following the muscle belly to its attachments at the patella.

Nerves

- **Femoral nerve (L2-L4):** Innervates the quadriceps femoris muscle group, which extends the leg at the knee. Also supplies the iliacus, pectineus, and sartorius muscles. The femoral nerve provides articular branches to the hip joint and the knee joint, and provides a number of cutaneous branches that serve the anteromedial thigh region. The femoral nerve terminates as the saphenous nerve, a cutaneous branch. The saphenous nerve supplies the skin and fascia of the anteromedial portions of the knee, leg, and foot.
- **Superior gluteal nerve (L4, L5):** Innervates the tensor fasciae latae muscle.
- **Lateral femoral cutaneous nerve (L2, L3):** Provides sensation to the skin on the lateral and anterior thigh. The nerve travels beneath the psoas major muscle and enters the thigh region after it passes beneath the inguinal ligament in the groin. At this point, it pierces the fascia lata to divide into anterior and posterior branches.[3] Anatomical variations may cause certain nerve branches to be more susceptible to impingement in some individuals than in others.

Clinical Relevance: Entrapment mononeuropathy of the lateral femoral cutaneous nerve has been implicated in meralgia paresthetica, a clinical syndrome involving burning pain and/or dysesthesia in the anterolateral thigh.[1]

Contributing factors to meralgia paresthetica include 1) Repetitive or continuous contraction or pathological shortening of the iliopsoas and sartorius muscles, 2) Pelvic tilt and limb length discrepancy that place heightened tension on the inguinal ligament, and 3) Anatomic variations that make the lateral femoral cutaneous nerve more vulnerable to compression.[4]

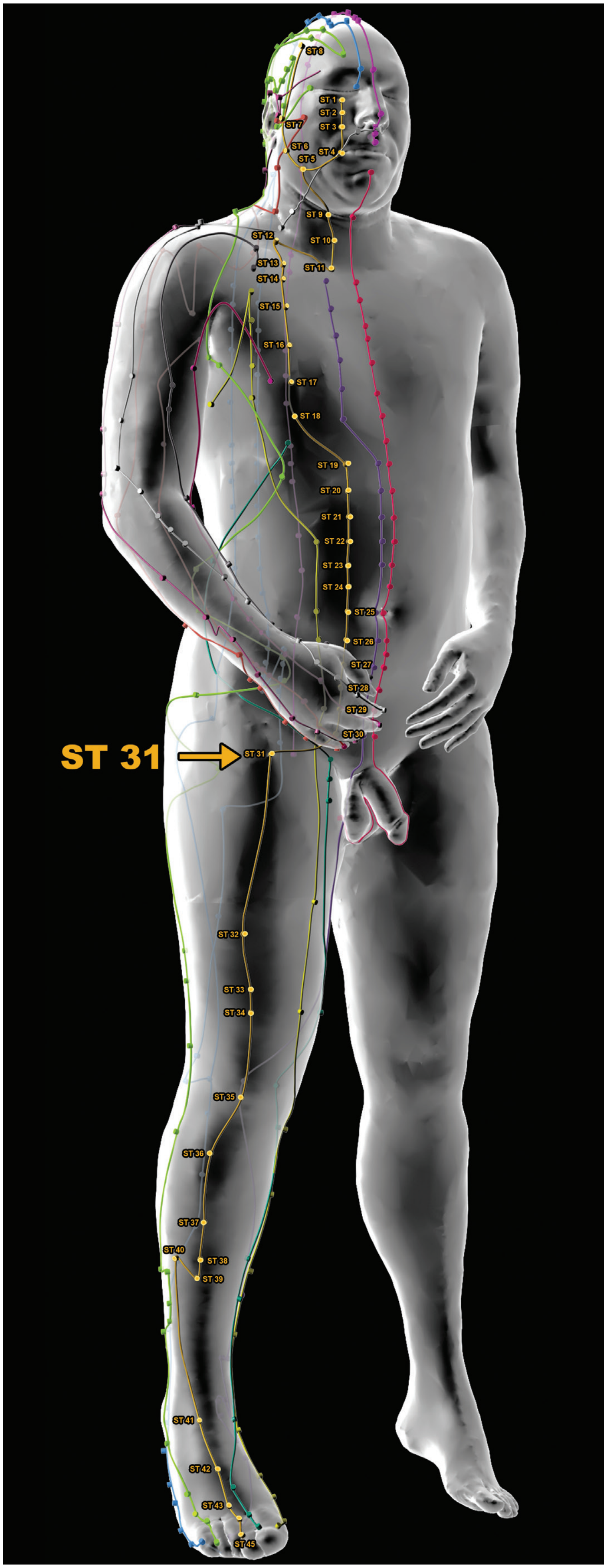


Figure 3-77. ST 31, "Thigh Joint", as shown here, stands level with the inferior border of the pubic symphysis, on the lateral edge of the sartorius muscle and directly inferior to the anterior superior iliac spine. Its name aptly describes its location.

In addition to treating local points with acupuncture, one might consider addressing spinal cord segments that give rise to this nerve (L2-L3), inspired by the approach involving spinal cord stimulation for this condition.[2]

Vessels

- **Superior gluteal artery:** Supplies the tensor fasciae latae muscle.
- **Lateral circumflex femoral artery, ascending and transverse branches:** Supply the femoral head and lateral thigh musculature.

Clinical Relevance: Improving circulation through the lateral circumflex femoral artery aids in supplying blood to the hip joint.

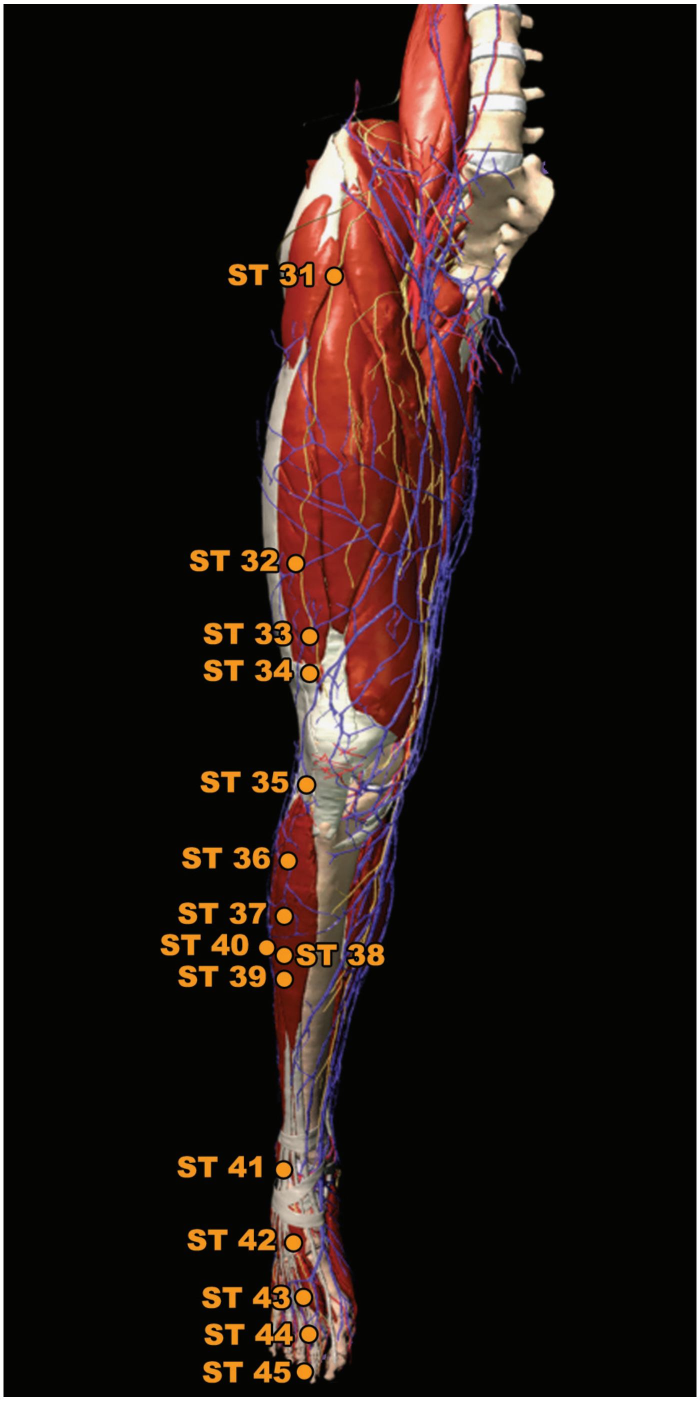


Figure 3-78. ST 31 appears here in relation to other points on the ST line of the pelvic limb.

Rupture of the superior gluteal artery can lead to gluteal compartment syndrome subsequent to hip dislocation.[5] The superior gluteal artery is the most commonly injured artery from stab wounds and other penetrating injuries to the gluteal region, so caution is advised when needling deeply in the hip area.

Indications and Potential Point Combinations

- **Muscle tension (local), thigh pain, hip pain:** ST 31, other local trigger points in muscles responsible for generating the pain pattern; check quadriceps femoris group (that Travell and Simons call the" four-faced trouble maker") and sartorius muscles.
- **Thigh pain**
- **Hip pain and reduced range of motion**
- **Pelvic limb paresis or paralysis**

References

1. Barna SA, Hu M, Buxo C, et al. Spinal cord stimulation for treatment of meralgia paresthetica. *Pain Physician*. 2005;8:315-318.
2. Barna SA, Hu M, Buxo C, et al. Spinal cord stimulation for treatment of meralgia paresthetica. *Pain Physician*. 2005;8:315-318.
3. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res*. 2010;2(6):274-276.
4. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res*. 2010;2(6):274-276.
5. Taylor BC, Dimitris C, Tancevski A, et al. Gluteal compartment syndrome and superior gluteal artery injury as a result of simple hip dislocation: a case report. Iowa *Orthop J*. 2011;31:181-6.

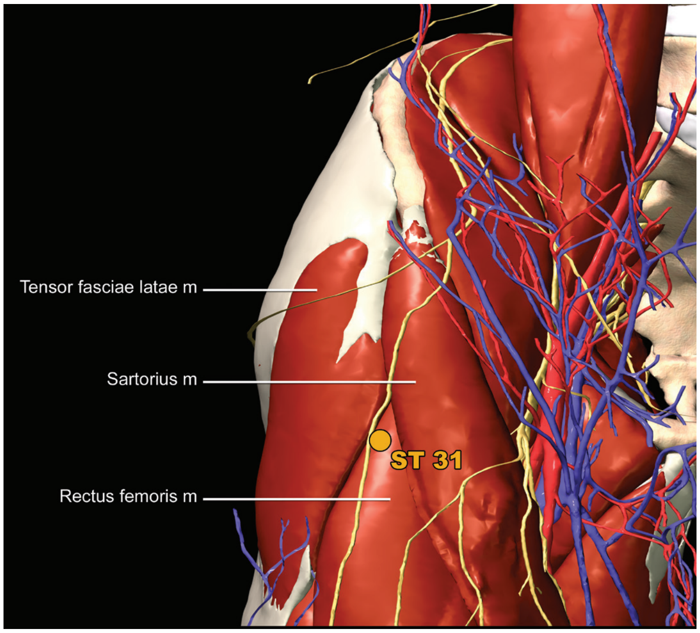


Figure 3-79. This image illustrates the relationship between the sartorius muscle and ST 31, as well as the other nearby muscles: the rectus femoris and tensor fasciae latae. Trigger points in the rectus femoris muscle at ST 31 refer strongly to the knee, earning this muscle the moniker "two joint puzzler", connoting its capacity to induce discomfort in both the hip and knee.

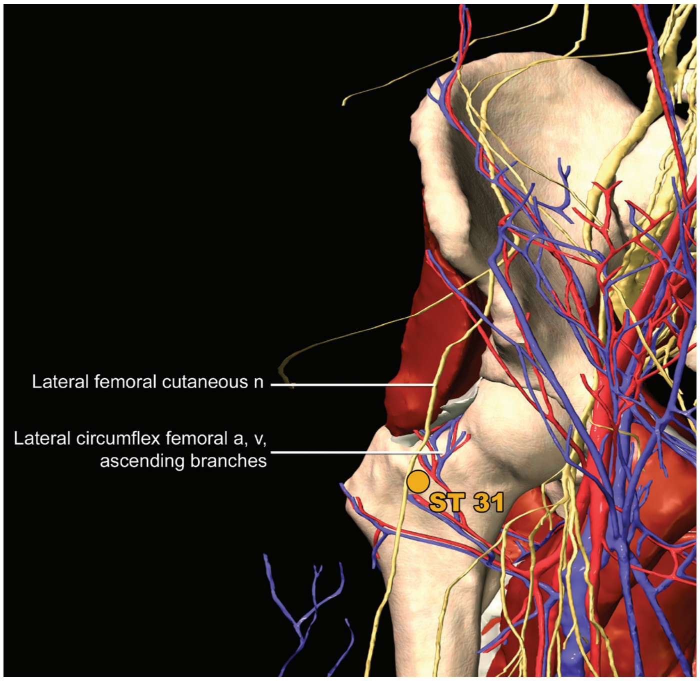

Lateral femoral cutaneous n
Lateral circumflex femoral a, v, ascending branches
ST 31

Figure 3-80. Note the proximity of ST 31 to the ascending branches of the lateral circumflex femoral artery and vein. These vessels supply and drain blood, respectively, from the femoral head region and nearby musculature. This image also reveals the proximity of ST 31 to the lateral femoral cutaneous nerve. Compressive clothing such as low-slung specific duty uniform belts, protective body armor worn by soldiers, or low-cut trousers, can injure the nerve and lead to the condition called “meralgia paresthetica”.

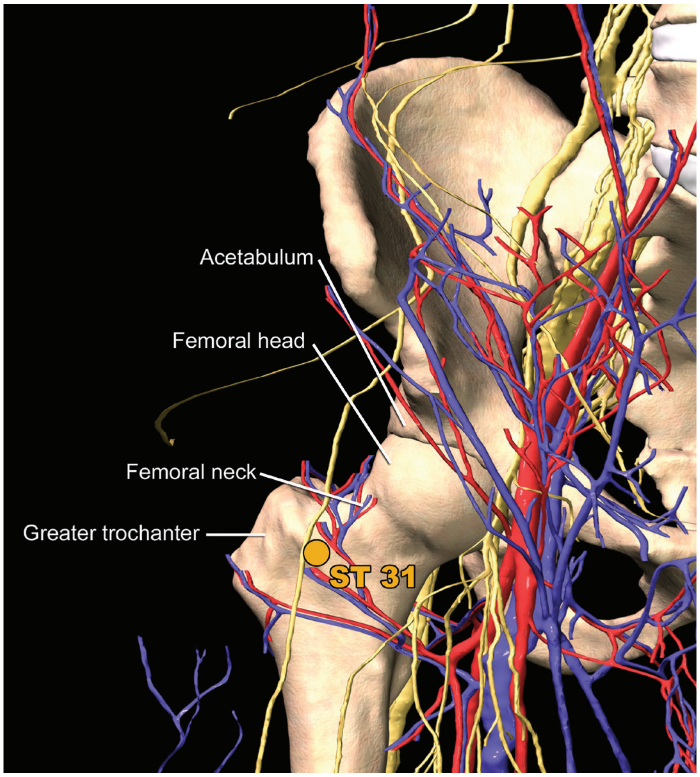

Acetabulum
Femoral head
Femoral neck
Greater trochanter
ST 31

Figure 3-81. This image depicts the osseous elements in the vicinity of ST 31.

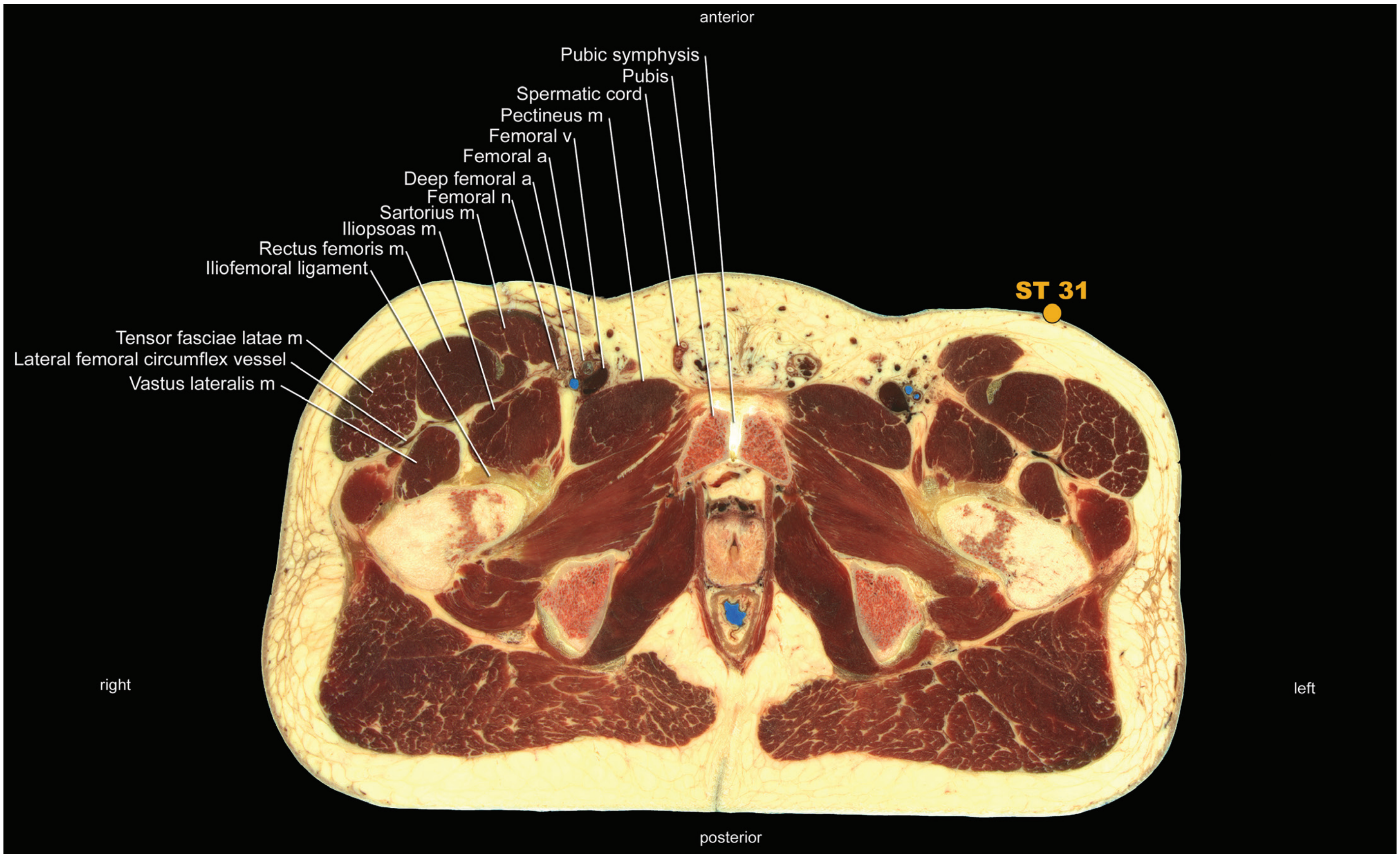

anterior
Pubic symphysis
Pubis
Spermatic cord
Pectineus m
Femoral v
Femoral a
Deep femoral a
Femoral n
Sartorius m
Iliopsoas m
Rectus femoris m
Iliofemoral ligament
Tensor fasciae latae m
Lateral femoral circumflex vessel
Vastus lateralis m
ST 31
right
left
posterior

Figure 3-82. The “Thigh Joint” point, ST 31, associates not only with the hip joint, but also large movers acting on the thigh, including the sartorius, tensor fasciae latae, and the rectus femoris muscles.

ST 32

Fu Tu "Crouching Rabbit"

On the anterior thigh region, 6 cun proximal to the superolateral angle of the patella, on the line connecting the ASIS and the superolateral patella. The point can also be found by dividing into thirds the distance between the prominence of the greater trochanter and the superolateral patella. ST 32 occurs just superior to the junction of the lower and middle thirds.

Muscles

- **Rectus femoris muscle ("the two-jointed puzzler"):** Extends the leg at the knee, and steadies the hip joint. Helps the iliopsoas muscle flex the thigh.
- **Vastus intermedius muscle ("the frustrator"):** Extends the leg at the knee.
- **Vastus lateralis muscle ("stuck patella muscle"):** Extends the leg at the knee.

Clinical Relevance: A number of trigger points in the quadriceps group cause problems in the cranial thigh. In particular, trigger points in the vastus lateralis that abut the fascia lata can issue a pain sensation described as akin to a "bolt of lightning".
As noted above, each of the quadriceps components in the vicinity of ST 32 has acquired a nickname due to the diagnostic confusion to which they contribute. Muscles affected by needling ST 32 depend on the depth of needle insertion.

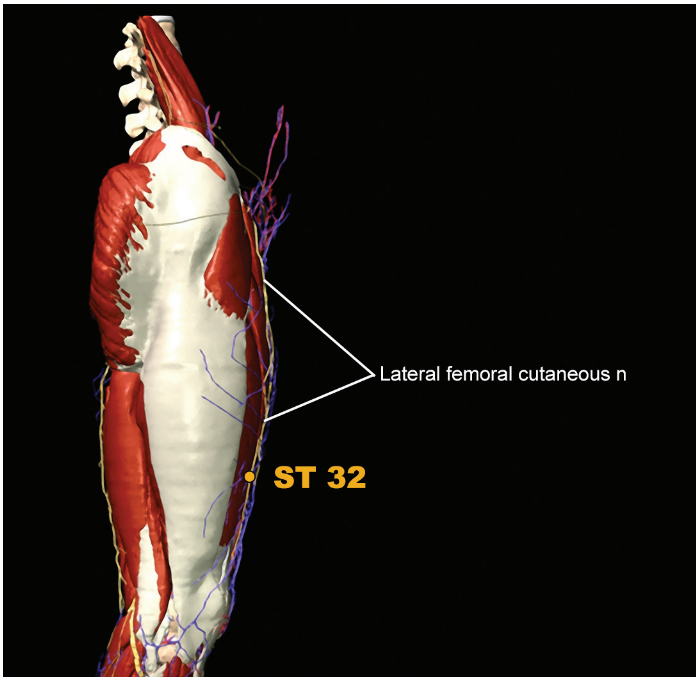

Lateral femoral cutaneous n
ST 32

Figure 3-83. ST 32 earned the name "Crouching Rabbit" for the bulge that appears in the living individual who is actively contracting the vastus lateralis muscle. The prominence in this bulge resembles the kyphotic spinal curvature of a rabbit crouching. While the Chinese name, "Futu", for ST 32, means "Crouching Rabbit", Futu for LI 18 means, "Support the Prominence".

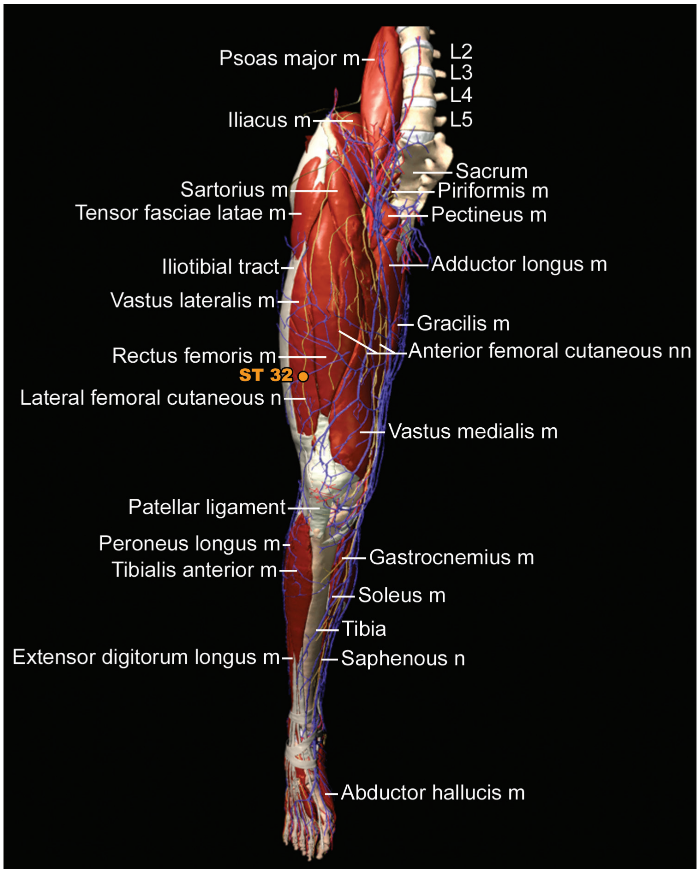

Psoas major m
L2
L3
L4
L5
Iliacus m
Sacrum
Sartorius m
Piriformis m
Tensor fasciae latae m
Pectineus m
Iliotibial tract
Adductor longus m
Vastus lateralis m
Gracilis m
Rectus femoris m
Anterior femoral cutaneous nn
ST 32
Lateral femoral cutaneous n
Vastus medialis m
Patellar ligament
Peroneus longus m
Gastrocnemius m
Tibialis anterior m
Soleus m
Tibia
Extensor digitorum longus m
Saphenous n
Abductor hallucis m

Figure 3-84. This image portrays ST 32 in the context of its neuromuscular neighbors.

Nerves

- **Anterior cutaneous branches of femoral nerve (L2-L4):** Supplies the skin on the anterior and medial parts of the thigh.
- **Lateral femoral cutaneous nerve (L2, L3):** Provides sensation to the skin on the lateral and anterior thigh.
- **Femoral nerve (L2-L4):** Innervates the quadriceps femoris muscle group, which extends the leg at the knee. Also supplies the iliacus, pectineus, and sartorius muscles. The femoral nerve provides articular branches to the hip joint and the knee joint, and provides a number of cutaneous branches that serve the anteromedial thigh region. The femoral nerve terminates as the saphenous nerve, a cutaneous branch. The saphenous nerve supplies the skin and fascia of the anteromedial portions of the knee, leg, and foot.

Clinical Relevance: Entrapment mononeuropathy of the lateral femoral cutaneous nerve has been implicated in meralgia paresthetica, a clinical syndrome involving burning pain and/or dysesthesia in the anterolateral thigh.

Contributing factors to meralgia paresthetica include 1) Repetitive or continuous contraction or pathological shortening of the iliopsoas and sartorius muscles, 2) Pelvic tilt and limb length discrepancy that place heightened tension on the inguinal ligament, and 3) Anatomic variations that make the lateral femoral cutaneous nerve more vulnerable to compression.[1]

Input from Group III- and Group IV-mediated afferent feedback through the femoral nerve influences the voluntary termination of exercise. This suggests that somatic afferent stimulation in the quadriceps muscle group may reduce peripheral fatigue and improve muscular adaptation to exercise.[2]

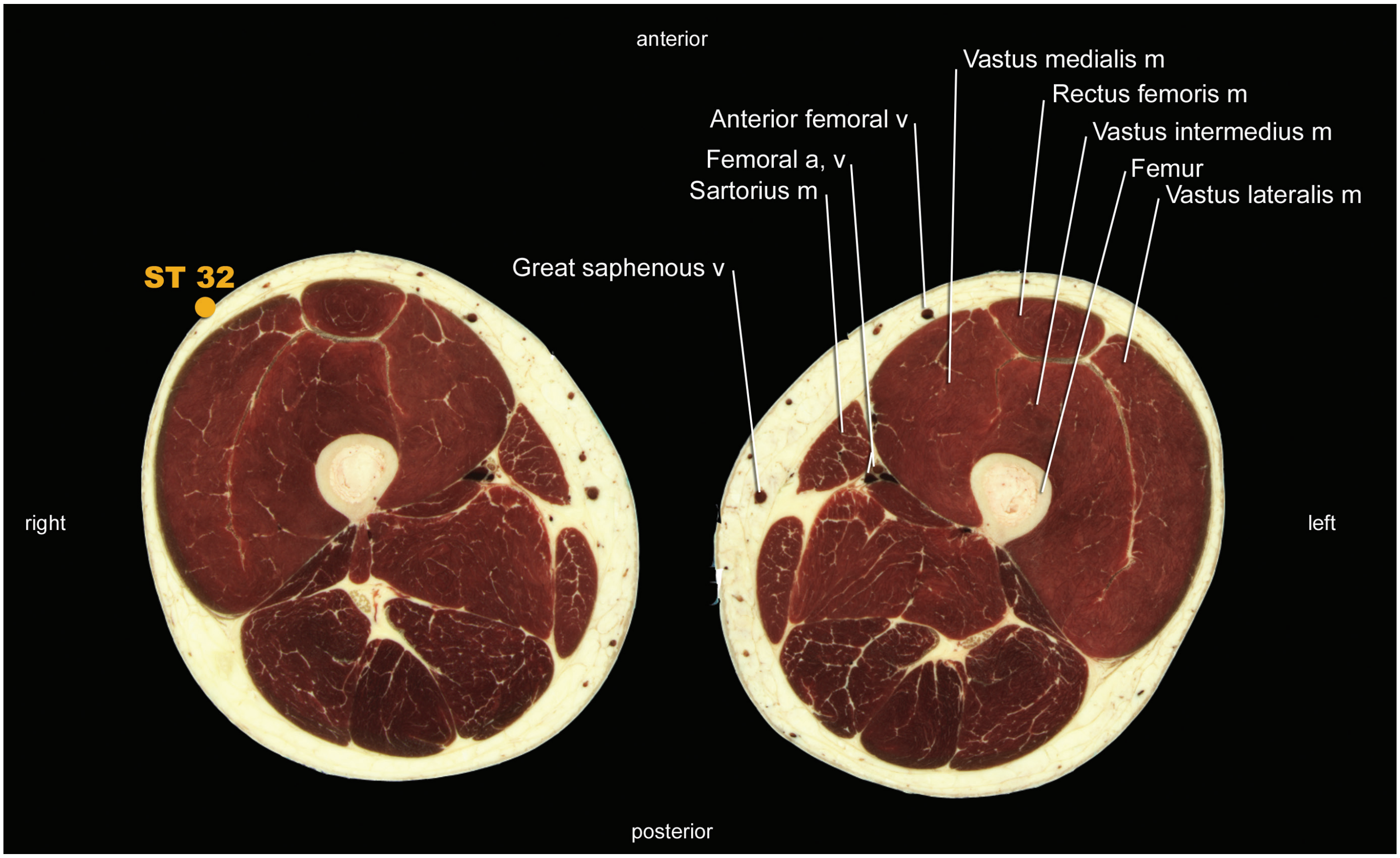


Figure 3-85. The cross section at ST 32 indicates the profound muscularity at this point. The underlying vastus lateralis muscle boasts the greatest muscle bulk of any of the quadriceps group and, as such, is responsible for a panoply of referred pain patterns, constituting a "hornet's nest" of problems, according to Travell and Simons. (Travell JG and Simons DG. *Volume 2. Myofascial Pain and Dysfunction. The Trigger Point Manual. The Lower Extremities.* Baltimore: Williams & Wilkins, 1983, p. 253.) Pain from myofascial trigger points in the vastus lateralis extends from the iliac crest to the lateral patella. Travell and Simons' nickname for the vastus intermedius muscle is "the frustrator" because its trigger points often elude direct palpation due to its central location. Pain patterns from vastus intermedius trigger points overlap with those of the vastus lateralis muscle. Both induce pain along the ST channel.

Vessels

- **Lateral circumflex femoral artery, descending branch:** Supplies the femoral head and lateral thigh musculature.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Pelvic somatic pain, anterior iliac region:** ST 32; palpate for myofascial trigger point contributors to palpatory tenderness, in addition to the vastus lateralis muscle, GB 26, GB 27, GB 28, GB 29; ST 36.
- **Pain, weakness, or paralysis of the legs (pelvic limbs) related to the femoral nerve distribution or midlumbar spinal segmental dysfunction:** ST 32,ST 36, Bafeng (web spaces between the toes), BL 23, BL 24, BL 25, GV 3, GV 4.

References

1. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res.* 2010;2(6):274-276.

2. Rossman MJ, Venturelli M, McDaniel J, et al. Muscle mass and peripheral fatigue: a potential role for afferent feedback? *Acta Physiol.* 2012; Jul 4. doi: 10.1111/j.1748-1716.2012.02471.x.

ST 33

Yin Shi "Yin Market"

On the anterior thigh, on the line connecting the ASIS with the superolateral angle of the patella, 3 cun proximal to the patella, along the lateral border of the rectus femoris muscle. ST 33 occurs midway between ST 32 and the superolateral patella.

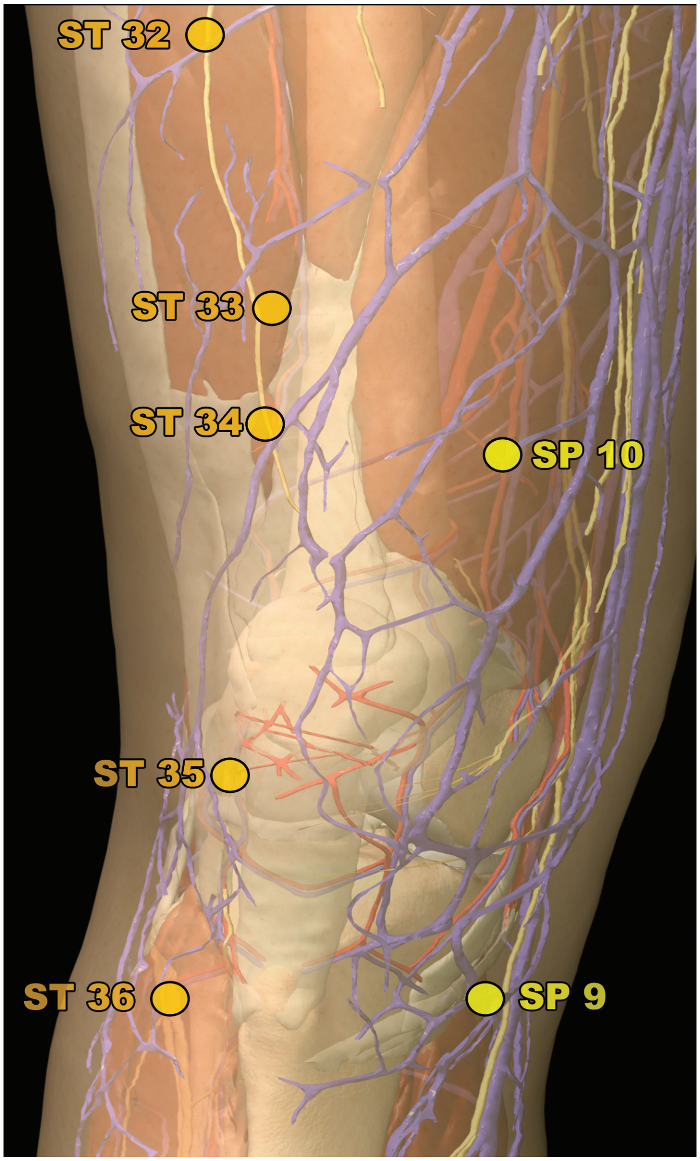


Figure 3-86. In Chinese medicine, climatic conditions of cold and damp (both "Yin" type pathogenic factors) are responsible for swelling and pain in the joint. These Yin pathogenic factors constitute a "Yin Market", i.e., the descriptive term for ST 33.

Muscles

- **Vastus lateralis muscle:** Extends the leg at the knee.
- **Rectus femoris muscle:** Extends the leg at the knee, and steadies the hip joint. Helps the iliopsoas muscle flex the thigh.

Clinical Relevance: A number of trigger points in the quadriceps group cause problems in the cranial thigh. Muscles affected by needling ST 33 depend on the depth and direction of needle insertion.

Nerves

- **Lateral femoral cutaneous nerve (L2, L3):** Provides sensation to the skin on the lateral and anterior thigh.
- **Femoral nerve (L2-L4):** Innervates the quadriceps femoris muscle group, which extends the leg at the knee. Also supplies the iliacus, pectineus, and sartorius muscles. The femoral nerve provides articular branches to the hip joint and the knee joint, and provides a number of cutaneous branches that serve the anteromedial thigh region. The femoral nerve terminates as the saphenous nerve, a cutaneous branch. The saphenous nerve supplies the skin and fascia of the anteromedial portions of the knee, leg, and foot.

Clinical Relevance: The femoral and lateral femoral cutaneous nerves govern strength and sensation, respectively, in the caudolateral thigh.

Vessels

- **Lateral circumflex femoral artery, descending branch:** Supplies the femoral head and lateral thigh musculature.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Knee pain, swelling, restriction in range of motion:** ST 33; palpate for myofascial trigger point contributors in the vastus lateralis muscle. Also evaluate ST 34 for tenderness to palpation, other trigger points in the region, and consider adding ST 35, ST 36, SP 9, SP 10, GB 34 for anterior knee pain.
- **Posterior knee pain:** ST 33, ST 34, and relevant KI, BL points.

ST 34

Liang Qiu "Ridge Mound", "Hill Ridge"

Above the knee, 2 cun proximal to the superolateral angle of the patella, along the lateral border of the tendon of the rectus femoris muscle. Because the height of the patella equals 2 cun, one can find ST 34 at the length of one patella above its superior border, along the line between the ASIS and the patella.

Muscles

- **Vastus lateralis muscle:** Extends the leg at the knee.
- **Rectus femoris muscle:** Extends the leg at the knee, and steadies the hip joint. Helps the iliopsoas muscle flex the thigh.

Clinical Relevance: A number of trigger points in the quadriceps group cause problems in the cranial thigh. Muscles affected by needling ST 34 depend on the depth and direction of needle insertion.

Nerves

- **Lateral femoral cutaneous nerve (L2, L3):** Provides sensation to the skin on the lateral and anterior thigh.
- **Femoral nerve (L2-L4):** Innervates the quadriceps femoris muscle group, which extends the leg at the knee. Also supplies the iliacus, pectineus, and sartorius muscles. The femoral nerve provides articular branches to the hip joint and the knee joint, and provides a number of cutaneous branches that serve the anteromedial thigh region. The femoral nerve terminates as the saphenous nerve, a cutaneous branch. The saphenous nerve supplies the skin and fascia of the anteromedial portions of the knee, leg, and foot.

Clinical Relevance: The femoral and lateral femoral cutaneous nerves govern strength and sensation, respectively, in the caudolateral thigh.

Vessels

- **Lateral circumflex femoral artery, descending branch**: Supplies the femoral head and lateral thigh musculature.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Anterior knee pain:** ST 34, ST 36, SP 10, SP 9. Consider myofascial trigger points referring to the knee, especially from the vastus lateralis (the "stuck patella" muscle), the rectus femoris (the "two-jointed puzzler"), the vastus intermedius (the "frustrator"), and the vastus medialis (the "buckling knee" muscle).
- **Leg pain or poor circulation in the pelvic limbs:** ST 34, after identifying the pain or impairment in circulation as originating from fascial restriction affecting the anterior pelvic limb. Release fascial restriction and trigger -point-generated tension. Add ST 36 as a distal point for cranial limb pain, or BL 40 for caudal limb pain.

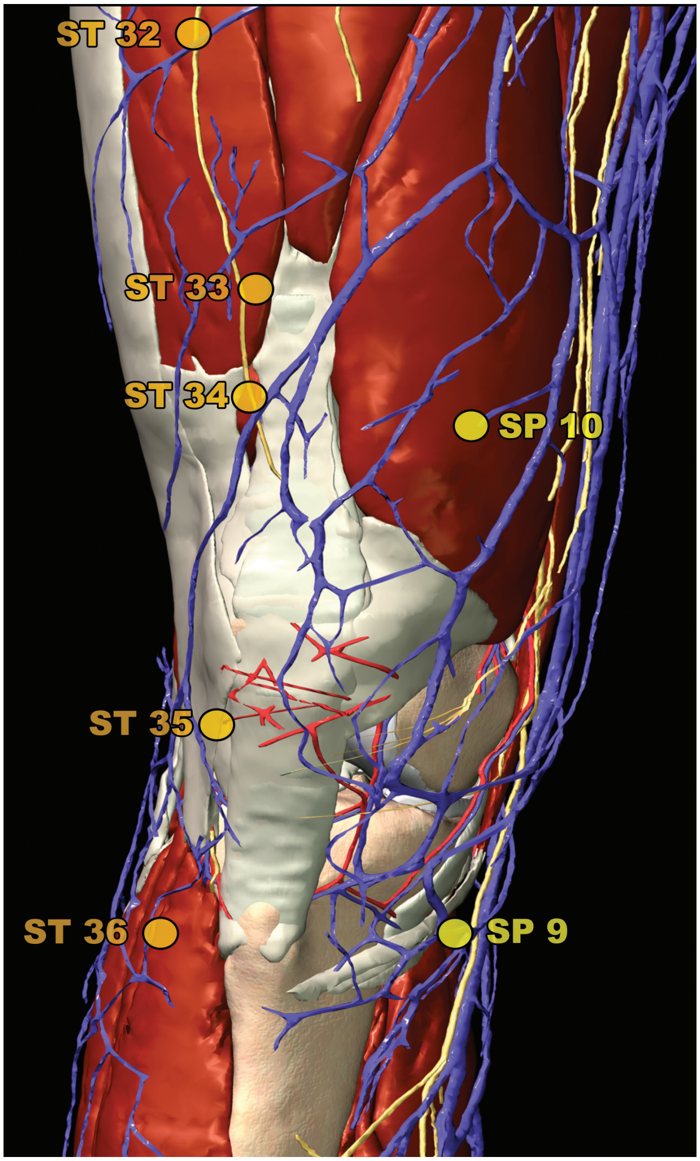


Figure 3-87. "Ridge Mound", or ST 34, sits at the lower limit of the mound produced by the vastus lateralis muscle.

Evidence-Based Applications

- Unilateral acupuncture for **advanced osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[1]
- Stimulation of ST 34 in geriatric individuals **improved gait performance** significantly better than a control point along the iliotibial band.[2] This is consistent with the finding that input from Group III- and Group IV-mediated afferent feedback through the femoral nerve influences the voluntary termination of exercise. Somatic afferent stimulation of the quadriceps muscle group may reduce peripheral fatigue and improve muscular adaptation to exercise.[1]

References

1. Tillu A, Roberts C, and Tillu S. Unilateral versus bilateral acupuncture on knee function in advanced osteoarthritis of the knee – a prospective randomized trial. *Acupuncture in Medicine.* 2001;19(1):15-18.

2. Hauer K, Wendt I, Schwenk M, et al. Stimulation of acupoint ST-34 acutely improves gait performance in geriatric patients during rehabilitation: a randomized controlled trial. *Arch Phys Med Rehabil.* 2011;92:7-14.

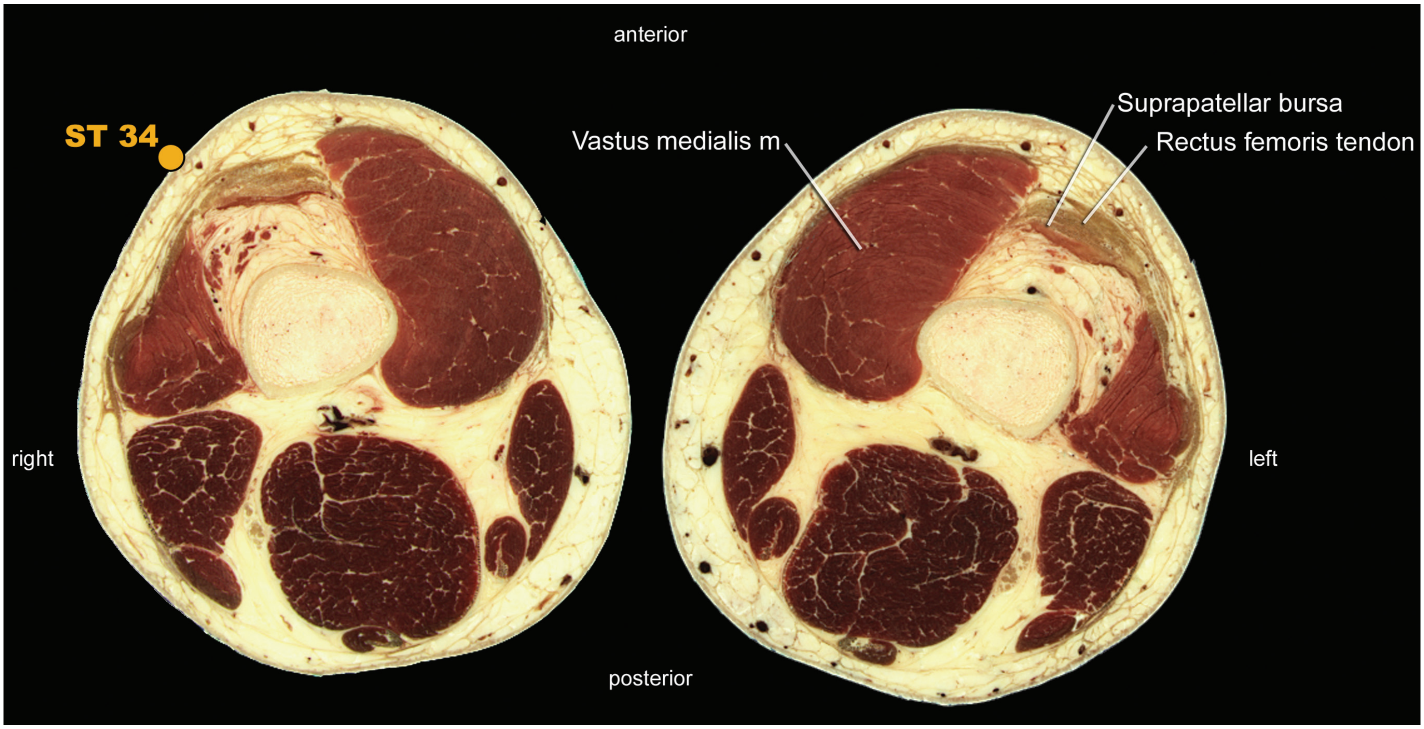

anterior
ST 34
Vastus medialis m
Suprapatellar bursa
Rectus femoris tendon
right
left
posterior

Figure 3-88. The suprapatellar bursa adjacent to ST 34 may help explain the point's indication for knee pain and arthritis. However, one should remain cautious when needling ST 34 so as not to cause suprapatellar bursitis.

ST 35

Du Bi "Calf's Nose"

In the depression below the patella and lateral to the patellar ligament, at approximately the level of the joint line of the knee.

Connective Tissues

- **Superficial infrapatellar bursa:** Sits between the patellar ligament and the skin, allowing mobility between the ligament and the skin.
- **Deep infrapatellar bursa:** Found at the lateral aspect of the patellar ligament, just proximal to the tibial tubercle. Allows for movement of the patellar ligament over the tibia.

Clinical Relevance: Disorders affecting the deep infrapatellar (also called retropatellar) bursa include calcification, inflammation, septic bursitis, gout, and traumatic hemorrhage.[2] The deep infrapatellar bursa can cause anterior knee pain in patients following patellectomy. Scarring of this bursa can lead to infrapatellar contraction syndrome. Acupuncture treatment of pain from infrapatellar bursitis can involve ST 35 due to its anatomic proximity to infrapatellar bursae.

Nerves

- **Anterior cutaneous branches of femoral nerve (L2-L4):** Supplies the skin on the anterior and medial parts of the thigh.
- **Infrapatellar branch of saphenous nerve:** The infrapatellar branch of the saphenous nerve provides cutaneous sensation to the anterior aspect of the knee as well as sensation to the anterior inferior knee capsule.
- **Recurrent articular nerve from common fibular (peroneal) nerve (from sciatic):** Supplies the knee joint. Branches of this nerve extend to the proximal anterior tibial muscle as well as the superior tibiofibular and knee joints.[3]

Clinical Relevance: Injury of the infrapatellar branch of the saphenous nerve may lead to anterior knee pain following various surgical procedures to the knee, including intramedullary nailing during repair of tibial shaft fracture. This neuropathic pain, including hyperalgesia, dysesthesia, and allodynia, may persist despite the absence of peripheral noxious stimulation or ongoing inflammation. In addition, surgical trauma may result in neuroma formation and reflex sympathetic dystrophy. Acupuncture may alleviate this neuropathic pain through local and regional influences.

Fibular intraneural cysts may affect motor and/or sensory branches of the fibular nerve. A cystic branch to the patellar tendon may cause disturbances in the region of ST 35.

Vessels

- **Lateral genicular anastomosis, joining the superior and lateral genicular arteries on the lateral aspect of the knee:** The arteries supplying the knee joint (and which form the arterial anastomoses around the knee) include genicular branches of the popliteal and femoral arteries as well as posterior recurrent branches of the anterior tibial recurrent and circumflex fibular arteries.

Clinical Relevance: Each of the contributing vessels to the genicular anastomoses provides the major source of blood to its respective region and supplies blood to the bony, ligamentous, meniscal, and regional soft tissues. Acupuncture at ST 35 may improve blood flow to regions in which vascular support has been impaired.

Indications and Potential Point Combinations

- **Knee joint pain:** ST 35, often combined with Xiyan (on medial border of patellar tendon) for knee problems. Together, these are known as the "Eyes of Knee."
- **Superficial infrapatellar bursitis ("clergyman knee"):** ST 35, Xiyan, ST 34, ST 36, SP 9, SP 10.

Evidence-Based Applications

- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis**, using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[1]
- Electroacupuncture (EA) and transcutaneous electrical nerve stimulation applied to painful **osteoarthritic knees** effectively reduced pain; EA also improved the "Timed Up-and-Go Test" (TUGT) scores.[5]

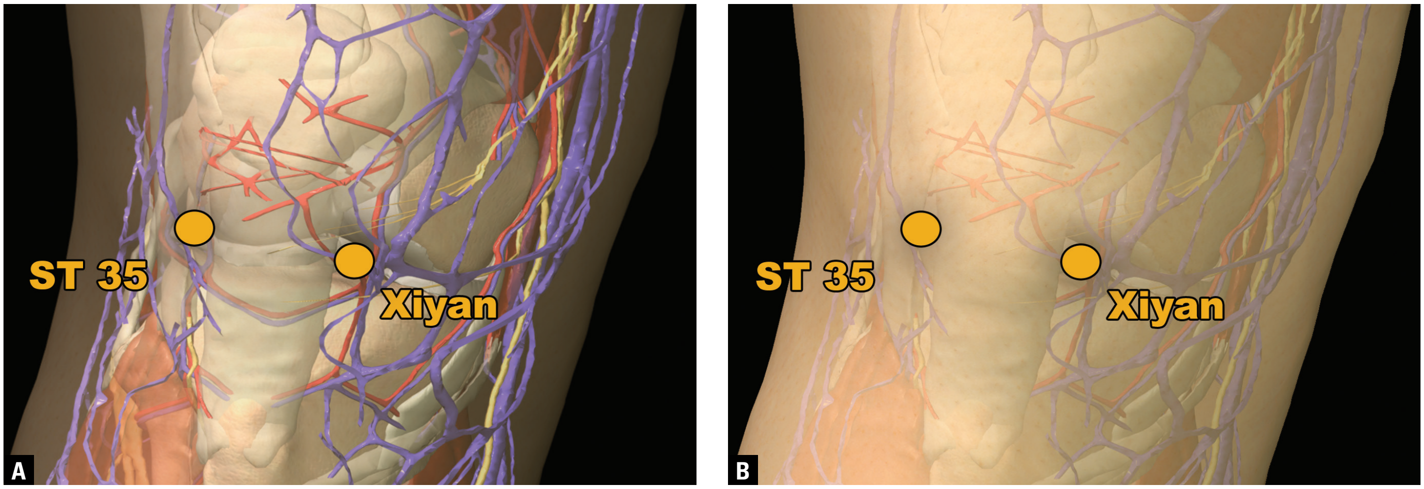


Figure 3-89A and B. When the knee extends, two depressions appear on either side of the patellar ligament, resembling the nose of a calf. Another term for this appearance is "Xiyan", meaning "Eyes of the Knee". ST 35 refers to the lateral eye of the knee.

- Laser acupuncture at ST 35 reduced pain in patients with **osteoarthritis in the knee.**[6]

References

1. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology.* 1999;38:346-354.
2. LaPrade RF. The anatomy of the deep infrapatellar bursa of the knee. *Am J Sports Medicine.* 1998;26(1): 129-132.
3. Spinner RJ, Puffer RC, Skinner JA, et al. The MRI appearance and importance of the "very" terminal branches of the recurrent articular branch in fibular intraneural ganglion cysts. *Clinical Anatomy.* 2011;24:268-272.
4. Leliveld MS and Verhofstad MHJ. Injury to the infrapatellar branch of the saphenous nerve, a possible cause for anterior knee pain after tibial nailing? *Injury, Int J Care Injured.* 2012;43:779-783.
5. Ng MML, Leung MCP, and Poon DMY. The effects of electro-acupuncture and transcutaneous electrical nerve stimulation on patients with painful osteoarthritic knees: a randomized controlled trial with follow-up evaluation. *J Alt Comp Med.* 2003;9(5):641-649.
6. Shen X, Zhao L, Ding G, et al. Effect of combined laser acupuncture on knee osteoarthritis: a pilot study. *Lasers Med Sci.* 2009;24:129-136.

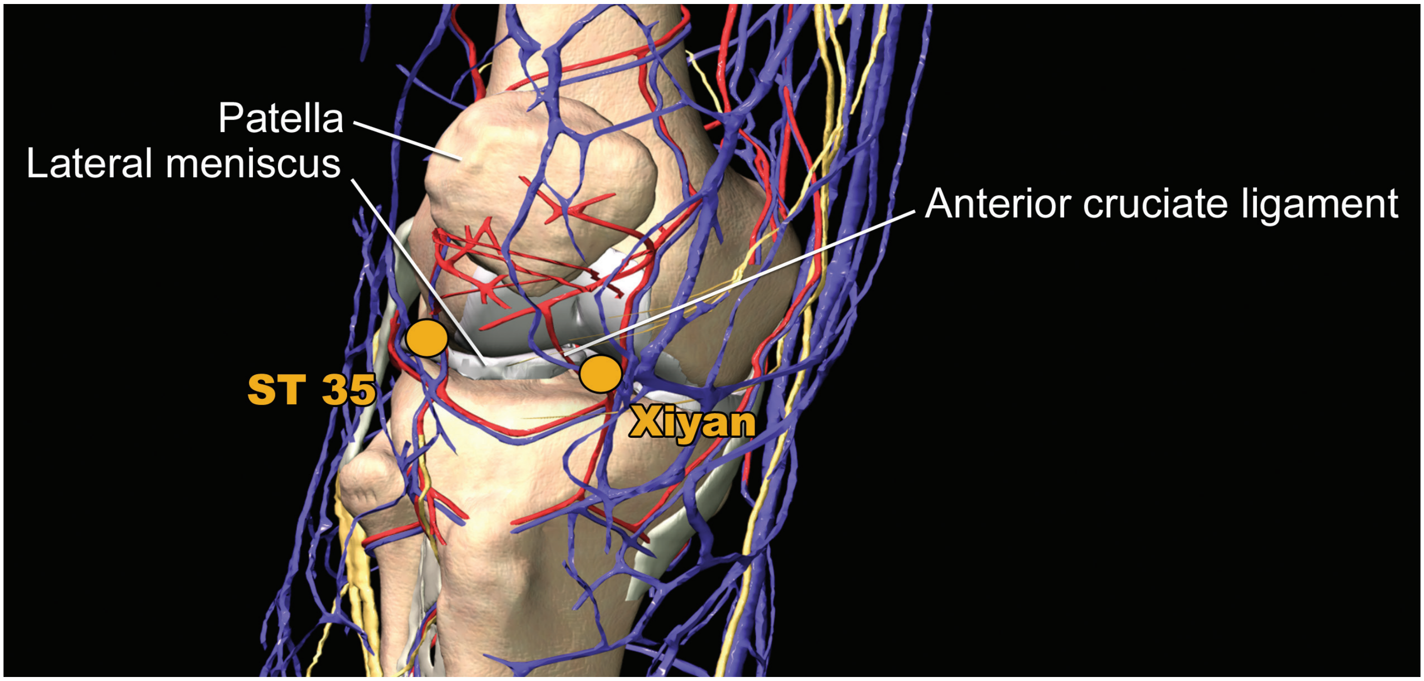

Patella
Lateral meniscus
Anterior cruciate ligament
ST 35
Xiyan

Figure 3-90. Note the proximity of the knee joint line to both ST 35 and (Medial) Xiyan. Although not shown here, the infrapatellar bursa, with its superficial and deep components, lies between the two points.

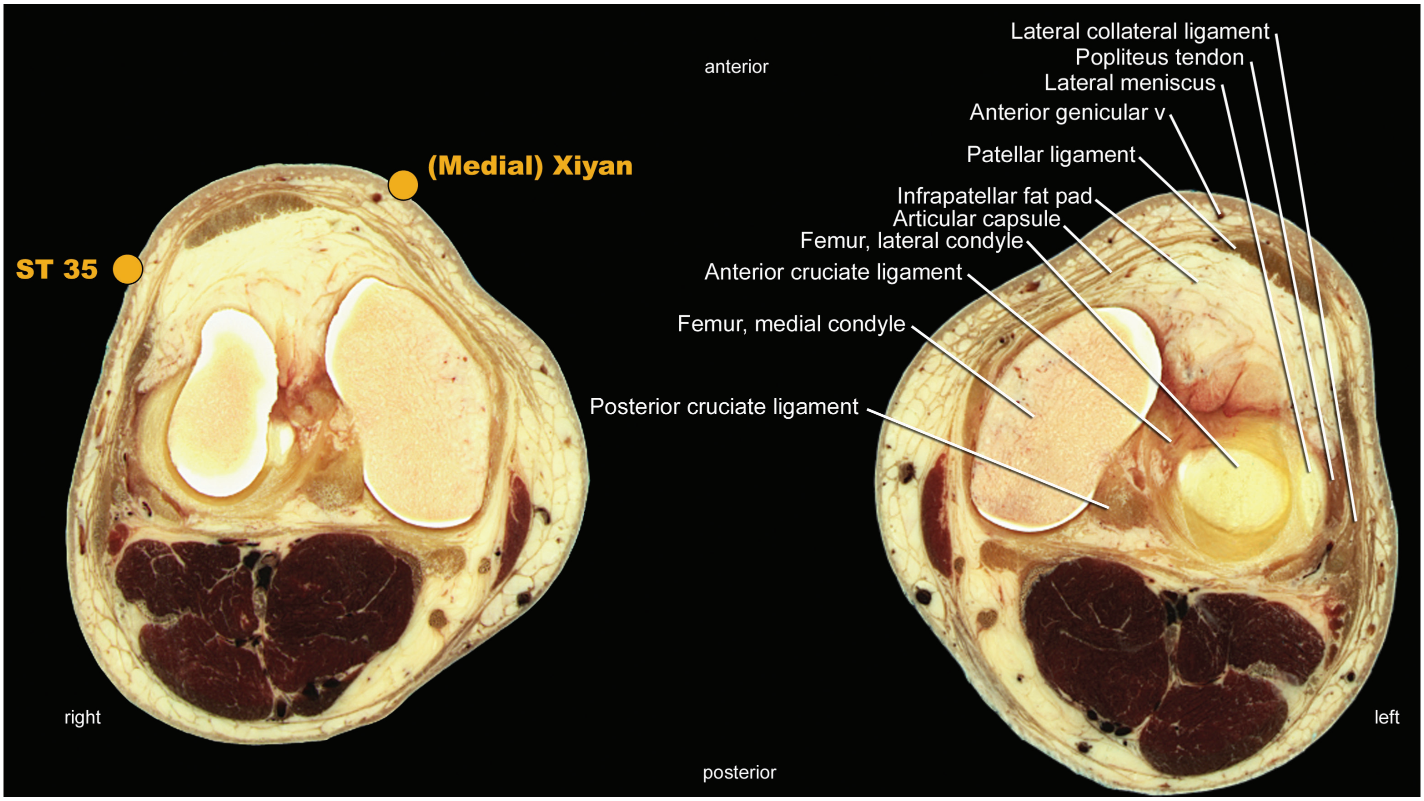

anterior
(Medial) Xiyan
ST 35
Lateral collateral ligament
Popliteus tendon
Lateral meniscus
Anterior genicular v
Patellar ligament
Infrapatellar fat pad
Articular capsule
Femur, lateral condyle
Anterior cruciate ligament
Femur, medial condyle
Posterior cruciate ligament
right
left
posterior

Figure 3-91. This cross section provides a glimpse the structures that a needle entering ST 35 might encounter.

ST 36

Zu San Li "Leg 3 Miles"

Below the knee, 3 cun distal to the apex of the patella and one finger-breadth lateral to the tibial tuberosity. Another point location method involves first finding GB 34; ST 36 lives 1 cun below GB 34 and 1 fingerbreadth lateral to the tibial tuberosity, or anterior crest of the tibia.

Connective Tissues

- **Interosseous membrane (IOM):** Separates the leg into an anterior and posterior compartment.

Clinical Relevance: The IOM of the leg and forearm share striking similarities, in light of the recognition that ankle and wrist injuries, respectively, simultaneously cause problems in the IOM, knee or elbow, and nerves that course between the tibia/fibula and radius/ulna.[75] Acupuncture at points such as ST 36 may improve the function and facilitate the repair of injured nerves, i.e., the fibular nerve in this case.

Muscles

- **Tibialis anterior muscle:** Inverts the foot and dorsiflexes the ankle.
- **Extensor digitorum longus muscle:** Dorsiflexes the ankle and extends the lateral four pedal digits.

Clinical Relevance: Muscle afferent activation in the anterior tibial and extensor digitorum longus muscles can affect organ function through a variety of neurologic connections, reflexes, and possibly also the release of "chaperone" proteins and their phosphorylation. Specifically, heat shock proteins (HSP), released after fatiguing stimulation of muscles in the anterior compartment of the crus, may constitute one potential pathway that affects cytoskeletal assembly and remodeling. Circulating HSP may alter metabolism and function of distant structures, including respiratory muscles, kidney, and brain.[76]

From a myofascial perspective, trigger point pathology in the anterior tibialis muscle at ST 36 leads to a descending pain referral pattern that proceeds directly down the shaft of the tibia, over the anterior ankle joint, and centered substantially over and within the great toe.

Manual acupuncture needle stimulation delivered to ST 36 activates every type of muscle afferent in the anterior tibialis muscle; i.e., groups I, II, III, and IV.[77] This finding provides insight into why stimulating ST 36 imparts such a wide variety of physiologic responses.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular nerve (L4, L5, S1):** Supplies skin on the anterior ankle and dorsum of the foot (except for the interdigital cleft). Also supplies the fibularis (peroneus) longus and brevis muscles.
- **Lateral sural cutaneous nerve (L4, L5, S1; branch of common fibular):** Supplies skin on the posterolateral portion of the lower leg.
- **Recurrent articular nerve from common fibular nerve:** Supplies the knee joint.

Clinical Relevance: Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[78]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[79,80] It is also important to note that, while acupuncture at ST 36 can facilitate recovery from fibular nerve injury,[81] too vigorous and deep needling could also injure the nerve.[82]

Afferent input from the fibular nerve at ST 36 and ST 37 ascends to the nucleus tractus solitarius (NTS) and dorsal motor nucleus of the vagus nerve (DMNV); EA at both of these sites regulates gastric motility.[83,84] However, activation of nerves at ST 37 demonstrated a less pronounced effect.

Compared to stimulation at ST 25, ST 36 activates the DMNV, while ST 25 influences activity in the rostral ventrolateral medulla (RVLM).[85] This emphasizes how acupuncture induces the regional specific effects that can preferentially modulate parasympathetic or sympathetic activity, respectively.

Vessels

- **Anterior tibial recurrent artery (ATRA):** Connects the anterior tibial artery to the genicular anastomosis and supplies structures in this region, including the lateral tibial condyle.[85] That ATRA anastomoses with the inferior lateral genicular artery (a branch of the popliteal artery) with branches surrounding the lateral intercondylar tubercle and the femoro-tibial joint capsule.

Clinical Relevance: The ATRA branches off of the anterior tibial artery (ATA) in the vicinity of ST 36. Thus, improving circulation

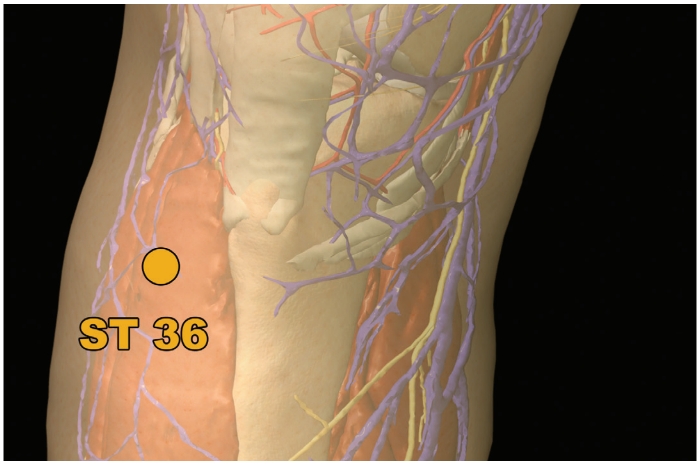


Figure 3-92. ST 36, "Leg Three Li", takes the lead for the amount of research performed on a single acupuncture point as well as its frequency of use in treatment. Its capacity to promote homeostasis makes it both an ancient and modern favorite. The name "Leg Three Li" implies its capacity to allow patients to walk longer distances with "li" equating to approximately 360 meters. Alternatively, "Leg Three Li" may simply indicate how one locates the point 3 cun, or 3 fingerbreadths, distal to the inferior border of the patella.

through acupuncture at ST 36 not only influences multiple levels of nerve function, but it also may improve hemodynamics of knee and surrounding structures. Arthroscopy of the joint, tibial fracture repair, and sub-meniscal arthrotomy may damage these fine vessels, requiring support through neuro- and circulatory modulation by means of acupuncture and related techniques.

Indications and Potential Point Combinations

- **As one of the most important acupuncture points in the body, ST 36 is worth considering as a supportive adjunct for nearly every condition. For some conditions, such as gastrointestinal motility disorders, its significance to modulate function makes its inclusion paramount. Its effects extend from the knee and pelvic limb as a whole to the lumbosacral spinal cord segments, brainstem (nucleus tractus solitarius and dorsal motor nucleus of the vagus nerve), limbic system, psychoneuroimmunologic regulation, and beyond.**
- **Gastrointestinal problems:** appendicitis, nausea and vomiting, gastritis, pain, diarrhea, constipation, dyspepsia, gastric ulcer: ST 36, BL 21, CV 12, PC 6.
- **Hepatitis and cholecystitis:** ST 36, GB 24, LR 14, CV 12.
- **All pain problems:** Combine with any pain management protocol to help counter the sympathetic overactivation associated with both acute and chronic pain.
- **Lower leg pain:** ST 36, pertinent trigger points. Specifically, myofascial trigger points in the tibialis anterior muscle refer to the cranial ankle (ST 41) and the big toe.
- **Fatigue, dizziness:** ST 36, GB 20, BL 10, GV 20.
- **Seizures:** ST 36, GB 20, Sishencong (GV 20 plus the four extra points 1 cun in either cardinal direction from GV 20; alternatively, GV 20 plus BL 7, BL 8). Add HT 7 for stress-induced seizures; LR 3 for nighttime seizures.
- **Asthma and breathing problems:** ST 36, BL 13, BL 23, LU 1, LU 2, LU 5, CV 17.
- **Immune stimulation:** ST 36, LI 4, LI 11, SP 6, GV 14.
- **Hypertension:** ST 36, ear points in the auricular branch of the vagus nerve distribution.
- **Hemiplegia:** ST 36, LI 4, points related to dysfunctional musculature to stimulate nerve function and release contraction, GV 20.
- **Metabolic disorders:** ST 36, ST 37, LI 4, GV 20, BL 22, BL 23; target additional points to specific dysfunction.

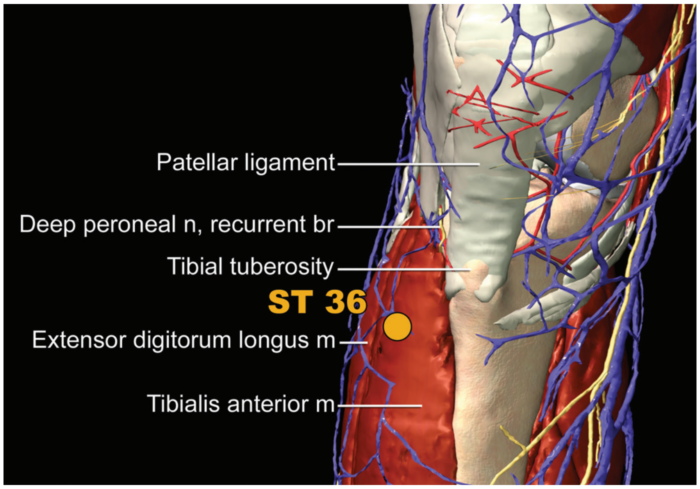


Figure 3-93. ST 36's location deep within the tibialis anterior muscle gives the acupuncturist ample opportunities to stimulate many types of afferents residing in this region. Stimulated somatic afferents in muscle from Groups I, II, III, and IV elicit widespread and diverse effects on the autonomic and central nervous systems. (Kagitani F, Uchida S, Hotta H, et al. Manual acupuncture needle stimulation of the rat hindlimb activates groups I, II, III and IV single afferent fibers in the dorsal spinal roots. Japanese Journal of Physiology. 2005;55(3):149-155.) Too, a rich supply of autonomic fibers from genicular arterial and venous anastomoses provide means of improving blood supply and drainage.

Evidence-Based Applications

Note: The number of studies on the physiology and clinical benefits of ST 36 seems endless and ever-growing. What appears below constitutes a mere snapshot of the times ST 36 has been tested clinically and experimentally. The main thing to remember regarding ST 36 is its capacity to neuromodulate not only from a musculoskeletal/somatic perspective but also in an autonomic/parasympathomimetic manner.

- Regarding the effects of acupuncture on canine **gastric motility** using ST 36, ST 40, ST 41, ST 42, ST 45, BL 12, or CV 12, only stimulation of ST 36 or BL 21 promoted gastric motility, whereas motility decreased with CV 12 stimulation. No significant changes in motility occurred after acupuncture at ST 40, ST 41, ST 42, or ST 45.[1]
- Acupuncture at LI 4, ST 36, SP 6, and SP 9 **reduced discomfort** and anxiety in patients undergoing colonoscopy.[2]
- Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients with **irritable bowel syndrome.**[3]
- Transcutaneous electrical nerve stimulation (TENS) at LI 4, LU 10, BL 57, and ST 36 effectively **reduced rectal hypersensitivity** in diarrhea-predominant **irritable bowel syndrome.**[4]
- Electroacupuncture at ST 36 and PC 6 **enhances gastric motility** by affecting the migrating myoelectrical complex.[5]
- Electroacupuncture at ST 36 altered the expression of nitric oxide synthase in the hypothalamus and adrenal gland, conferring **protective effects against ulcer** in a rat model.[6]
- Electroacupuncture simultaneously at both PC 6 and ST 36 has a synergistic effect on **gastric myoelectrical activity.**[7]
- Moxibustion (using *Artemisia vulgaris*) at CV 12, ST 25, and ST 36 was effective in **preventing acute gastric lesions** induced by indomethacin in rats.[8]
- Acupuncture at ST 36, CV 12, and PC 6 served as an effective short- and medium-term treatment for **chronic idiopathic dyspepsia**, with fewer adverse effects and longer effectiveness than treatment with the prokinetic agent, domperidone.[9]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully **treated sleep-related laryngospasm with gastroesophageal reflux**, refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[10]
- **Hypoglycemic** effects of ST 36 may involve serotonin.[11]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[12]

- Acupuncture at ST 36 exerted **dual effects (i.e., either stimulatory or inhibitory) on gastric motility depending on pre-treatment motility.** Stimulatory effects were mediated via vagal efferent and opioid pathways.[13]

- Acupuncture at ST 36 and LR 3 significantly **reduced liver injury** markers when rats were acupunctured after, but not before, CCL_4-induced hepatotoxicity.[14]

- Electroacupuncture at ST 36 influences **adrenal function.**[15]

- Acupuncture at LR 3, SP 6, SP 9, and ST 36 benefited patients with **chronic painful peripheral diabetic neuropathy.**[16]

- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis.**[17]

- Acupuncture and electroacupuncture at BL 17, BL 17.5, BL 20, BL 23, ST 36, and SP 6 effectively regulated levels of glucagon and immune factors, reduced blood coagulability, improved microcirculation, and heightened insulin sensitivity in **Type-II diabetics.**[18]

- Acupuncture at BL 32, TH 6, and ST 36 improved **constipation due to diabetes mellitus** in a report on a series of cases.[19]

- Electroacupuncture at ST 36 enhanced the regularity of gastric myoelectric activity in **diabetic patients with gastric dysrhythmia.**[20]

- Electroacupuncture at PC 6 and ST 36 helps control **chemotherapy-induced emesis.**[21]

- Acupuncture at ST 36 and GB 34 may exert their **hypotensive effects** by decreasing renin secretion.[22]

- Electroacupuncture at ST 36 **lowers blood pressure** in dogs, possibly in part by acting on opioid receptors on blood vessels.[23]

- Following **acute myocardial infarction,** patients receiving acupuncture at CV 14, CV 17, ST 36, PC 6, and SP 6 demonstrated the following changes: reduced blood viscosity and myocardial oxygen consumption, improved microcirculation and left ventricular function, improved collateral circulation, and reduced the area of infarction.[24]

- Electroacupuncture at ST 36 and ST 38 potentiated the **hypotensive effect** of nitroglycerin, which helped achieve the target mean arterial pressure during microscope middle ear surgery under general anesthesia with halothane.[25]

- Acupuncture at ST 36, BL 15, BL 20, HT 5, and PC 6 reduced the number of attacks per week in **angina** patients and reduced ST-segment depression during exercise, possibly indicating protection of the myocardium from ischemia.[26]

- A case report indicated that acupuncture at ST 36, KI 3, and LR 3 produced dramatic improvement in **chronic venous ulceration.**[27]

- Acupuncture at LI 4, LI 11, B 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[28]

- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud's syndrome**, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[29]

- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **keratoconjunctivitis sicca** (KCS, or dry eye).[30]

- The four points LI 11, SP 10, SP 6, and ST 36 treat **acute urticaria.**[31]

- May improve hypertension by **benefiting microcirculation;** studied with LI 11, LR 3, and LI 4.[32]

- Case report of improvement with acupuncture at LR 3, KI 3, SP 6, and ST 36 for **sweating associated with malignancy,** unresponsive to other measures.[33]

- Acupuncture-like transcutaneous nerve stimulation at SP 6, ST 36, LI 4, and CV 24 improves whole saliva production in patients with radiation-induced **xerostomia** in head-and-neck cancer patients treated with radical radiotherapy.[34]

- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4,

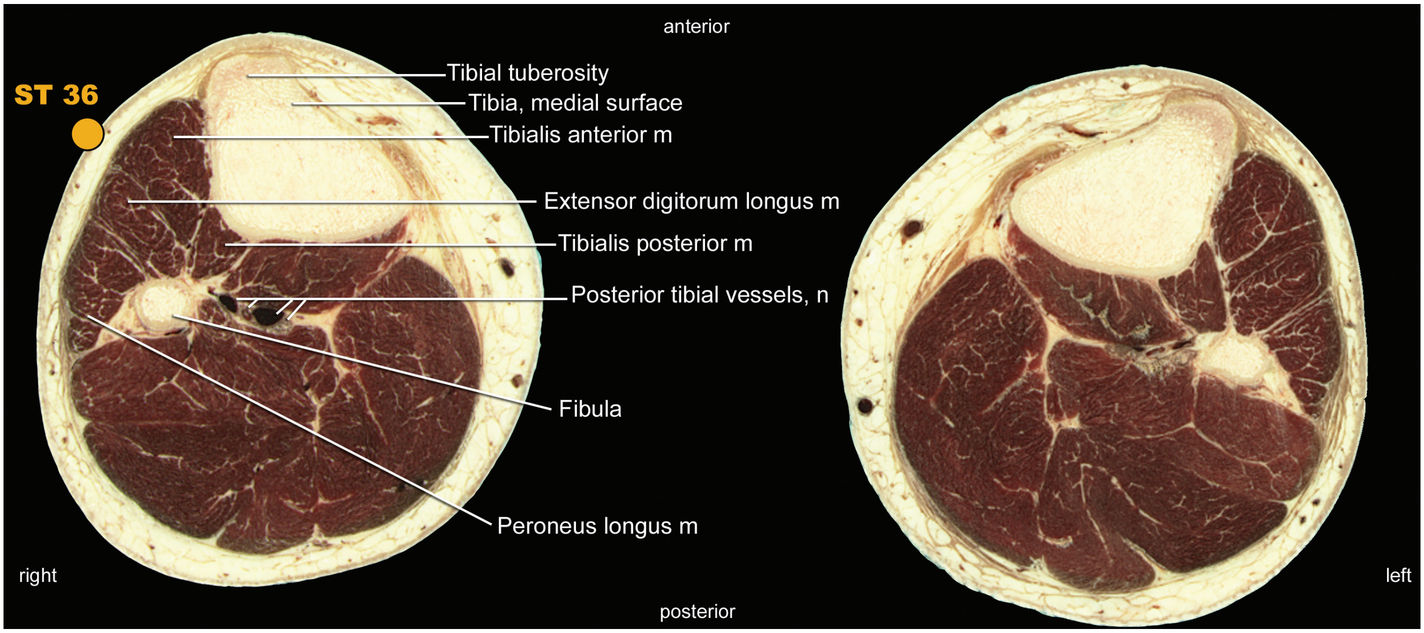


Figure 3-94. A needle inserted into ST 36 could penetrate either the tibialis anterior muscle, the extensor digitorum longus muscle, or both, depending on the angle of entry, as demonstrated by this cross section. That is, directing the needle toward the tibial tuberosity would select the tibialis anterior. A right-angle insertion method would impact the intermuscular cleavage plane, while a more lateral approach would target more the extensor digitorum longus muscle.

LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[35]

- Both manual acupuncture and low-frequency EA to LI 4, ST 4, ST 7, ST 36, HT 7, SP 6, and KI 5 caused significant increases in local blood flow overlying the parotid gland, suggesting a mechanism for increased salivary flow in **xerostomia** patients.[36]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with **Sjögren's syndrome.**[37]
- Acupuncture stimulation of GV 14 caused hypothermia via a decrease in metabolic rate, an increase in cutaneous circulation on the back, and perspiration. In contrast, acupuncture stimulation of PC 6 or ST 36 produced a slight **hyperthermia,** putatively due to a decrease in cutaneous circulation.[38]
- Acupuncture at SP 6 produced a strong vasoconstriction in the ipsilateral leg and a slight vasoconstriction in the contralateral leg with no change in the arms Stimulation of ST 36 produced a **superficial vasoconstriction** in the skin of both legs but no change in the arms. Stimulation of PC 6 or LI 11 caused ipsilateral vasoconstriction in the arms only. This information suggests a topographical representation in the neural segments responsible for the change in sympathetic activity.[39]
- Repeated acupuncture at ST 36, LI 11, SP 10, and GV 14 significantly decreased leukocyte and lymphocyte values in healthy humans, although cortisol and norepinephrine plasma levels remained unchanged. The mechanism whereby acupuncture affected **leukocyte circulation** was unknown.[40]
- A case series involving acupuncture at ST 36 supported its effectiveness in treating **leukopenia.**[41]
- Electroacupuncture at ST 36 **enhanced splenic natural killer (NK) cell cytotoxicity,** interleukin-2, and interferon-γ in rats.[42,43] The anterior hypothalamus may be at least partly responsible for modulating NK cell activity.[44]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with **Sjögren's syndrome.**[45]
- A case series evaluating acupuncture for **poison ivy contact dermatitis** reported effectiveness with the acupuncture points SP 10, LI 11, and ST 36.[46] These points were also effective in reducing the severity and preventing recurrences of **herpes simplex infections**[47] and in clearing **psoriasis lesions.**[48]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia (OAT syndrome).**[49]
- Needling GB 34, ST 36, SP 6, and BL 67 may help **decrease the need for labor induction and cesarean section.**[50]
- Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an effective **analgesic during oocyte aspiration;** these analgesic effects equal those of conventional analgesics.[51] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[52]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[53]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in **improvement in sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[54]
- Acupressure at KI 1, GB 34, ST 36, and SP 6 helped relieve **fatigue** in patients with **end-stage renal disease.**[55]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis** in women.[56]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[57]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[58]
- Unilateral acupuncture for advanced **osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[59]
- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis,** using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[60]
- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in **prophylaxis of migraine** compared to flunarizine.[61]
- **HIV-related peripheral neuropathy** improved with electroacupuncture on BL 60, ST 36, KI 1, and LR 3.[62]
- Electroacupuncture at ST 36 and ST 44 **affected monoamine (serotonin, dopamine, and norepinephrine) levels in the corpus striatum of obese rats** and increased ATPase activity in the striatum.[63]
- EA at GV 2, GV 14, GV 20, GV 24.5, prevented tissue shrinkage of the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and perirhinal cortex. EA at ST 36 and SP 6 prevented tissue shrinkage in all of the aforementioned regions except for the dorsal hippocampus. EA to GV 2 + GV 14 + GV 20 + GV 24.5 or ST 36 + SP 6 reduced the cognitive deficits in pilocarpine-epileptic rats. Administration of p-chlorophenylalanine, a compound that depletes serotonin, negated the behavioral and some of the histologic changes due to EA. This suggests that the functional recovery exhibited by the rats may have been influenced through serotonergic pathways affected by acupuncture and subsequent **neuroprotective benefits.**[64]
- Electroacupuncture at ST 36 and ST 44 increased the frequency of spontaneous discharges of neurons in the ventromedial nucleus of the hypothalamus (VMH) in obese rats. It also increased the levels of tyrosine, dopamine, tryptamine, while lowering serotonin levels. This suggested that acupuncture may be beneficial for **weight reduction** by influencing the satiety center – the VMH.[65]
- Electroacupuncture at GV 2, GV 14, and ST 36 markedly **suppressed cortical epileptiform discharges** in rats. Possible mechanisms involved include alterations of opioid, serotonin, and

gamma-aminobutyric acid (GABA) levels and recurrent inhibition of the cortex and hippocampus.[66]

- Acupuncture at LI 4 and ST 36 **activated the hypothalamus and nucleus accumbens.** Both of these brain structures are important in mediating acupuncture analgesia. Acupuncture at LI 4 and ST 36 **deactivated areas within the limbic system,** including the rostral part of the anterior cingulate cortex, amygdala formation, and hippocampal complex. Limbic deactivation may play a role in acupuncture analgesia by affecting pain perception – in particular, its affective-cognitive aspect.[67]

- Electroacupuncture at ST 36 + SP 6 was compared to GB 34 + BL 57, in order to study differences in brain activation from acupuncture points located in the same spinal segments. Both overlapping and distinct cerebral response patterns from stimulation of the two pairs were observed. Both pairs of points (ST 36/SP 6 and GB 34/BL 57) activated the primary and secondary somatosensory areas, insula, ventral thalamus, parietal Brodmann Area 40, temporal lobe, putamen, and cerebellum; both deactivated the amygdala. However, ST 36/SP 6 **specifically activated the orbital frontal cortex and deactivated the hippocampus,** while GB 34/BL 57 activated the dorsal thalamus and inhibited the primary motor area and premotor cortex. These cerebral response differences may help explain why ST 36/SP 6 is indicated more for visceral disorders and pain while GB 34/BL 57 are important points for modulation of muscle and tendon function and motor output.[68]

- **Electroacupuncture at ST 36 (especially at low frequency) produced more widespread fMRI signal increase than manual acupuncture.** Hemodynamic signal increases from acupuncture were noted in the anterior insula, while decreases were noted in limbic and paralimbic structures: the amygdala, anterior hippocampus, subgenual cortex, retrosplenial cingulate cortex, ventromedial prefrontal cortex, frontal pole, and temporal pole. Electroacupuncture, but not manual acupuncture, produced a significant signal increase in the anterior middle cingulate cortex. Only low frequency (i.e., 2 Hz) electroacupuncture produced a signal increase in the pontine raphe area. These findings are concordant with those of other researchers indicating that the limbic system plays an important role in mediating the effects of acupuncture on the central nervous system.[69]

- Input from ST 36 converges on the **nucleus tractus solitarius (NTS),** which may account for the autonomic effects of stimulating this point.[70]

- Pre-injury electroacupuncture at GB 20 or ST 36 can partly regulate the lipid peroxidation occurring as a consequence of **cerebral ischemia.**[71]

- Electroacupuncture at ST 36 or GB 20 may increase thioredoxin expression which could minimize oxidative modifications of thiol groups of surrounding proteins, thereby helping reduce oxidative damage following **brain ischemia.**[72]

- Acupuncture at CV 17, CV 12, CV 6, ST 36, and SP 10 conferred protective effects on **cognitive impairments** caused by multi-infarction dementia in rats, suggesting it may benefit patients with vascular dementia.[73]

- Neuroanatomical tracers have demonstrated commonality of central nervous system cell groups in the brain that control the stomach and the limb at ST 36. Overlapping neurons showed up in the dorsal motor nucleus of the vagus nerve, the nucleus raphe magnus, the nucleus gigantocellularis, the locus coeruleus, and hypothalamic nuclei, in addition to several other locations.[74]

References

1. Jeong SM, Kim H-Y, and Nam T-C. Effect of traditional acupuncture on canine gastric motility. *J Vet Clin.* 2002;19(4):397-400.

2. Fanti L, Gemma M, Passaretti S, Guslandi M, Testoni PA, Casati A, and Torri G. Electroacupuncture analgesia for colonoscopy: a prospective, randomized, placebo-controlled study. *American Journal of Gastroenterology.* 2003;98(2):312-316.

3. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.

4. Xiao W-B and Liu Y-L. Rectal hypersensitivity reduced by acupoint TENS in patients with diarrhea-predominant irritable bowel syndrome: a pilot study. *Digestive Diseases and Sciences.* 2004;49(2):312-319.

5. Qian L, Peters LJ, and Chen JDZ. Effects of electroacupuncture on gastric migrating myoelectrical complex in dogs. *Digestive Diseases and Sciences.* 1999;44(1):56-62.

6. Sun J-P, Pei H-T, Jin X-L, Yin L, Tian Q-H, and Tian S-J. Effects of acupuncturing Tsusanli (ST36) on expression of nitric oxide synthase in hypothalamus and adrenal gland in rats with cold stress ulcer. *World Journal of Gastroenterology.* 2005;11(32):4962-4966.

7. Shiotani A, Tatewaki M, Hoshino E, and Takahashi T. Effects of electroacupuncture on gastric myoelectrical activity in healthy humans. *Neurogastroenterol Motil.* 2004;16:293-298.

8. Freire AO, Sugai GCM, Blanco MM, Tabosa A, Yamamura Y, and Mello LEAM. Effect of moxibustion at acupoint Ren-12 (Zhongwan), St-25 (Tianshu), and St-36 (Zuzanli) in the prevention of gastric lesions induced by indomethacin in Wistar rats. *Digestive Diseases and Sciences.* 2005;50(2):366-374.

9. Cittadini M, Marmori F, Diacinti D, and Walker JI. Randomized trial of acupuncture compared with prokinetic drugs and sham acupuncture for chronic idiopathic dyspepsia. *Medical Acupuncture.* 14(2). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol14_2/article2.html.

10. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci.* 2003;326(2):107-109.

11. Chang S-L, Tsai C-C, Lin J-G, Hsieh C-L, Lin R-T, and Cheng J-T. Involvement of serotonin in the hypoglycemic response to 2Hz electroacupuncture of zusanli acupoint (ST36) in rats. *Neuroscience Letters.* 2005;379:69-73.

12. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.

13. Tatewaki M, Harris M, Uemura K, Ueno T, Hoshino E, Shiotani A, Pappas TN, and Takahashi T. Dual effects of acupuncture on gastric motility in conscious rats. *Am J Physiol Regul Integr Comp PHysiol.* 2003;285:R862-R872.

14. Liu H-J, Hsu S-F, Hsieh C-C, Ho T-Y, Hsieh C-L, Tsai C-C, and Lin J-G. The effectiveness of Tsu-San-Li (St-36) and Tai-Chung (Li-3) acupoints for treatment of acute liver damage in rats. *American Journal of Chinese Medicine.* 2001;29(2):221-226.

15. Lin JS, Su HL, Chang SH, Shien YS, and Wu LS. Treatment of iatrogenic Cushing's syndrome in dogs with electroacupuncture stimulation of Stomach 36. *American Journal of Chinese Medicine.* 1991;19(1):9-15.

16. Abuaisha BB, Costanzi JB, and Boulton AJM. Acupuncture for the treatment of chronic painful peripheral diabetic neuropathy: a long-term study. *Diabetes Research and Clinical Practice.* 1998;29:115-121.

17. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine.* 2004;24(3):163-165.

18. Chen J, Ma Y, Cai S, Liang H, and Shen J. Effects of acupuncture on the high hemagglutination state, blood-sugar-raising hormone and immunocyte factor levels in type-II diabetes patients. *World J Acup-Mox.* 2001;11(4):12-17.

19. Xiong X-H and Deng De-Ming. Acupuncture treatment of constipation due to diabetes mellitus: an observation of 21 cases. *International Journal of Clinical Acupuncture.* 1995;6(1):19-21.

20. Chang C-S, Ko C-W, Wu C-Y, and Chen G-H. Effect of electrical stimulation on acupuncture points in diabetic patients with gastric dysrhythmia: a pilot study. *Digestion.* 2001;64:184-190.

21. Shen J, Wenger N, Glaspy J, Hays RD, Albert PS, Choi C, and Chekelle PG. Electroacupuncture for control of myeloablative chemotherapy-induced emesis. A randomized controlled trial. *JAMA.* 2000;284:2755-2761.

22. Chiu YJ, Chi A, and Reid IA. Cardiovascular and endocrine effects of acupuncture in hypertensive patients. *Clin and Exper Hypertension.* 1997;19(7):1047-1063.

23. Li P, Sun F-Y, and Zhang A-Z. The effect of acupuncture on blood pressure: the interrelation of sympathetic activity and endogenous opioid peptides. *Acupuncture & Electrotherapeutics Res., Int J.* 1983;8:45-56.

24. Zhu B, Bi L, Liang S, Pang L, Wang S, Liu J, Jiang A, Li C, Ye Z, Yang H, Chen Z, Wang K, Bian S, Guo X, and Hong H. Effect of acupuncture on left ventricular function, microcirculation, blood rheology and cyclicnucleotides in patients with acute myocardial infarction. *Journal of Traditional Chinese Medicine.* 1989;9(1):63-68.

25. Saghaei M, Ahmadi A, and Rezvani M. Clinical trial of nitroglycerin-induced controlled hypotension with or without acupoint electrical stimulation in microscopic middle ear surgery under general anesthesia with halothane. *Acta Anaesthesiol Tiawanica.* 2005;43:135-139.

26. Richter A, Herlitz J, and Hialmarson A. Effect of acupuncture in patients with angina pectoris. *European Heart Journal.* 1991;12:175-178.

27. Mears T. Acupuncture for chronic venous ulceration. *Acupuncture in Medicine.* 2003;21(4):150-152.

28. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.*

1995;13(2):91-92.

29. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine*. 1997;241:119-124.

30. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand*. 2004;82:283-290.

31. Chen C-J and Yu H-S. Acupuncture treatment of urticaria. *Arch Dermatol*. 1998;134:1397-1399.

32. Zhou Y, Chen Q, Hou Z, and Chen Y. Experimental research on treatment of hypertension with acupuncture. *Journal of Traditional Chinese Medicine*. 1993;13(4):277-280.

33. Hallam C and Whale C. Acupuncture for the treatment of sweating associated with malignancy. *Acupuncture in Medicine*. 2003;21(4):155-156.

34. Wong RKW, Jones GW, Sagar SM, Babjak A-F, and Whelan T. A Phase I-II study in the use of acupuncture-like transcutaneous nerve stimulation in the treatment of radiation-induced xerostomia in head-and-neck cancer patients treated with radical radiotherapy. *Int J Radiation Oncology Biol Phys*. 2003;57(2):472-480.

35. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.

36. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson B. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjogren's syndrome. *Journal of Oral Rehabilitation*. 1993;20:541-548.

37. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation*. 1993;20:541-548.

38. Lin M-T, Liu G-G, Soong J-J, Chern Y-F, and Wu K-M. Effects of stimulation of acupuncture loci Ta-Chuei (Go-14), Nei-Kuan (EH-6) and Tsu-San-Li (St-36) on thermoregulatory function of normal adults. *Am J Chin Med*. 1979;7(4):324-332.

39. Lin M-T, Chandra A, and Chen-Yen S-M. Effects of needle stimulation of acupuncture loci Nei-Kuan (EH-6), Tsu-San-Li (St-36), San-Yin-Chiao (Sp-6) and Chu-Chih (LI-11) on cutaneous temperature and pain threshold in normal adults. *Am J Chin Med*. 1982;9(4):305-314.

40. Kou W, Bell JD, Gareus I, Pacheco-Lopez G, Goebel MU, Spahn G, Stratmann M, Janssen OE, Schedlowski M, and Dobos GJ. Repeated acupuncture treatment affects leukocyte circulation in healthy young male subjects: a randomized single-blind two-period crossover study. *Brain, Behavior, and Immunity*. 2005;19:318-324.

41. Wei Z. Clinical observation on therapeutic effect of acupuncture at Zusanli for leukopenia. *Journal of Traditional Chinese Medicine*. 1998;18(2):94-95.

42. Yu Y, Kasahara T, Sato T, Guo S-Y, Liu Y-Q, Asano K, and Hisamitsu T. Enhancement of splenic interferon-γ, interleukin-2, and NK cytotoxicity by S 36 acupoint acupuncture in F344 rats. *Japanese Journal of Physiology*. 1997;47:173-178.

43. Sato T, Yu Y, Guo SY, Kasahara T, and Hisamitsu T. Acupuncture stimulation enhances splenic natural killer cell cytotoxicity in rats. *Japanese Journal of Physiology*. 1996;46:131-136.

44. Hahm E-T, Lee J-J, Lee W-K, Bae H-S, Min B-I, and Cho Y-W. Electroacupuncture enhancement of natural killer cell activity suppressed by anterior hypothalamic lesions in rats. *Neuroimmunomodulation*. 2004;11:268-272.

45. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation*. 1993;20:541-548.

46. Lioa SJ. Acupuncture for poison ivy contact dermatitis. *Acupuncture & Electrotherapeutics Res., Int J*. 1988;13:31-39.

47. Liao SJ. Acupuncture treatment for herpes simplex infections. *Acupuncture & Electrotherapeutics Res., Int J*. 1991;16:135-142.

48. Liao SJ and Liao TA. Acupuncture treatment for psoriasis: a retrospective case report. *Acupuncture & Electrotherapeutics Res., Int J*. 1992;17:195-208.

49. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.

50. Duke K and Don M. Acupuncture use for pre-birth treatment. A literature review and audit-based research. *Complementary Therapies in Clinical Practice*. 2005;11:121-126.

51. Stener-Victorin E, Waldenström U, Nilsson L, Wikland M, Janson PO. A prospective randomized study of electro-acupuncture versus alfentanil as anaesthesia during oocyte aspiration in in-vitro fertilization. *Human Reproduction*. 1999;14(10):2480-2484.

52. Stener-Victorin E, Waldenström U, Wikland M, Nilsson L, Hägglund L, and Lundeberg T. Electro-acupuncture as a preoperative analgesic method and its effects on implantation rate and neuropeptide Y concentrations in follicular fluid. *Human Reproduction*. 2003;18(7):1454-1460.

53. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.

54. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility*. 2005;84(1):141-147.

55. Tsay S-L. Acupressure and fatigue in patients with end-stage renal disease – a randomized controlled trial. *International Journal of Nursing Studies*. 2004;41:99-106.

56. Alraek T and Baerheim A. "An empty and happy feeling in the bladder…": health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine*. 2001;9(4):219-223.

57. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. Journal of International Medical Research. 2003;31:552-556.

58. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. Acupuncture in Medicine. 2003;21(4):138-149.

59. Tillu A, Roberts C, and Tillu S. Unilateral versus bilateral acupuncture on knee function in advanced osteoarthritis of the knee – a prospective randomized trial. Acupuncture in Medicine. 2001;19(1):15-18.

60. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology*. 1999;38:346-354.

61. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache*. 2002;42:855-861.

62. Galantino MLA, Eke-Okoro ST, Findley TW, and Condoluci D. Use of noninvasive electroacupuncture for the treatment of HIV-related peripheral neuropathy: a pilot study. *Journal of Alternative and Complementary Medicine*. 1999;5(2):135-142.

63. Liu Z, Sun F, Zhu M, Wang Y, Wei Q, Su J, and Yuan J. Effect of acupuncture on the striatum of obesity rats. *Acupuncture Research*. 2001;26(2):122-126.

64. Guilherme dos Santos Jr. J. Tabosa A, Hoffman Martins do Monte F, Blanco MM, de Oliveira Freire A, and Mello LE. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neuroscience Letters* 2005;384:234-238.

65. Liu Z, Sun F, Su J, Zhao M, Zhu M, Wang Y, Wei Q, Li J, and Gu Y. Study on action of acupuncture on ventromedial nucleus of hypothalamus in obese rats. *Journal of Traditional Chinese Medicine*. 2001;21(3):220-224.

66. Wu D. Mechanism of acupuncture in suppressing epileptic seizures. *Journal of Traditional Chinese Medicine*. 1992;12(3):187-192.

67. Wu M-T, Hsieh J-C, Xiong J, Yang C-F, Pan H-B, Chen Y-CI, Tsai G, Rosen BR, and Kwong KK. Central nervous pathway for acupuncture stimulation: Localization of processing with functional MR imaging of the brain – preliminary experience. *Radiology*. 1999;212:133-141.

68. Zhang W-T, Jin Z, Luo F, Zhang L, Zeng Y-W, and Han J-S. Evidence from brain imaging with fMRI supporting functional specificity of acupoints in humans. *Neuroscience Letters*. 2004;354:50-53.

69. Napadow V, Makris N, Liu J, Ketner NW< kwong KK, and Hui KKS. Effects of electroacupuncture versus manual acupuncture on the human brain as measured by fMRI. *Human Brain Mapping*. 2005;24:193-205.

70. Meng Z and Lu G-W. The functional linkage among the "ZSL" – spinal dorsal horn – SN. *Science in China (Series B)*. 1993;36(10):1198-1206.

71. Siu FKW, Lo SCL, and Leung MCP. Effectiveness of multiple pre-ischemia electro-acupuncture on attenuating lipid peroxidation induced by cerebral ischemia in adult rats. *Life Sciences*. 2004;75:1323-1332.

72. Siu FKW, LO SCL, and Leung MCP. Electro-acupuncture potentiates the disulphide-reducing activities of thioredoxin system by increasing thioredoxin expression in ischemia-reperfused rat brains. *Life Sciences*. 2005;77:386-399.

73. Yu J, Liu C, Zhang X, and Han J. Acupuncture improved cognitive impairment caused by multi-infarct dementia in rats. *Physiology and Behavior*. 2005 [in press].

74. Lee CH, Jung HS, Lee TY, et al. Studies of the central neural pathways to the stomach and Zusanli (ST36). *Am J Chin Med*. 2001;29(2):211-220.

75. Lalezari S, Amrami KK, Tubbs RS, et al. Interosseous membrane: The anatomic basis for combined ankle and common fibular (peroneal) nerve injuries. *Clinical Anatomy*. 25:401-406.

76. Jammes Y, Steinberg JG, By Y, et al. Fatiguing stimulation of one skeletal muscle triggers heat shock proteins activation in several rat organs: the role of muscle innervation. *J Exp Biol*. 2012; 215(Pt22):4041-4048.

77. Kagitani F, Uchida S, Hotta H, et al. Manual acupuncture needle stimulation of the rat hindlimb activates groups I, II, III, and IV single afferent nerve fibers in the dorsal spinal roots. *Jpn J Physiol*. 2005;55(3):149-155.

78. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation*. 2013;16(3):256-260.

79. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med*. 2012;18(2):130-136.

80. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol*. 2006;291(1):H318-H326.

81. Lu Z and Chen Z. Electroacupuncture for treatment of 12 cases of infantile peroneal nerve injury. *J Tradit Chin Med*. 2000;20(2):130-131.

82. Sato M, Katsumoto H, Kawamura K, et al. Peroneal nerve palsy following acupuncture treatment. A case report. *J Bone Joint Surg Am*. 2003;85-A(5):916-918.

83. Wang JJ, Liu XD, Qin M, et al. Electro-acupuncture of Tsusanli and Shangchuhsu regulates gastric activity possibly through mediation of the vagus solotary (sic) complex. *Hepatogastroenterology*. 2007;54(78):1862-1867.

84. Wang JJ, Ming Q, Liu XD, et al. Electro-acupuncture of Foot YangMing regulates gastric activity possibly through mediation of the dorsal vagal complex. *Am J Chin Med*. 2007;35(3):455-464.

85. Iwa M, Tateiwa M, Sakita M, et al. Anatomical evidence of regional specific effects of acupuncture on gastric motor function in rats. *Auton Neurosci*. 2007;137(1-2):67-76.

86. Hannouche D, Duparc F, and Beaufils P. The arterial vascularization of the lateral tibial condyle: anatomy and surgical applications. *Surg Radiol Anat*. 2006;28:38-45.

ST 37

Shang Ju Xu "Upper Great Hollow"

On the anterolateral aspect of the leg, 3 cun below ST 36 or 6 cun below ST 35; one finger-breadth lateral to the anterior margin of the tibia.

Connective Tissues

- **Interosseous membrane (IOM):** Separates the leg into an anterior and posterior compartment.

Clinical Relevance: The IOM of the leg and forearm share striking similarities, in light of the recognition that ankle and wrist injuries, respectively, simultaneously cause problems in the IOM, knee or elbow, and nerves that course between the tibia/fibula and radius/ulna.[2] Acupuncture at points such as ST 37 may improve the function and facilitate the repair of injured nerves, i.e., branches of the fibular nerve in this case.

Muscles

- **Tibialis anterior muscle:** Inverts the foot and dorsiflexes the ankle.
- **Extensor digitorum longus muscle:** Dorsiflexes the ankle and extends the lateral four pedal digits.

Clinical Relevance: Muscle afferent activation in the anterior tibial and extensor digitorum longus muscles can affect organ function through a variety of neurologic connections, reflexes, and possibly also the release of "chaperone" proteins and their phosphorylation. Specifically, heat shock proteins (HSP), released after fatiguing stimulation of muscles in the anterior compartment of the crus, may constitute one potential pathway that affects cytoskeletal assembly and remodeling. Circulating HSP may alter metabolism and function of distant structures, including respiratory muscles, kidney, and brain.[3]

From a myofascial perspective, trigger point pathology in the anterior tibialis muscle at ST 36 and ST 37 leads to a descending pain referral pattern that proceeds directly down the shaft of the tibia, over the anterior ankle joint, and centered substantially over and within the great toe.

Trigger point provocation in the extensor digitorum longus muscle near ST 37 can cause pain to radiate from the mid-crus down the dorsum of the foot to digits II through IV.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular nerve (L4, L5, S1):** Supplies skin on the anterior ankle and dorsum of the foot (except for the interdigital cleft). Also supplies the fibularis (peroneus) longus and brevis muscles.
- **Lateral sural cutaneous nerve (L4, L5, S1; branch of common fibular):** Supplies skin on the lateral lower leg.

Clinical Relevance: Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[4]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of

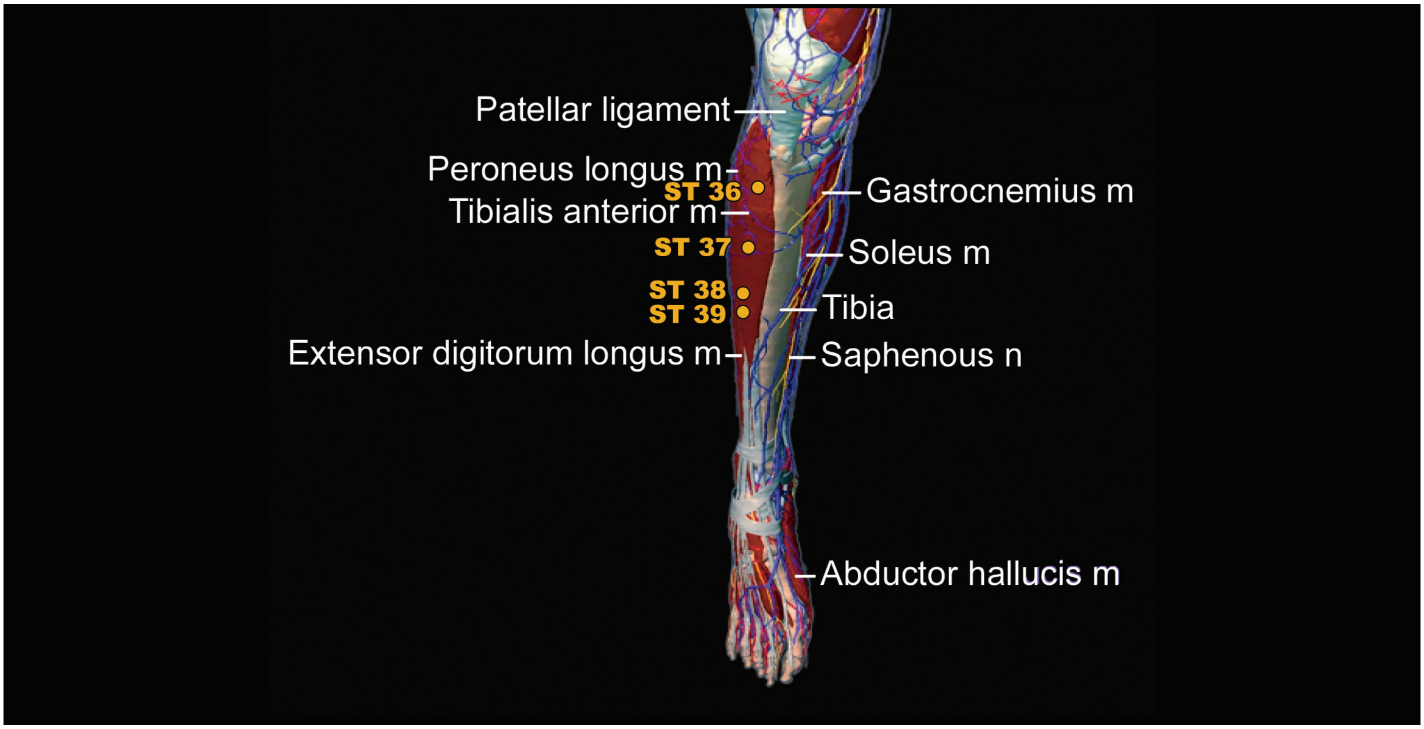


Figure 3-95. ST points on the anterior crus relate to the deep peroneal (fibular) nerve, and, as such, share common indications related to digestion. That is, they connect to the nucleus tractus solitarius in the brainstem but may have differing amplitudes of effects thereon.

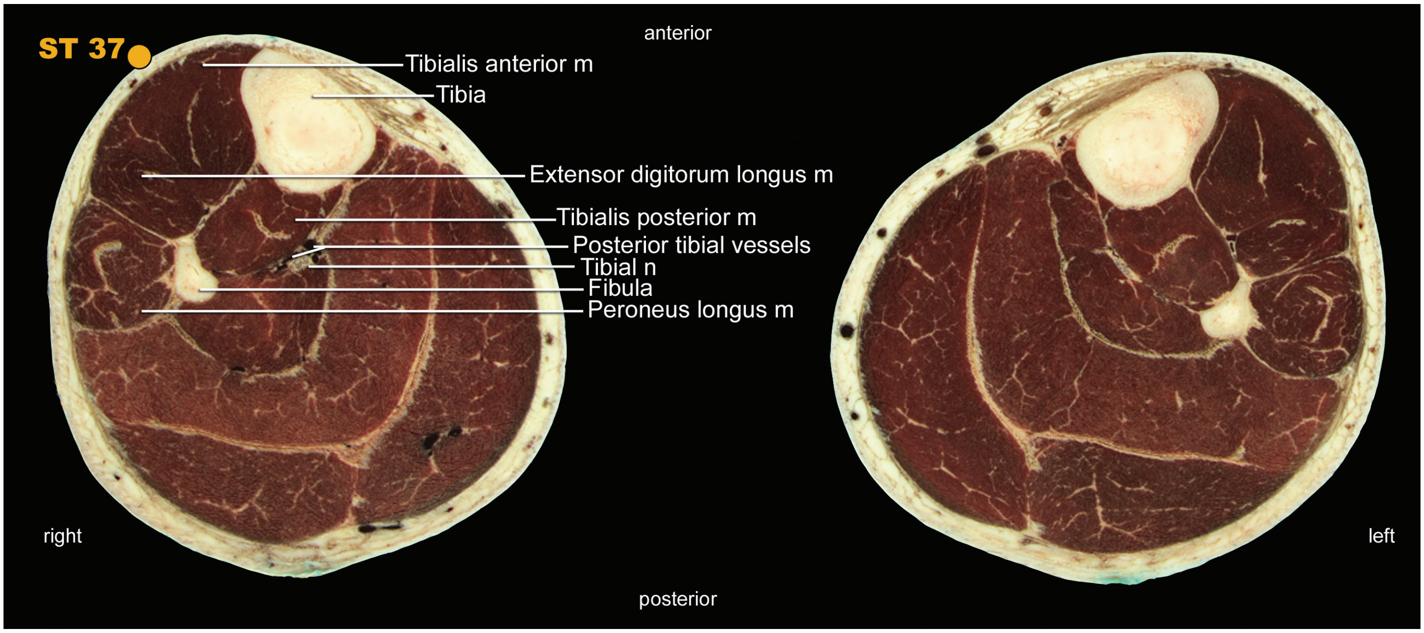


Figure 3-96. ST 37, the "Upper Great Hollow", compares to ST 39, the "Lower Great Hollow", connoting the gulley that sometimes forms along the myofascial cleavage plane between contracting anterior tibialis and extensor digitorum muscles on the anterolateral shin.

sympathetic nervous system activity.[5,6] It is also important to note that, while acupuncture at ST 36 (and, likely, ST 37 as well) can facilitate recovery from fibular nerve injury,[7] too vigorous and deep needling could also injure the nerve.[8]

Afferent input from the fibular nerve at ST 36 and ST 37 ascends to the nucleus tractus solitarius (NTS) and dorsal motor nucleus of the vagus nerve (DMNV); EA at both of these sites regulates gastric motility.[9,10] However, activation of nerves at ST 37 demonstrated a less pronounced effect.

Vessels

- **Anterior tibial artery (ATA):** Distributes blood to the anterior compartment of the leg.

Clinical Relevance: Inferolateral arteries such as the ATA are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[11] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

Indications and Potential Point Combinations

- **Diarrhea:** ST 37, ST 36, SP 6, LI 4.
- **Abdominal pain and distension:** ST 37, ST 36, CV 10, CV 12.

Evidence-Based Applications

Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[1]

References

1. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.
2. Lalezari S, Amrami KK, Tubbs RS, et al. Interosseous membrane: The anatomic basis for combined ankle and common fibular (peroneal) nerve injuries. *Clinical Anatomy.* 25:401-406.
3. Jammes Y, Steinberg JG, By Y, et al. Fatiguing stimulation of one skeletal muscle triggers heat shock proteins activation in several rat organs: the role of muscle innervation. *J Exp Biol.* 2012;215(Pt22):4041-4048.
4. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
5. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
6. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol.* 2006;291(1):H318-H326.
7. Lu Z and Chen Z. Electroacupuncture for treatment of 12 cases of infantile peroneal nerve injury. *J Tradit Chin Med.* 2000;20(2):130-131.
8. Sato M, Katsumoto H, Kawamura K, et al. Peroneal nerve palsy following acupuncture treatment. A case report. *J Bone Joint Surg Am.* 2003;85-A(5):916-918.
9. Wang JJ, Liu XD, Qin M, et al. Electro-acupuncture of Tsusanli and Shangchuhsu regulates gastric activity possibly through mediation of the vagus solotary (sic) complex. *Hepatogastroenterology.* 2007;54(78):1862-1867.
10. Wang JJ, Ming Q, Liu XD, et al. Electro-acupuncture of Foot YangMing regulates gastric activity possibly through mediation of the dorsal vagal complex. *Am J Chin Med.* 2007;35(3):455-464.
11. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;7:15. doi:10.1186/1754-9493-7-15.

ST 38

Tiao Kou "Tight Mouth", "Ribbon Opening"

On the anterolateral leg, 8 cun below ST 35 or 8 cun above the lateral malleolus (i.e., halfway between), one finger-breadth lateral to the anterior margin of the tibia.

Connective Tissues

- **Interosseous membrane (IOM):** Separates the leg into an anterior and posterior compartment.

Clinical Relevance: The IOM of the leg and forearm share striking similarities, in light of the recognition that ankle and wrist injuries, respectively, simultaneously cause problems in the IOM, knee or elbow, and nerves that course between the tibia/fibula and radius/ulna.[3] Acupuncture at points such as ST 38 may improve the function and facilitate the repair of injured nerves, i.e., branches of the fibular nerve in this case.

Muscles

- **Tibialis anterior muscle:** Inverts the foot and dorsiflexes the ankle.
- **Extensor digitorum longus muscle:** Dorsiflexes the ankle and extends the lateral four pedal digits.

Clinical Relevance: Muscle afferent activation in the anterior tibial and extensor digitorum longus muscles can affect organ function through a variety of neurologic connections, reflexes, and possibly also the release of "chaperone" proteins and their phosphorylation. Specifically, heat shock proteins (HSP), released after fatiguing stimulation of muscles in the anterior compartment of the crus, may constitute one potential pathway that affects cytoskeletal assembly and remodeling. Circulating HSP may alter metabolism and function of distant structures, including respiratory muscles, kidney, and brain.[4]

From a myofascial perspective, trigger point pathology in the anterior tibialis muscle at ST 36 and ST 37 leads to a descending pain referral pattern that proceeds directly down the shaft of the tibia, over the anterior ankle joint, and centered substantially over and within the great toe. It is conceivable that trigger points further down could produce a similar pain referral pattern.

Trigger point provocation in the extensor digitorum longus muscle near ST 37 and ST 38 can cause pain to radiate from the mid-crus down the dorsum of the foot to digits II through IV.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular nerve (L4, L5, S1):** Supplies skin on the anterior ankle and dorsum of the foot (except for the interdigital cleft). Also supplies the fibularis (peroneus) longus and brevis muscles.
- **Lateral sural cutaneous nerve (L4, L5, S1; branch of common fibular):** Supplies skin on the lateral crus.

Clinical Relevance: The superficial fibular nerve may experience compression where it pierces the crural fascia and branches into cutaneous nerves.[5] Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial fibular nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem.

Vessels

- **Anterior tibial artery (ATA):** Distributes blood to the anterior compartment of the leg.

Clinical Relevance: Inferolateral arteries such as the ATA are vulnerable to damage during surgical procedures such

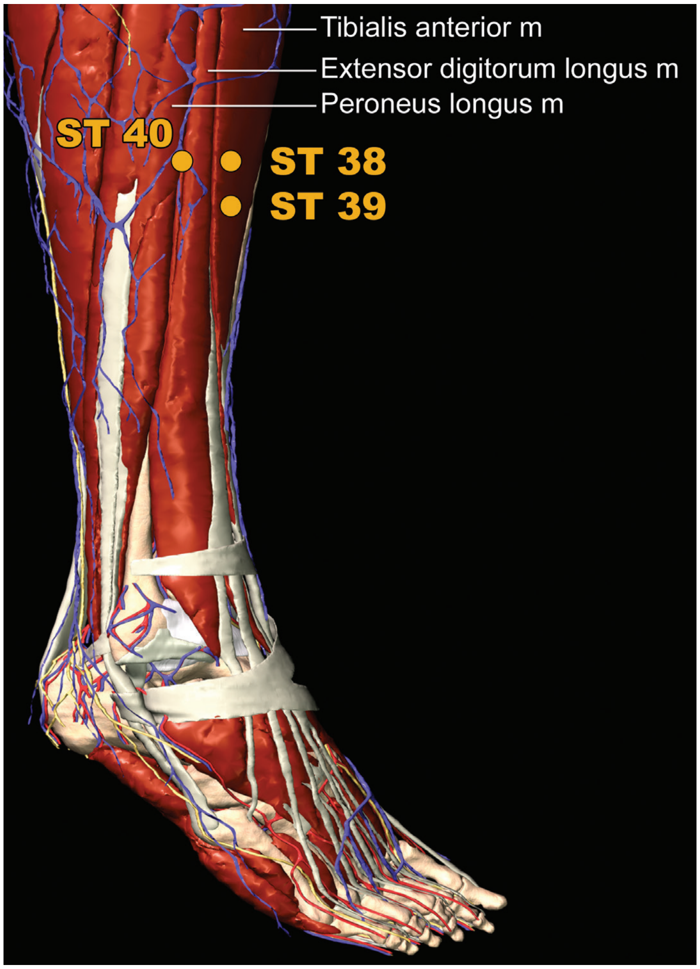


Figure 3-97. The anatomy associated with ST 38, "Tight Mouth" or "Ribbon Opening", hints at the name's origin. That is, as the extensor digitorum longus muscle ascends toward the knee, its width appears to narrow. In contrast, the tibialis anterior muscle looks like a ribbon unfurling toward the knee.

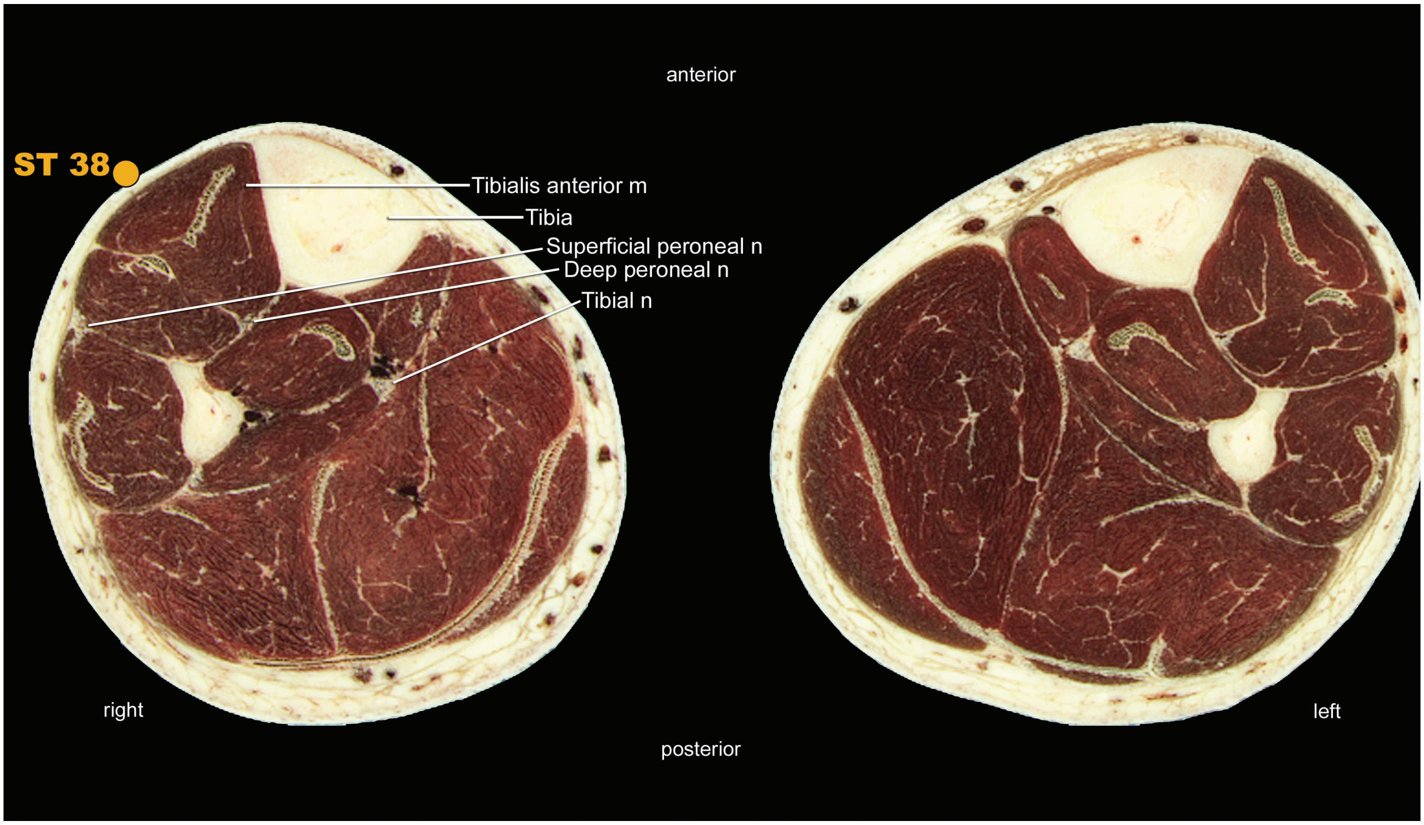


Figure 3-98. This depiction of the limb transected at ST 38 indicates the disparity in location of the superficial and deep peroneal (fibular) nerves, illustrating pictorially how the structures that they supply will differ as well.

as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[6] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

Indications and Potential Point Combinations

- **Pain or paralysis in the leg:** ST 38, ST 36, Bafeng (web spaces between the toes); identify dysfunctional nerves and spinal cord segments. BL 23, BL 25, BL 27.
- **Anterolateral leg pain:** ST 38. Check for trigger points in the tibialis anterior and extensor digitorum longus muscles.

Evidence-Based Applications

- Electroacupuncture at ST 38 and GB 34 provided significantly more relief for patients with **tennis elbow** than did manual acupuncture.[1]
- Electroacupuncture at ST 36 and ST 38 potentiated the **hypotensive** effect of nitroglycerin, which helped achieve the target mean arterial pressure during microscope middle ear surgery under general anesthesia with halothane.[2]

References

1. Tsui P and Leung MCP. Comparison of the effectiveness between manual acupuncture and electro-acupuncture on patients with tennis elbow. *Acupuncture & Electrotherapeutics Res., Int. J.* 2002;27:107-117.
2. Saghaei M, Ahmadi A, and Rezvani M. Clinical trial of nitroglycerin-induced controlled hypotension with or without acupoint electrical stimulation in microscopic middle ear surgery under general anesthesia with halothane. *Acta Anaesthesiol Tiawanica.* 2005;43:135-139.
3. Lalezari S, Amrami KK, Tubbs RS, et al. Interosseous membrane: The anatomic basis for combined ankle and common fibular (peroneal) nerve injuries. *Clinical Anatomy.* 25:401-406.
4. Jammes Y, Steinberg JG, By Y, et al. Fatiguing stimulation of one skeletal muscle triggers heat shock proteins activation in several rat organs: the role of muscle innervation. *J Exp Biol.* 2012;215(Pt22):4041-4048.
5. McCrory P, Bell S, adn Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
6. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2721-2724,

ST 39

Xia Ju Xu “Lower Great Hollow”

On the anterolateral surface of the leg, 1 cun below ST 38 and one finger-breadth lateral to the anterior margin of the tibia.

Three cun below ST 37.

Connective Tissues

- **Interosseous membrane (IOM):** Separates the leg into an anterior and posterior compartment.

Clinical Relevance: The IOM of the leg and forearm share striking similarities, in light of the recognition that ankle and wrist injuries, respectively, simultaneously cause problems in the IOM, knee or elbow, and nerves that course between the tibia/fibula and radius/ulna.[1] Acupuncture at points such as ST 39 may improve the function and facilitate the repair of injured nerves, i.e., branches of the fibular nerve in this case.

Muscles

- **Tibialis anterior muscle:** Inverts the foot and dorsiflexes the ankle.
- **Extensor digitorum longus muscle:** Dorsiflexes the ankle and extends the lateral four pedal digits.
- **Extensor hallucis longus muscle:** Extends the big toe and dorsiflexes the ankle.

Clinical Relevance: A trigger point in the extensor hallucis longus muscle coincides with ST 39. Myofascial dysfunction in this region can cause a pain referral pattern to emanate from this site to the groove between the 1st and 2nd metatarsals, on the dorsum of the foot.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Muscles supplied include the tibialis anterior, extensor digitorum longus, and extensor hallucis longus. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular nerve (L4, L5, S1):** Supplies skin on the anterior ankle and dorsum of the foot (except for the interdigital cleft). Also supplies the fibularis (peroneus) longus and brevis muscles.
- **Lateral sural cutaneous nerve (L4, L5, S1; branch of common fibular):** Supplies skin on the lateral crus.

Clinical Relevance: The superficial fibular nerve may experience compression where it pierces the crural fascia and branches into cutaneous nerves.[2] Typically, nerve entrapment syndromes manifest as burning or “pins and needles” sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial fibular nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem. Entrapment of the deep fibular nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Vessels

- **Anterior tibial artery (ATA):** Distributes blood to the anterior compartment of the leg.

Clinical Relevance: Inferolateral arteries such as the ATA are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[3] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

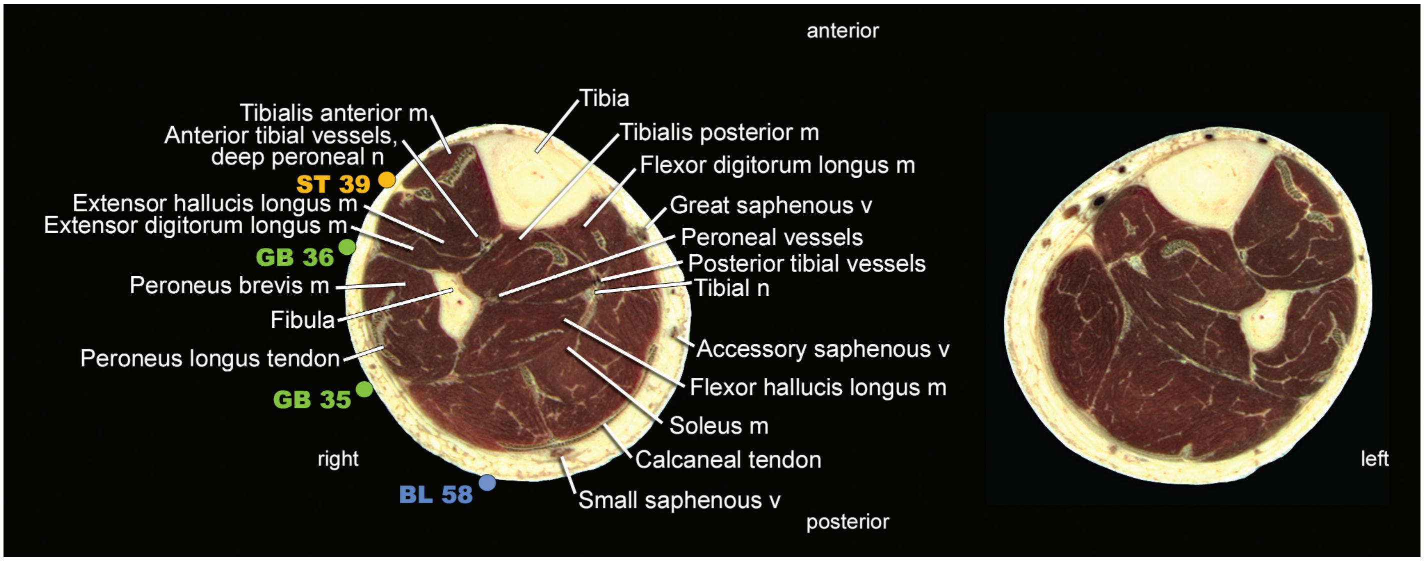

anterior
Tibialis anterior m
Anterior tibial vessels,
deep peroneal n
ST 39
Extensor hallucis longus m
Extensor digitorum longus m
GB 36
Peroneus brevis m
Fibula
Peroneus longus tendon
GB 35
right
BL 58
Tibia
Tibialis posterior m
Flexor digitorum longus m
Great saphenous v
Peroneal vessels
Posterior tibial vessels
Tibial n
Accessory saphenous v
Flexor hallucis longus m
Soleus m
Calcaneal tendon
Small saphenous v
posterior
left

Figure 3-99. This cross section illustrates how the muscular anatomy of the distal limb is becoming more complex, as myofascial structures narrow and become more numerous. ST 39, the “Lower Great Hollow”, resides at the distal limit of the groove created between the tibialis anterior and extensor digitorum/extensor hallucis longus muscles. ST 37, the “Upper Great Hollow”, sits at the gulley’s proximal end.

Indications and Potential Point Combinations

- **Small Intestine disorders: enteritis, abdominal pain with borborygmi, flatulence:** ST 39, ST 36, LI 4, LI 11, CV 10.
- **Leg weakness:** ST 39, ST 36, additional points pertaining to cause of weakness, including BL points related to impaired spinal cord segments.
- **Pain in the first metatarsal and first metatarsophalangeal joint:** Check for trigger points in the extensor hallucis longus muscle that refer to this region; add LR 2, LR 3.

References

1. Lalezari S, Amrami KK, Tubbs RS, et al. Interosseous membrane: The anatomic basis for combined ankle and common fibular (peroneal) nerve injuries. *Clinical Anatomy.* 25:401-406.
2. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
3. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2721-2724.

ST 40

Feng Long “Bountiful Bulge”

On the lateral surface of the leg, 8 cun below ST 35 or 8 cun above the lateral malleolus (i.e., halfway between), two finger-breadths lateral to the anterior margin of the tibia Level with ST 38.

Muscles

- **Extensor digitorum longus muscle:** Dorsiflexes the ankle and extends the lateral four pedal digits.
- **Extensor hallucis longus muscle**: Extends the big toe and dorsiflexes the ankle.
- **Fibularis (peroneus) brevis muscle:** Weakly plantarflexes the ankle and everts the foot.

Clinical Relevance: The trigger point associated with the fibularis brevis muscle occurs in the vicinity of ST 40 The referred pain pattern issues to the lateral malleolus and along the lateral aspect of the dorsum of the foot. More distal trigger points in the fibularis brevis instead focus on the anterior angle and posterolateral heel.

Nerves

- **Lateral sural cutaneous nerve – a branch of the common fibular (peroneal) nerve:** Supplies skin on the posterolateral portion of the leg.
- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular (peroneal) nerve:** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.

Clinical Relevance: The superficial fibular nerve may experience compression where it pierces the crural fascia and branches into cutaneous nerves.[4] Typically, nerve entrapment syndromes manifest as burning or “pins and needles” sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial fibular nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem. Entrapment of the deep fibular nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis muscle.

Vessels

- **Anterior tibial artery (ATA):** Distributes blood to the anterior compartment of the leg.

Clinical Relevance: Inferolateral arteries such as the ATA are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[5] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

Indications and Potential Point Combinations

- **Gastrointestinal problems, especially with fluid retention or swelling:** ST 40, ST 36, SP 9, SP 6, CV 6.
- **Chest pain, asthma:** ST 40, ST 36, ST 13, BL 13, LU 1, LU 7.

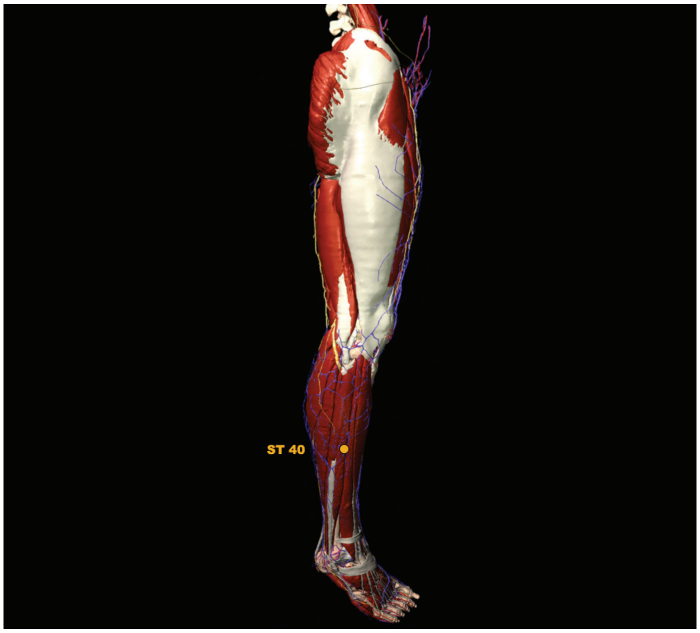


Figure 3-100. The name “Bountiful Bulge” for ST 40 describes the mound produced by the nearby gastrocnemius muscle. This contrasts sharply with the nearby “Great Hollow” described by ST 37 at one end and ST 39 at the other.

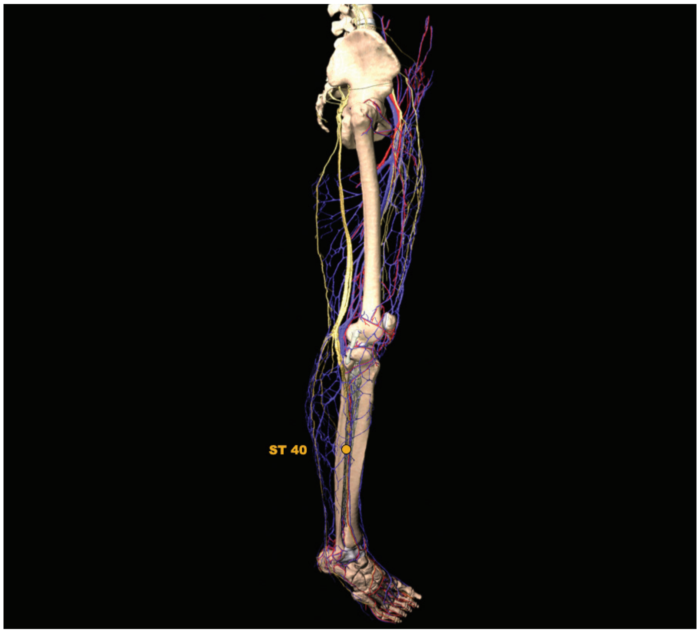


Figure 3-101. ST 40 overlies a rich neurovascular passageway, as seen in this image.

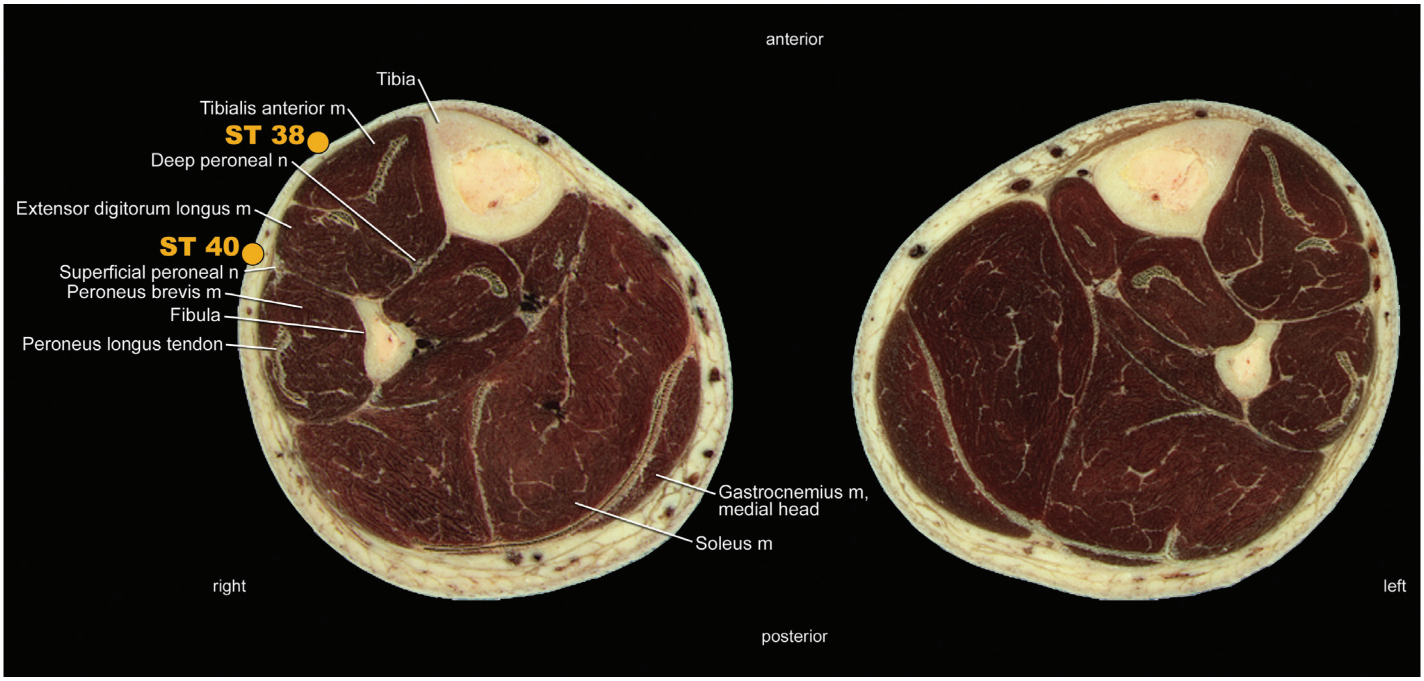


Figure 3-102. ST 40 and ST 38 lie within the same cross-section. ST 40 lives one fingerbreadth lateral to ST 38.

- **Pain or swelling of pelvic limbs:** ST 40, SP 6, SP 9, LR 8.
- **Migraine:** ST 40, LI 4, LR 3, GV 20.
- **Vertigo, dizziness:** ST 40, GB 20, BL 10, GV 20.
- **Epilepsy:** ST 40, ST 36, LR 3, LI 4, HT 7, GV 20.

Evidence-Based Applications

- Acupuncture using magnetic needles at LI 11, ST 40, and LR 3 lowered endothelin-1, a potent **vasoconstrictive peptide.**[1]
- Regarding the effects of acupuncture on canine **gastric motility** using ST 36, ST 40, ST 41, ST 42, ST 45, BL 12, or CV 12, only stimulation of ST 36 or BL 21 promoted gastric motility, whereas motility decreased with CV 12 stimulation. No significant changes in motility occurred after acupuncture at ST 40, ST 41, ST 42, or ST 45.[2]
- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma patients.**[3]
- Acupuncture at ST 40, GB 20, GV 20, and LU 7, as well as dermal needle tapping at GV 14 improved symptoms in a majority of cases of patients with **vertebrobasilar ischemic vertigo,** as reported in a case series from China.[6]

References

1. Jiang X. Effects of magnetic needle acupuncture on blood pressure and plasma ET-1 level in the patient of hypertension. *Journal of Traditional Chinese Medicine.* 2003;23(4):290-291.

2. Jeong SM, Kim H-Y, and Nam T-C. Effect of traditional acupuncture on canine gastric motility. *J Vet Clin.* 2002;19(4):397-400.

3. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate bronchodilating response in asthma patients. *J Chin Med Assoc.* 2005;68(12):591-594.

4. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.

5. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2721-2724.

6. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *J Tradit Chin Med.* 2009;29(2):87-89.

ST 41

Jie Xi "Stream Divide"

On the dorsum of the foot, between the tendons of the extensor digitorum longus muscle (lateral) and the extensor hallucis longus muscle (medial), level with the prominence of the lateral malleolus.

Identify the extensor hallucis longus tendon by asking the patient to extend the big toe against resistance; this reveals the tendon of the extensor hallucis longus. Do the same for the other digits to identify the extensor digitorum longus tendon.

An alternate name for this point, Xie Dai, means "shoelaces", providing a mnemonic of sorts as to its location.

Note: Avoid needling deeply; the joint and dorsalis pedis artery sit beneath this point.

Muscles

- **Extensor hallucis longus tendon:** Extends the big toe and dorsiflexes the ankle.
- **Extensor digitorum longus tendon:** Dorsiflexes the ankle and extends the lateral four pedal digits.

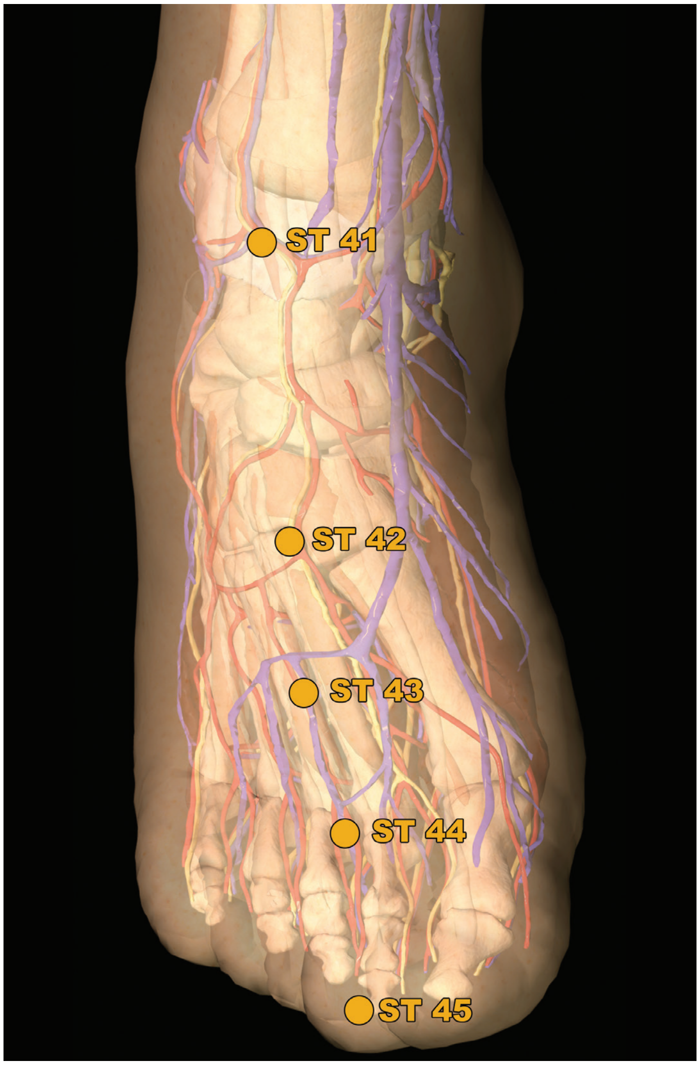


Figure 3-103. This image illustrates the proximity of ST 41 to the joint capsule.

Clinical Relevance: These two extensor tendons and accompanying neurovasculature are vulnerable to compression placed on them by the extensor retinacula of the ankle and foot. The transverse crural ligament (also known as the transverse extensor retinaculum or superior retinaculum), appears in Figure 3-104 as the uppermost of the extensor retinacula present on the dorsal ankle. This ligament binds the extensor digitorum longus, the extensor hallucis longus, the peroneus (fibularis) tertius, and tibialis anterior tendons. It is continuous with the fascia of the leg and attaches to both the tibia and fibula. Fascial restriction may compress branches of the deep fibular nerve that supply each muscle as the nerve descends along the anterior compartment. Ill-fitting shoes that compress these structures can cause pain and myofascial or neuromuscular dysfunction.[2] Instead of cutting the crural fascia with invasive approaches, acupuncture and related techniques should be tried to help reduce the pressure and relax the myofascia.

Afferent input from the skin and muscle of the ankle encode ankle joint movements.[3] Altered input from compression or stretch can disturb joint function and make the ankle more susceptible to injury. Acupuncture can modify mechanoreceptor input to correct aberrancies in neuromuscular control.[4]

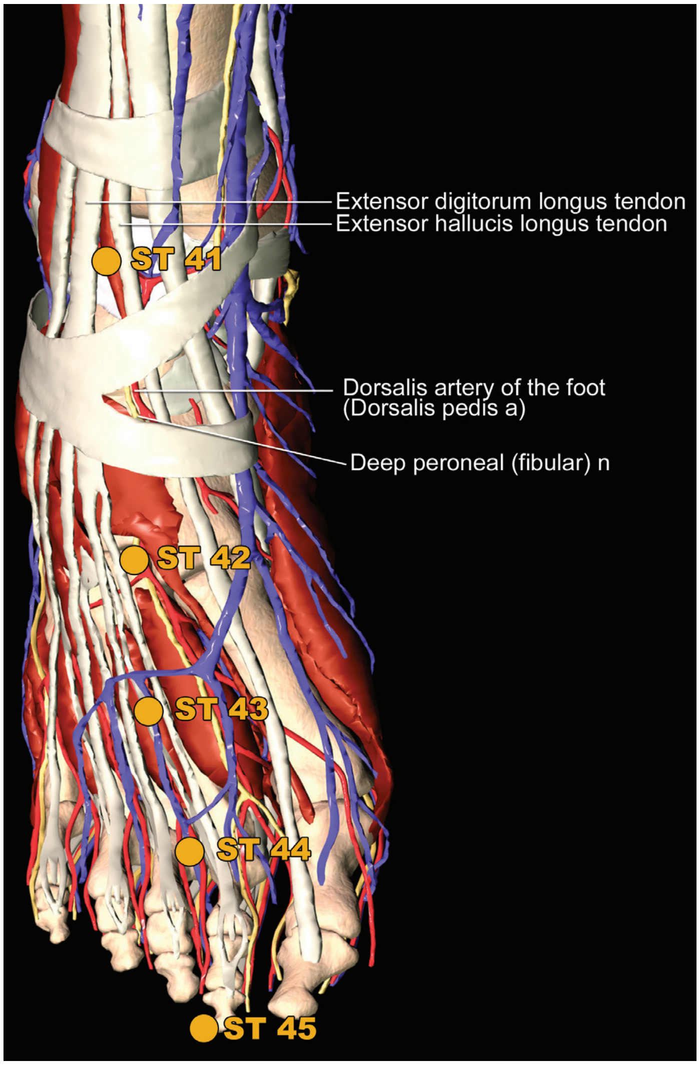

Extensor digitorum longus tendon
Extensor hallucis longus tendon
ST 41
Dorsalis artery of the foot
(Dorsalis pedis a)
Deep peroneal (fibular) n
ST 42
ST 43
ST 44
ST 45

Figure 3-104. At ST 41, "Ravine Divide", the tendons of the extensor hallucis longus and extensor digitorum longus tendons diverge to form the walls of a metaphorical ravine that ferries blood from the dorsalis pedis artery.

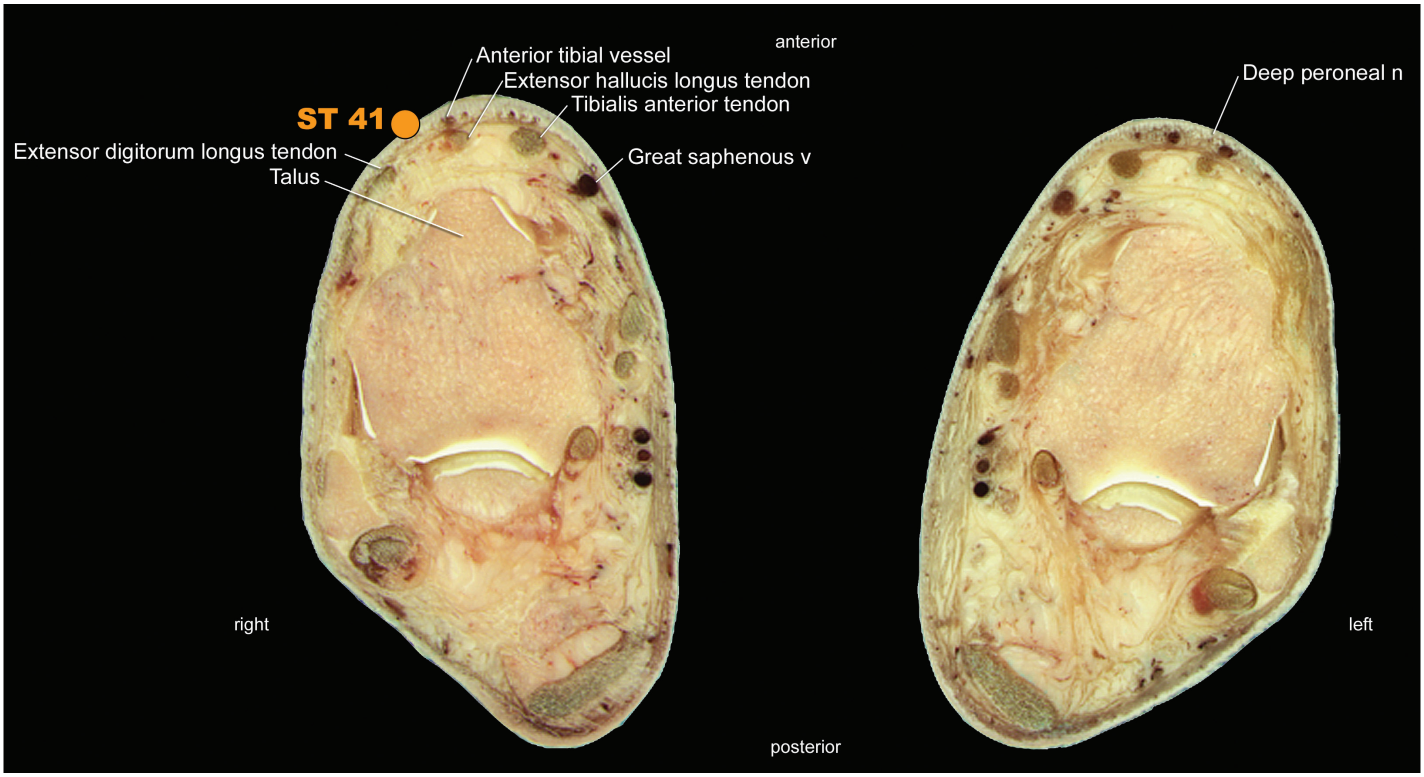


Figure 3-105. The shallow ravine in which ST 41 sits emphasizes the need to needle this point careful to avoid injuring the joint and/or nearby vessels.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular (peroneal) nerve (L4, L5, S1):** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.

Clinical Relevance: Torsional injury to the ankle can damage the common fibular nerve and its terminal branches, including the articular branch. Acupuncture in this instance may assist in improving nerve health and function.

Vessels

- **Dorsalis pedis artery:** Supplies the muscles on the dorsum of the foot. The dorsalis pedis artery pierces the first dorsal interosseous muscle and becomes the deep plantar artery, which becomes part of the plantar arterial arch.

Clinical Relevance: Avoid deep needling that might injure the dorsalis pedis artery or other vessels in this vicinity. Neuromodulation via acupuncture of the nervi vasorum may improve regional circulation.

Indications and Potential Point Combinations

- **Local inflammation, ankle pain, ankle instability:** ST 41, BL 59, BL 60, KI 3, KI 7, GB 39, GB 40, tender areas.
- **Pain or paralysis of lower extremities:** ST 41. Check for trigger-points (ST 36) in the tibialis anterior muscle which may refer pain to the region around ST 41 and the big toe (LR 2, LR 1, SP 2, SP 1). Identify other trigger points, such as extensor digitorum longus in the ST 36 region that may refer pain to GB 41-GB 44 region and the extensor hallucis longus that may send pain to the first metatarsal. For paralysis or paresis, identify dysfunctional neuroanatomic tracts and treat accordingly, not forgetting the paraspinal points addressing dysfunctional spinal cord segments. Bafeng (webspaces between toes) to encourage neural communication to digits.

Evidence-Based Applications

- Regarding the effects of acupuncture on canine gastric motility using ST 36, ST 40, ST 41, ST 42, ST 45, BL 12, or CV 12, only stimulation of ST 36 or BL 21 promoted **gastric motility**, whereas motility decreased with CV 12 stimulation. No significant changes in motility occurred after acupuncture at ST 40, ST 41, ST 42, or ST 45.[1]

References

1. Jeong SM, Kim H-Y, and Nam T-C. Effect of traditional acupuncture on canine gastric motility. *J Vet Clin.* 2002;19(4):397-400.

2. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: A case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.

3. Aimonetti J-M, Roll J-P, Hospod V, et al. Ankle joint movements are encoded by both cutaneous and muscle afferents in humans. *Exp Brain Res.* 2012;221:167-176.

4. Zhu Y, Qiu ML, Ding Y, et al. Effects of electroacupuncture on the proprioception of athletes with functional ankle instability. *Zhongguo Zhen Jiu.* 2012;32(6):503-506.

5. Spinner RJ, Binaghi D, Socolovsky M, et al. Letter to the editor. Torsional injury to the ankle resulting in fibular neuropathy affects the common fibular nerve as well as its terminal branches, specifically, the articular branch. *Clinical Anatomy.* 2012;25:515-517.

ST 42

Chong Yang "Surging Yang"

On the highest part of the dorsum of the foot, approximately 1.5 cun distal to ST 41, in a depression between the tendons of the extensor hallucis longus and the extensor digitorum muscles, located over the pulsation of the dorsalis pedis artery. Can also be located on the line drawn between ST 41 and ST 43, where the dorsalis pedis artery can be palpated.

Note: References differ about the location of this point, with some placing it distal to the intermediate and lateral cuneiform bones (as shown on the CD). Another lists the location "between the first and second cuneiform bones and the scaphoid [navicular]." Because the point's name, "Surging Yang", refers to the pulse palpable at the dorsalis pedis artery, an anatomically correct location would keep it over the artery and over an accessible high point of the foot, as depicted in Figure 3-106.

Muscles

- **Extensor hallucis brevis muscle:** Part of the extensor digitorum brevis, the extensor hallucis brevis muscle extends the great toe and assists the long extensor muscles in extending the toes.
- **Extensor digitorum longus tendon:** Dorsiflexes the ankle and extends the lateral four pedal digits.

Clinical Relevance: The extensor hallucis brevis muscle may entrap the deep fibular nerve as it courses through the tight tunnel between the 1st and 2nd tarsometatarsal joints. See Figures 3-106 and 3-107 to view the relationship between the extensor hallucis brevis muscle, the aforementioned joints, and ST 42.

Nerves

- **Deep fibular (peroneal) nerve (L4, L5, S1):** Supplies motor to the anterior muscles of the leg and the dorsum of the foot. Provides sensation to the skin of the foot in the region of the first interdigital cleft. Also innervates the anterior part of the interosseous membrane while the tibial nerve innervates its posterior aspect.
- **Superficial fibular (peroneal) nerve (L4, L5, S1):** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.

Clinical Relevance: Acupuncture at ST 42 may improve the function of the deep fibular nerve in the case of entrapment or compression.

Vessels

- **Arcuate artery:** The 2nd, 3rd, and 4th metatarsal arteries arise from the arcuate artery, and divide into two dorsal digital arteries that course along the sides of adjoining toes. The metatarsal arteries are, in turn, connected to the plantar arch and plantar metatarsal arteries via the perforating arteries. The arcuate artery is not always present, but instead a dorsal arterial network consisting of the lateral tarsal artery and dorsal metatarsal arteries and proximal perforating arteries may[1] contribute to the blood supply of metatarsal arteries II through IV.

Clinical Relevance: The nervi vasorum associated with the arcuate artery may be responsible for autonomic neuromodulation derived from needling this site.

Indications and Potential Point Combinations

- **Hypertension:** ST 42, LI 11, ST 9.
- **Migraine prophylaxis:** ST 42, ST 36, LI 6, and ST 8 for headache along the LI and ST lines of the head.

Evidence-Based Applications

- **Migraine prophylaxis:**[2] Though not as effective as TH 5, GB 34, GB 40, and GB 20, ST 8, LI 6, ST 36, and ST 42 offered minor benefits for migraine prophylaxis.

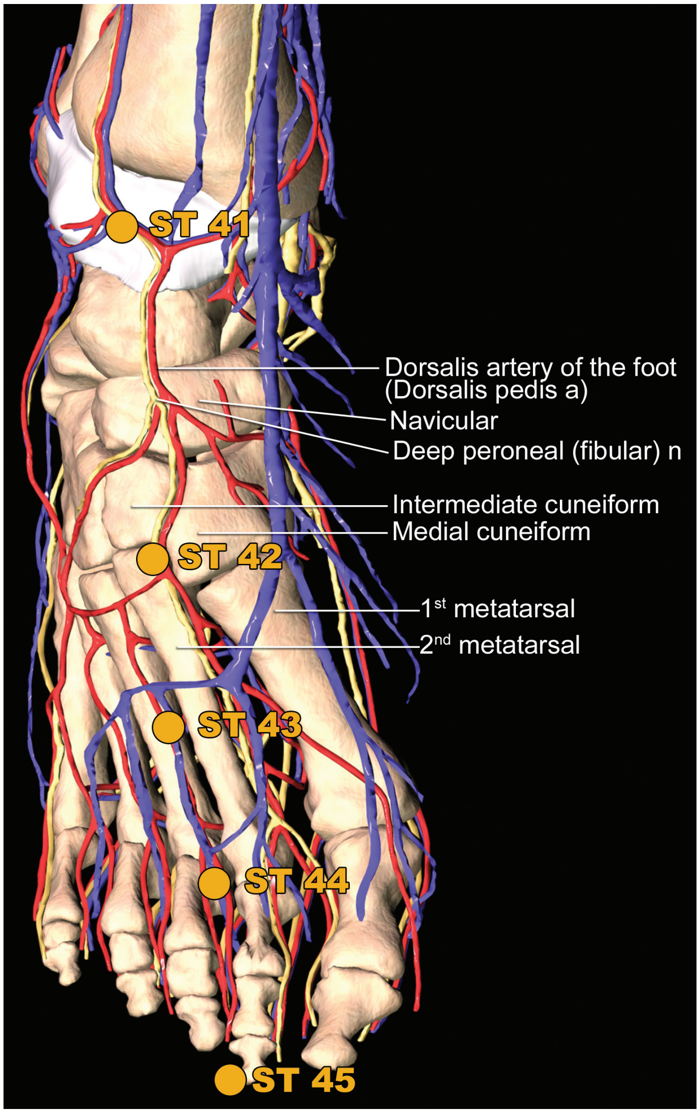


Figure 3-106. The readily palpable pulse from the prominent arterial structures at this part of the foot corresponds to the name "Surging Yang" for ST 42.

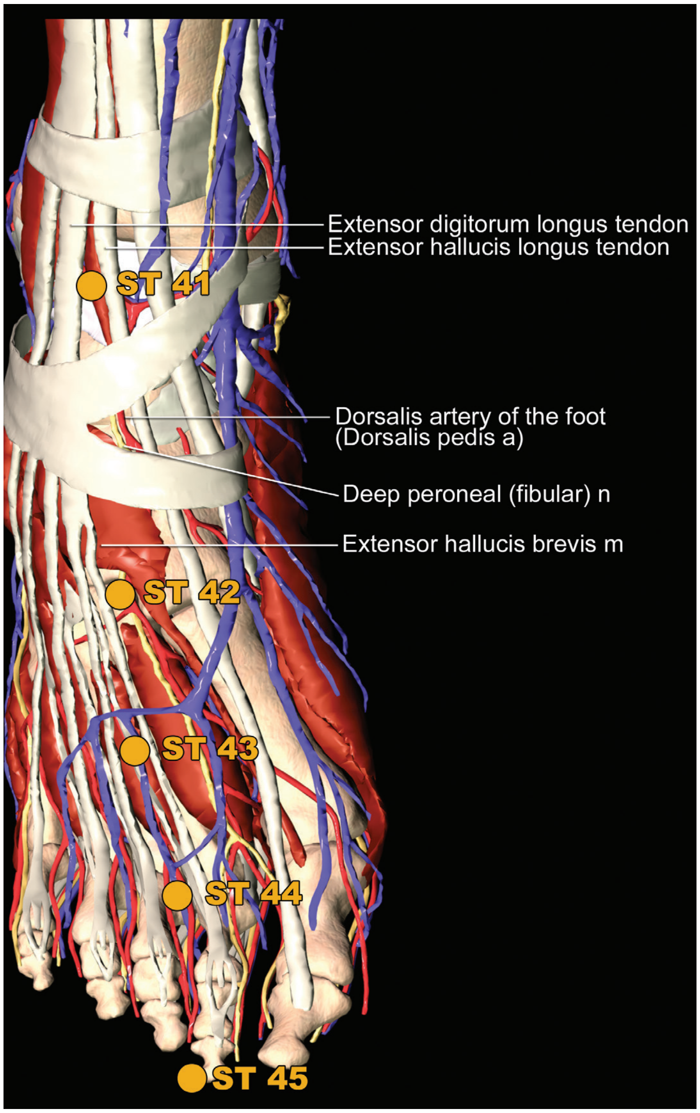

Extensor digitorum longus tendon
Extensor hallucis longus tendon
ST 41
Dorsalis artery of the foot
(Dorsalis pedis a)
Deep peroneal (fibular) n
Extensor hallucis brevis m
ST 42
ST 43
ST 44
ST 45

Figure 3-107. ST 42 sits atop a high-traffic intersection of nerves, vessels, and foot musculature.

References

1. DiLandro AC, Lilja EC, Lepore FL, et al. The prevalence of the arcuate artery: a cadaveric study of 72 feet. *J Am Podiatr Med Assoc.* 2001;91(6):300-305.
2. Li Y, Zheng Hui, Witt CM, et al. Acupuncture for migraine prophylaxis: a randomized controlled trial. *CMAJ.* 2012;184(4):401-410.

ST 43

Xian Gu "Sunken Valley"

On the dorsum of the foot, in a depression distal to the proximal juncture of the 2nd and 3rd metatarsal bones.

Muscles

- **Extensor digitorum longus tendon:** Dorsiflexes the ankle and extends the lateral four pedal digits.
- **Second dorsal interosseous muscle:** The dorsal interossei muscles of the foot abduct the 2nd through the 4th pedal digits and flex the metatarsophalangeal joints.

Clinical Relevance: Myofascial dysfunction of the foot may lead to development of trigger point pathology and discomfort when walking. Identifying the actual location of pain and the trigger point origin of referred pain initiates the process of releasing tense musculature and reducing the discomfort and pathology of nerve entrapment.

The interosseous muscles of the foot establish its architecture.[1] They provide for fine motor manipulation under normal circumstances.

Nerves

- **Superficial fibular (peroneal) nerve:** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.
- **Lateral plantar nerve:** A terminal branch of the tibial nerve, the lateral plantar nerve divides into deep and superficial branches.

The superficial branch gives off two digital nerves that provide cutaneous sensation to the little toe and the lateral part of the fourth toe. Both the superficial and deep branches supply motor branches to the quadratus plantae, abductor digiti minimi, flexor digiti minimi brevis, plantar and dorsal interossei, lateral three lumbricals, and adductor hallucis muscles.

Clinical Relevance: Ligamentous laxity or myofascial dysfunction in the foot may lead to nerve irritation. If this occurs between the 2nd and 3rd metatarsal bones, acupuncture stimulation of ST 43 may aid in its resolution.

The lateral plantar nerve may suffer entrapments at several locations from where it branches off of the tibial nerve to its myriad destinations. Relevant to ST 43, the lateral plantar nerve assists its counterpart, the medial plantar nerve, in supplying the interdigital nerves by means of their terminal branches. Morton's neuroma can afflict the plantar interdigital nerves (usually between metatarsals III and IV, however), including the one supplying the region distal to ST 43. Not a true neuroma, this pathology consists of a fibrotic nodule that forms at the site, associated with varying amounts of demyelination of the involved nerve. This perineural fibrosis occurs ordinarily where the interdigital nerve sits between the heads of the adjacent metatarsal bone. Thus, ST 43 is somewhat proximal to the usual location of a Morton's neuroma, but this site provides needling access to the axon proximal to the pathology.[2]

Vessels

- **Dorsal venous arch of the foot:** Formed by the dorsal digital veins which are continuous with the dorsal metatarsal veins in the subcutaneous tissue on the dorsum of the foot. The dorsal and plantar venous arches communicate. Veins leaving the dorsal venous arch converge to form the great saphenous vein on the medial aspect and the small saphenous vein on the lateral aspect.
- **Second dorsal metatarsal artery:** Divides into two dorsal digital arteries for the adjoining sides of the 2nd and 3rd toes.

Clinical Relevance: Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[3]

Indications and Potential Point Combinations

- **Disorders stemming from sympathetic nervous system arousal:** agitation, insomnia, nightmares: ST 43, ST 36, LR 2, HT 7.

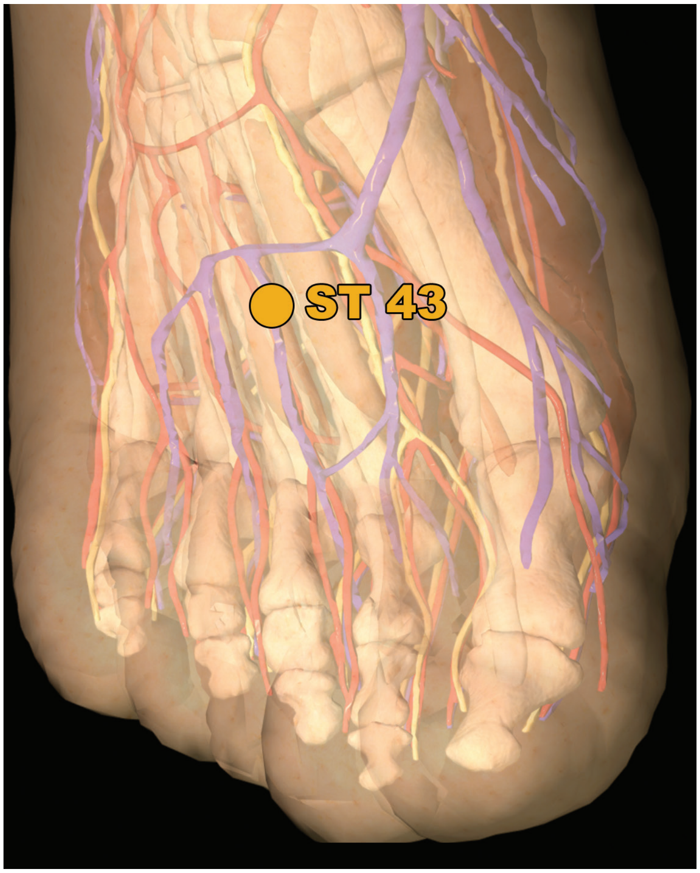


Figure 3-108. The historical association of acupuncture points to blood vessels surfaces in the names of these distal ST line points. That is, "Ravine Divide" (ST 41) leads to "Surging Yang" (ST 42), which then descends into the "Sunken Valley" at ST 43.

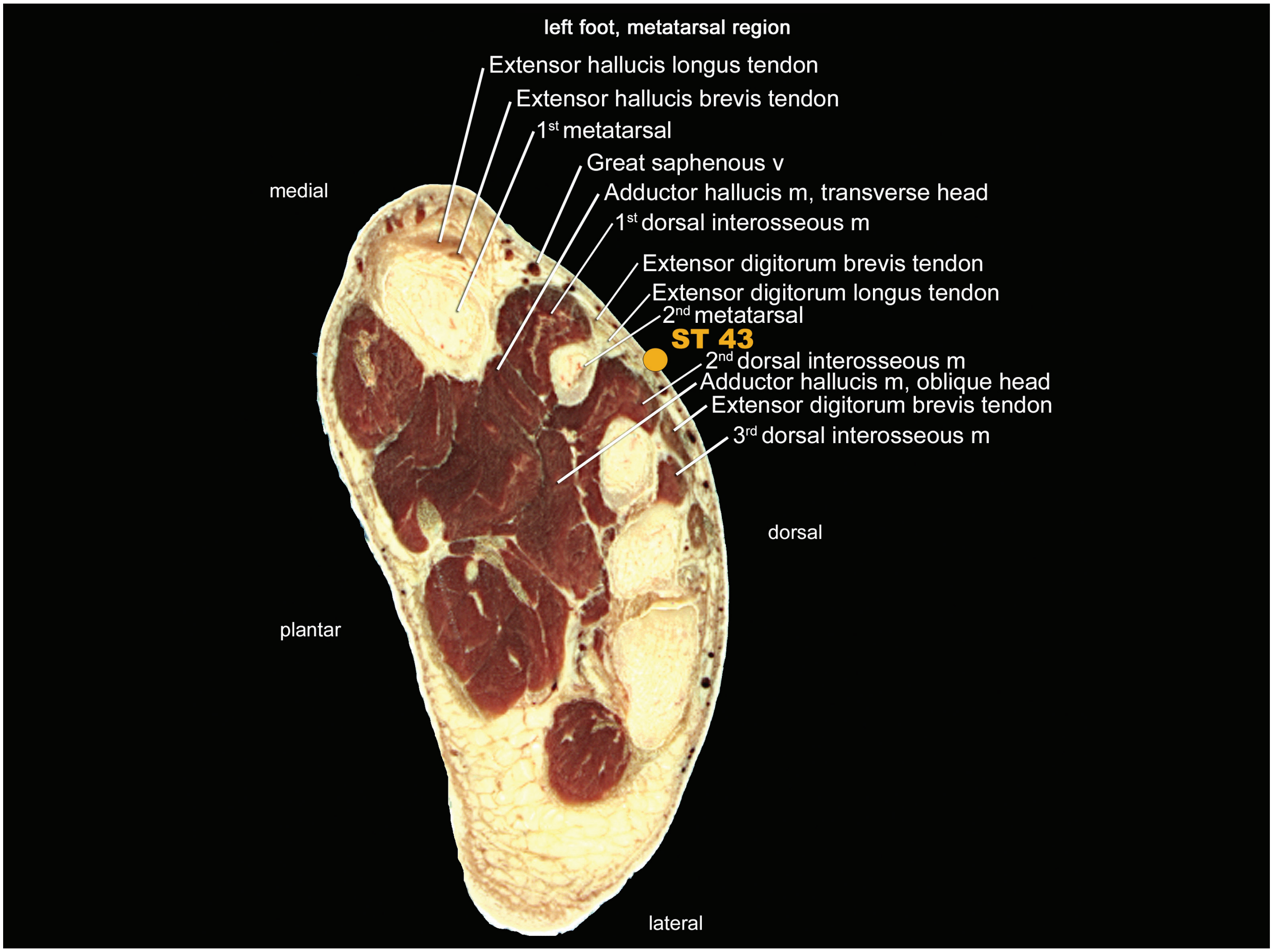

left foot, metatarsal region
Extensor hallucis longus tendon
Extensor hallucis brevis tendon
1st metatarsal
Great saphenous v
Adductor hallucis m, transverse head
1st dorsal interosseous m
Extensor digitorum brevis tendon
Extensor digitorum longus tendon
2nd metatarsal
ST 43
2nd dorsal interosseous m
Adductor hallucis m, oblique head
Extensor digitorum brevis tendon
3rd dorsal interosseous m
medial
dorsal
plantar
lateral

Figure 3-109. This cross section at ST 43 reveals the muscular anatomy that an acupuncture needle would encounter, depending on its depth of insertion.

References

1. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
2. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
3. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.

ST 44

Nei Ting "Inner Courtyard"

On the dorsum of the foot, distal to the 2nd and 3rd metatarsophalangeal joints, half cun proximal to the web margin.

Muscles

- **Extensor digitorum longus tendons for the 2nd and 3rd toes:** Dorsiflexes the ankle and extends the lateral four pedal digits.
- **Extensor digitorum brevis tendons for the 2nd and 3rd toes:** Extends the 2nd through 4th digits at the metatarsophalangeal joint and assists the long extensors in extending the toes.

Clinical Relevance: Acupuncture and related techniques at sites such as ST 44, or to similar sites near the other web spaces of the foot (i.e., the Bafeng points), may help stimulate recovery of neuromuscular function in cases of central nervous system damage and peripheral neuropathy.[5]

Nerves

- **Superficial fibular (peroneal) nerve:** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.

Clinical Relevance: Nerve stimulation via acupuncture and related techniques at ST 44 and its partner points near neighboring web spaces may aid in the restoration of sensation and motor control to the distal pelvic limb.

Vessels

- **Branch site of the 2nd dorsal metatarsal artery:** Two dorsal digital arteries supply the adjoining sides of the 2nd and 3rd toes.

Clinical Relevance: The rich vascularization of ST 44 heightens the ability of stimulation at this site to induce wide-ranging autonomic neuromodulation and hemodynamic shifts through the nervi vasorum of these small arteries.

Indications and Potential Point Combinations

- **Sympathetic arousal, inflammatory disorders, especially of theface:** toothache, gingivitis, oral lesions, pharyngitis, tonsillitis: ST 44, ST 36, LI 4, LU 7, CV 22.
- **Fever:** ST 44, GV 20, GV 24.5 (Yintang).

Evidence-Based Applications

- Electroacupuncture at ST 36 and ST 44 affected monoamine (serotonin, dopamine, and norepinephrine) levels in the corpus striatum of obese rats and increased ATPase activity in the striatum.[1] Striatal dopamine pathways may be influential in **pathological overeating and obesity.**[2]
- Electroacupuncture at ST 36 and ST 44 increased the frequency of spontaneous discharges of neurons in the ventromedial nucleus of the hypothalamus (VMH) in **obese** rats. It also increased the levels of tyrosine, dopamine, tryptamine, while lowering serotonin levels. This suggested that acupuncture may be beneficial for **weight reduction** by influencing the satiety center – the VMH.[3]
- Electroacupuncture at the Sanjiao (Hungry) and Shen Men (Stomach) ear points as well as body points LI 4, LI 11, ST 25, ST 36, ST 44, and LR 3 may have **lowered serum total cholesterol, triglyceride, and LDL cholesterol levels** by increasing serum beta endorphin levels.[4]

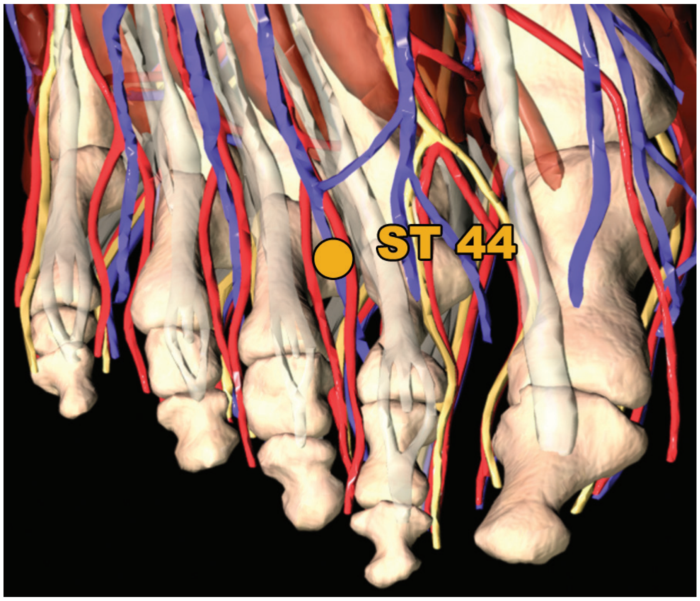


Figure 3-110. This "Inner Court", ST 44, houses a multitude of vessels, i.e., the dorsal digital arteries and veins. Although the nerves are not visible in this depiction, neurologic connections between points such as ST 44 and the face may be mediated by tracts in the spinal cord and brain stem that link caudal spinal cord segments to the spinal trigeminal tract nucleus as well as sites in the brain and brainstem. [Shankland WE. The trigeminal nerve. Part I: an overview. Journal of Craniomandibular Practice. 2000;18(4):238-248.] This helps to explain why ST 44 often appears in point formulae for pain and inflammation in the face, nose, mouth, and sinuses; i.e., areas supplied by the trigeminal nerve.

References

1. Liu Z, Sun F, Zhu M, Wang Y, Wei Q, Su J, and Yuan J. Effect of acupuncture on the striatum of obesity rats. *Acupuncture Research.* 2001;26(2):122-126.
2. Wang GJ, Volkow ND, Logan J, Pappas NR, Wong CT, Zhu W, Netusil N, and Fowler JS. Brain dopamine and obesity. *Lancet.* 2001;357(9253):354-357.
3. Liu Z, Sun F, Su J, Zhao M, Zhu M, Wang Y, Wei Q, Li J, and Gu Y. Study on action of acupuncture on ventromedial nucleus of hypothalamus in obese rats. *Journal of Traditional Chinese Medicine.* 2001;21(3):220-224.
4. Cabioglu MT and Ergene N. Electroacupuncture therapy for weight loss reduces serum total cholesterol, triglycerides, and LDL cholesterol levels in obese women. *American Journal of Chinese Medicine.* 2005;33(4):525-533.
5. Jagirdar PC. The usefulness of acupuncture in leprosy. *Indian J Lepr.* 1986;58(4):618-622.

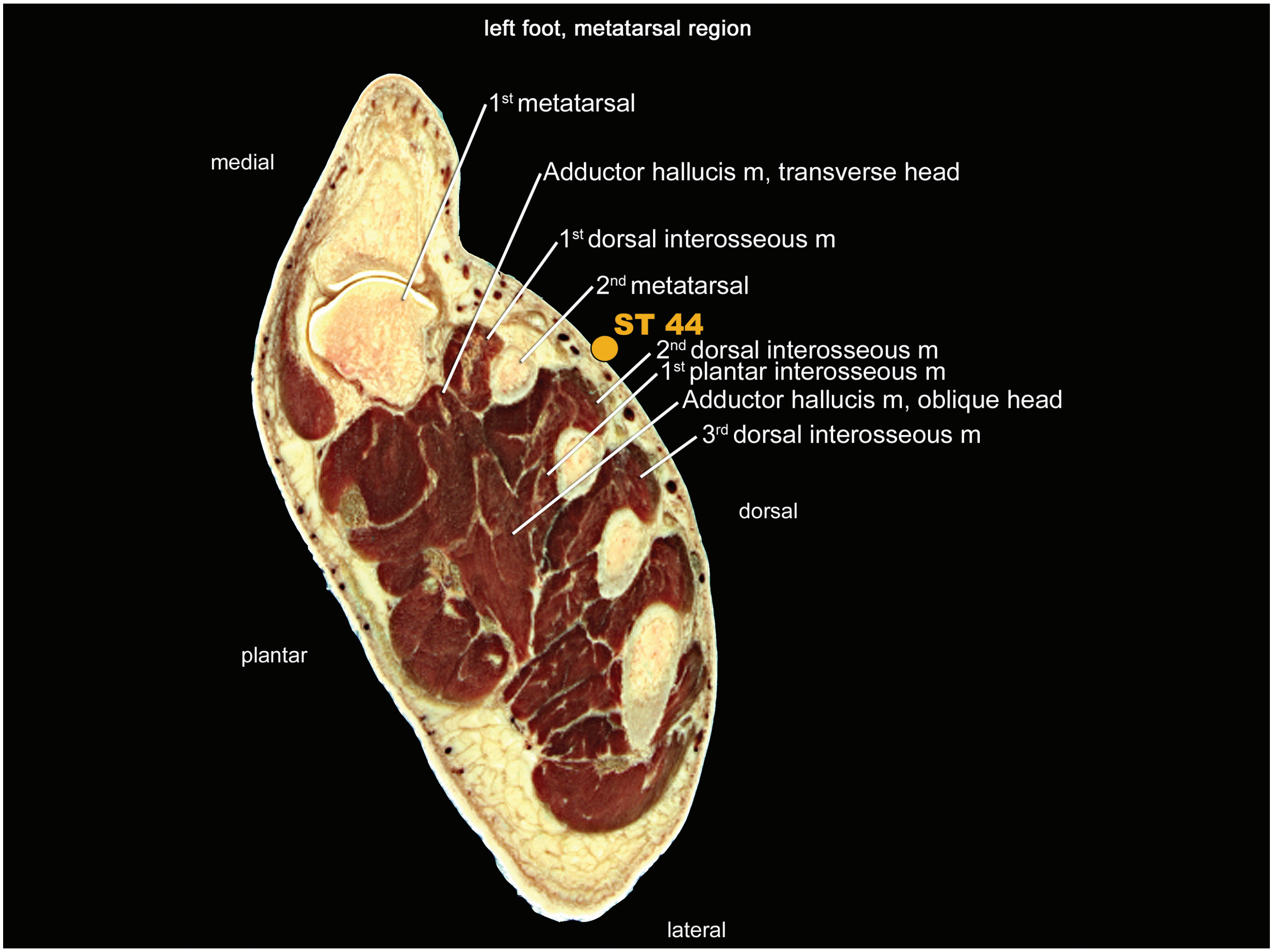

left foot, metatarsal region
medial
1st metatarsal
Adductor hallucis m, transverse head
1st dorsal interosseous m
2nd metatarsal
ST 44
2nd dorsal interosseous m
1st plantar interosseous m
Adductor hallucis m, oblique head
3rd dorsal interosseous m
dorsal
plantar
lateral

Figure 3-111. Note the vessels present in the superficial fascia below ST 44. These vascular channels contain abundant sympathetic nerve fibers that readily impact the autonomic nervous system. The Chinese described vasoregulation and autonomic neuromodulation through metaphors such as “releasing Heat” and “calming the Mind”.

ST 45

Li Dui "Strict Exchange", "Severe Mouth", "Change of Course" or "Running Point"

At the lateral nail angle of the 2nd toe.

Nerves

- **Superficial fibular (peroneal) nerve:** Innervates the skin on the distal third on the anterior leg and on the dorsum of the foot. Also supplies the fibularis (peroneus) longus and brevis muscles.

Clinical Relevance: The abundant supply of sensory nerve fibers at the ting points of the digits provide ample opportunities to neuromodulate and improve nerve function in cases of sensory or motor compromise.

Vessels

- **Dorsal digital artery for the 2nd toe:** Supplies the toe.

Clinical Relevance: The characteristics of ting points that tend to produce strong hemodynamic shifts occur as a result of the ever-narrowing arterioles that then switch direction and transform into venules. Despite their small size, these vessels are endowed with ample nervi vasorum that make ting points capable of inducing profound autonomic shifts.

Indications and Potential Point Combinations

- **Severe toothache, tonsillitis, other orofacial pain:** ST 45, LI 4, ST 5.

Evidence-Based Applications

- Acupuncture at ST 45, BL 58, ST 40, ST 36, KI 7, SP 6, LU 9, LI 4, LU 11, CV 17, LI 1, SP 1, HT 9, SI 1, BL 67, PC 9, TH 1, GB 44, LR 1, and KI 1, as well as moxa at GV 14, resulted in rapid improvement in a 13 month baby suffering from **staphylococcal skin infection** after a poor 50 day response to antibiotics.[1]

References

1. Diogenes MS, Carvalho AC, and Tabosa AM. Acupuncture and moxibustion as fundamental therapeutic complements for full recovery of staphylococcal skin infection after a poor 50-day treatment response to antibiotics. *J Altern Complement Med.* 2008;14(6):757-761.

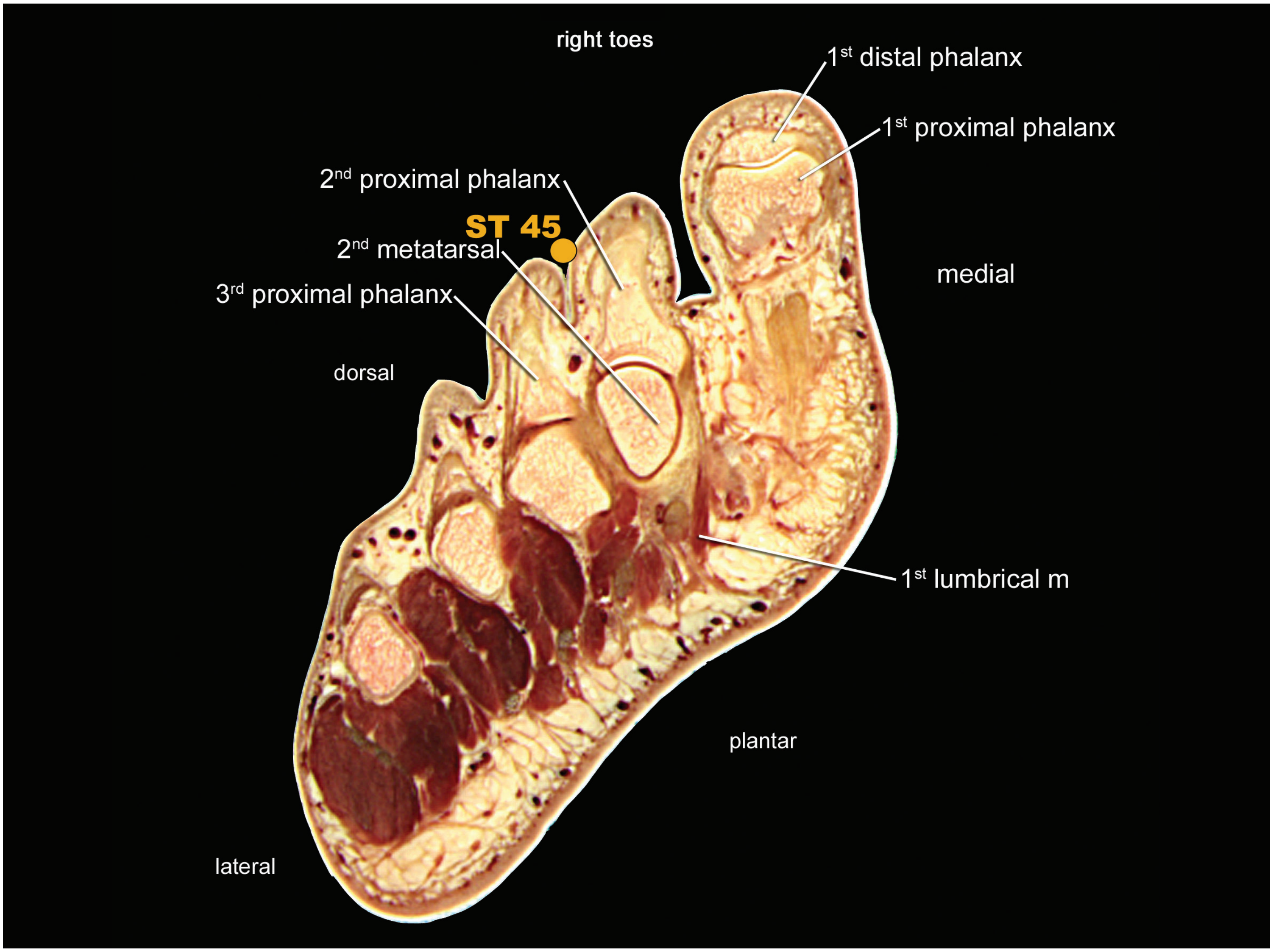
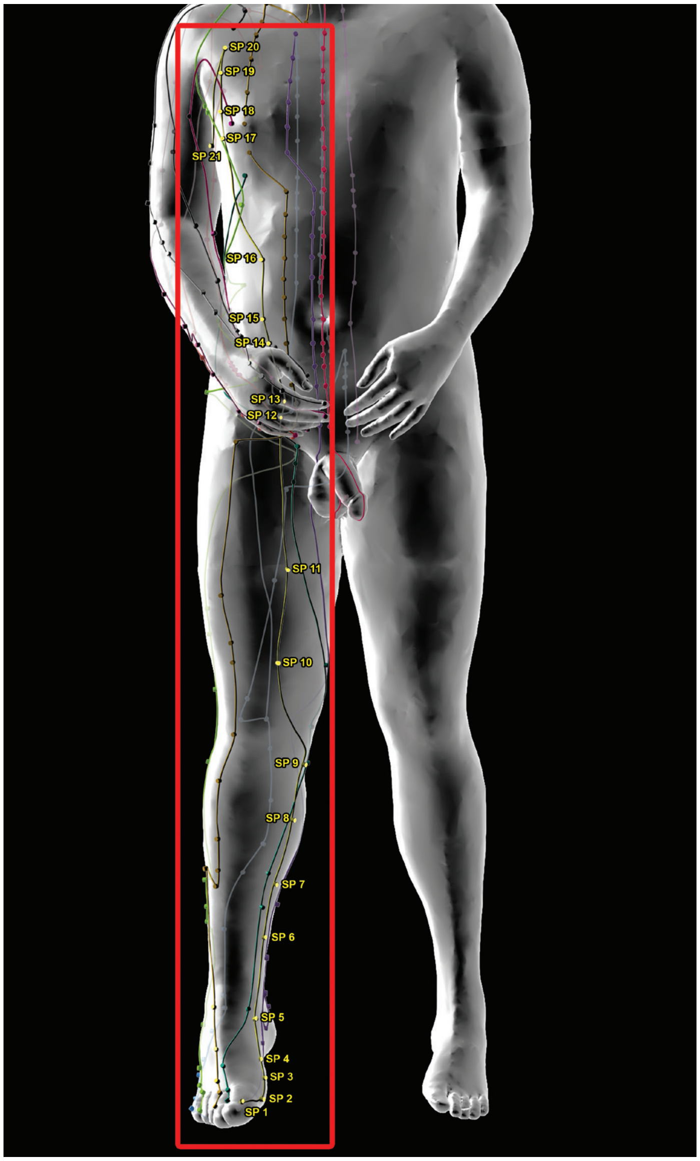


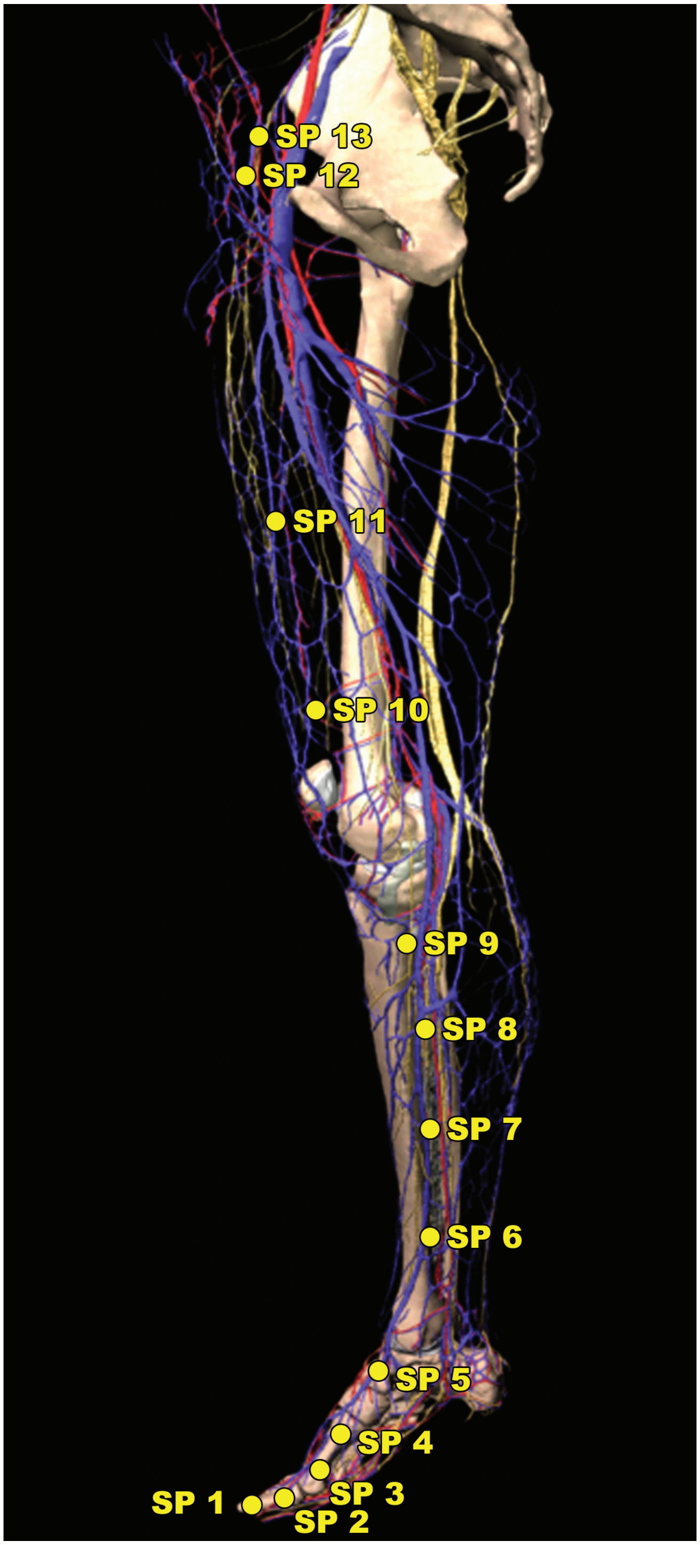
Figure 3-112. ST 45 has several names. "Severe Mouth" connotes its capacity to treat afflictions on the face and mouth. "Change of Course" implies the shift in direction taken by the blood supply. "Running Point" suggests its involvement in the push-off phase of a running foot.

Channel 4:: The Spleen (SP)

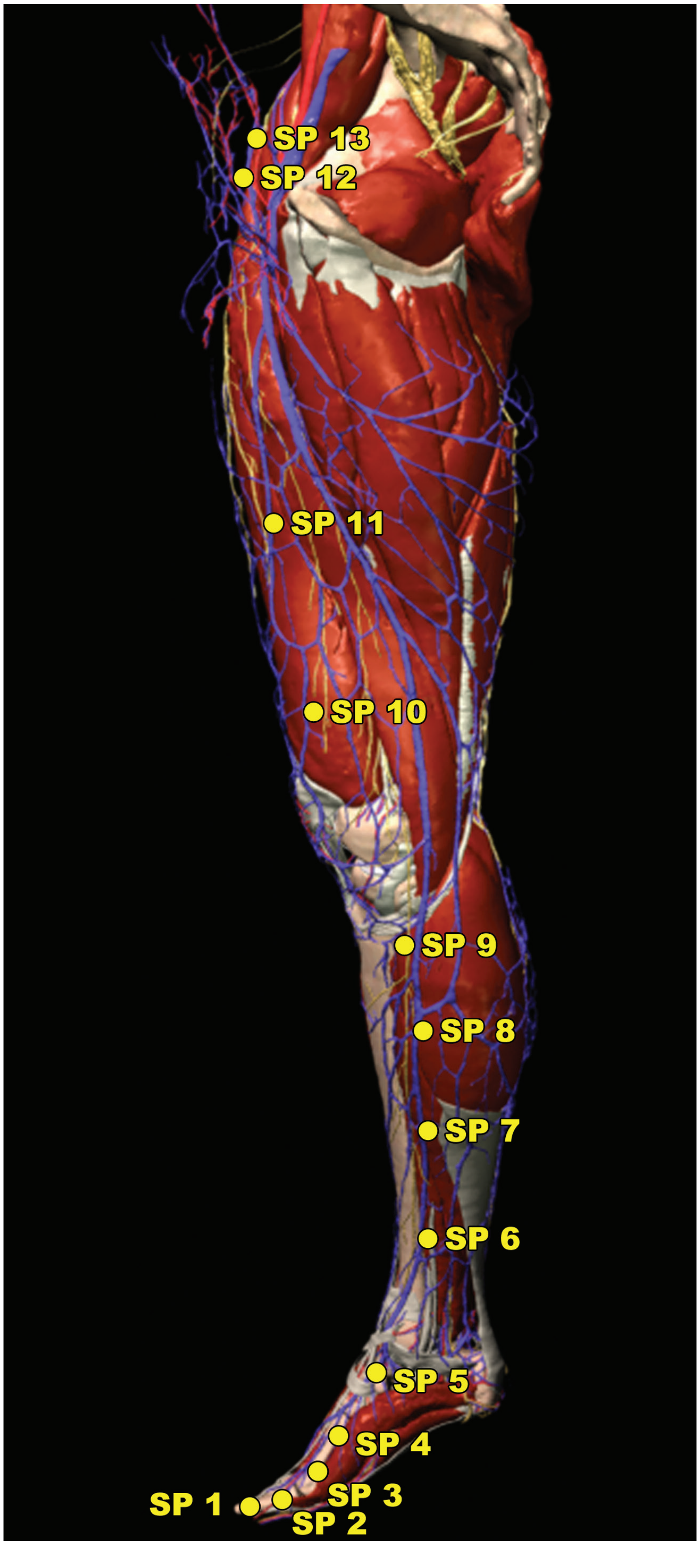
The Spleen channel begins on the medial aspect of the great toe. It ascends the medial pelvic limb, crosses the anteromedial groin, and continues toward the axilla by way of the linea semilunaris on the abdomen and along the groove lateral to the breast upon the thorax. After reaching most superior point (SP 20), the SP channel dives off its peak to the lateral ribcage, ending on the midaxillary line at SP 21.


SP 20
SP 19
SP 18
SP 17
SP 21
SP 16
SP 15
SP 14
SP 13
SP 12
SP 11
SP 10
SP 9
SP 8
SP 7
SP 6
SP 5
SP 4
SP 3
SP 2
SP 1

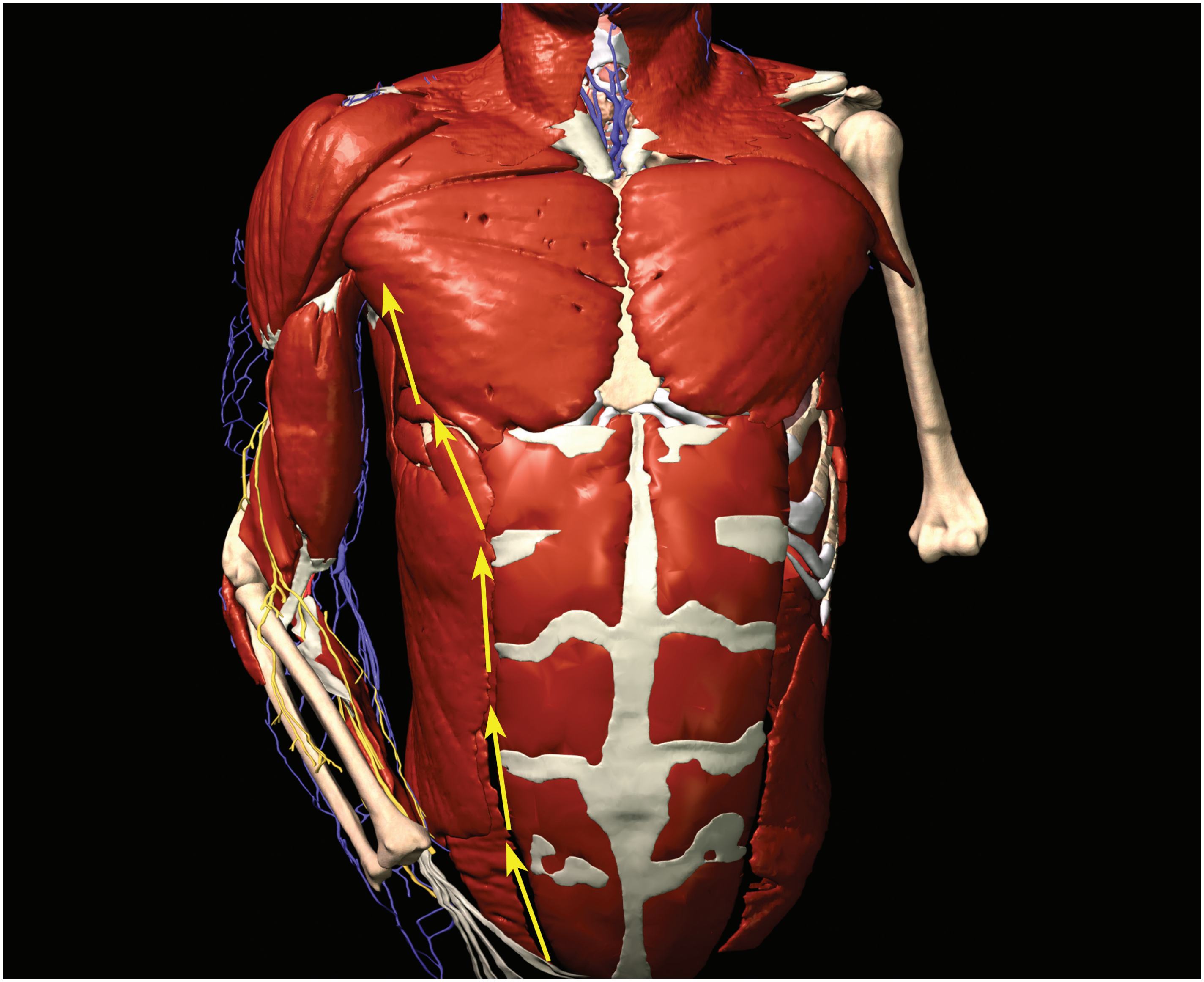
This image illustrates the course of the SP channel in its entirety.


SP 13
SP 12
SP 11
SP 10
SP 9
SP 8
SP 7
SP 6
SP 5
SP 4
SP 3
SP 1
SP 2

The most salient function of the SP channel concerns venous drainage. This becomes apparent when comparing the courses of the major venous pathways of the pelvic limb to the trajectory of the SP channel. Specifically, the great saphenous vein parallels the SP pathway most closely, overlapping as well with the network of interlacing lymphatics on the medial surface of the lower extremity.


SP 13
SP 12
SP 11
SP 10
SP 9
SP 8
SP 7
SP 6
SP 5
SP 4
SP 3
SP 1
SP 2

From a neuroanatomic standpoint, the SP line follows the femoral nerve and its terminal cutaneous branch, the saphenous nerve.



The yellow arrows in this figure show the SP channel course across the anterior abdomen and thorax. This pathway follows one of three collateral routes for abdominopelvic venous return in the event of inferior vena caval obstruction or ligation.

That is, if blood from the lower abdomen and pelvis finds an impasse at the IVC, it can still return to the heart by way of these valveless venous channels on the body surface.

The three collateral routes correspond roughly to the acupuncture channels ST, SP, and Governor Vessel (GV). The truncal ST channel associates with the anastomosing inferior and superior epigastric veins that eventually enter the internal thoracic veins and drain into the superior vena cava.

The second pathway overlaps the SP line and makes use of the superficial epigastric or the superficial circumflex iliac veins. Ordinarily, these would empty into the great saphenous vein in the groin, but if pushed they will take advantage of a subcutaneous collateral pathway involving the thoracoepigastric vein. This takes the venous blood into the axillary vein by tributaries such as the lateral thoracic vein, lateral to the breast beneath the SP pathway.

The third collateral route involves the interlacing vessels along the GV channel that include the epidural venous plexus, lumbar veins, and the azygos network along the back.

SP 1

Yin Bai “Hidden White”

On the medial side of the base of the nail of the great toe, the width of a Chinese leek leaf from the corner of the nail (approximately 0.1 cun).

Nerves

- **Superficial peroneal nerve:** Supplies the skin on the medial great toe via dorsal digital branches.
- **Proper plantar digital branches of the medial plantar nerve:** Supplies the dorsal surface of the distal tips of the toes (including the nail bed region). This sensory branch arises from the medial plantar nerve and provides sensation to the medial aspect of the great toe.[4]

Clinical Relevance: The superficial location of the medial plantar proper digital nerve makes it vulnerable to chronic compression that often leads to neuropathy. Ill-fitting shoes or a space-occupying lesion within the toe such as a ganglion cyst can also lead to neuropathic compression. Acupuncture or related neuromodulatory techniques applied to SP 1, SP 2, and SP 3 may aid in restoring normal nerve function and reducing pain in conjunction with addressing the cause of compression.

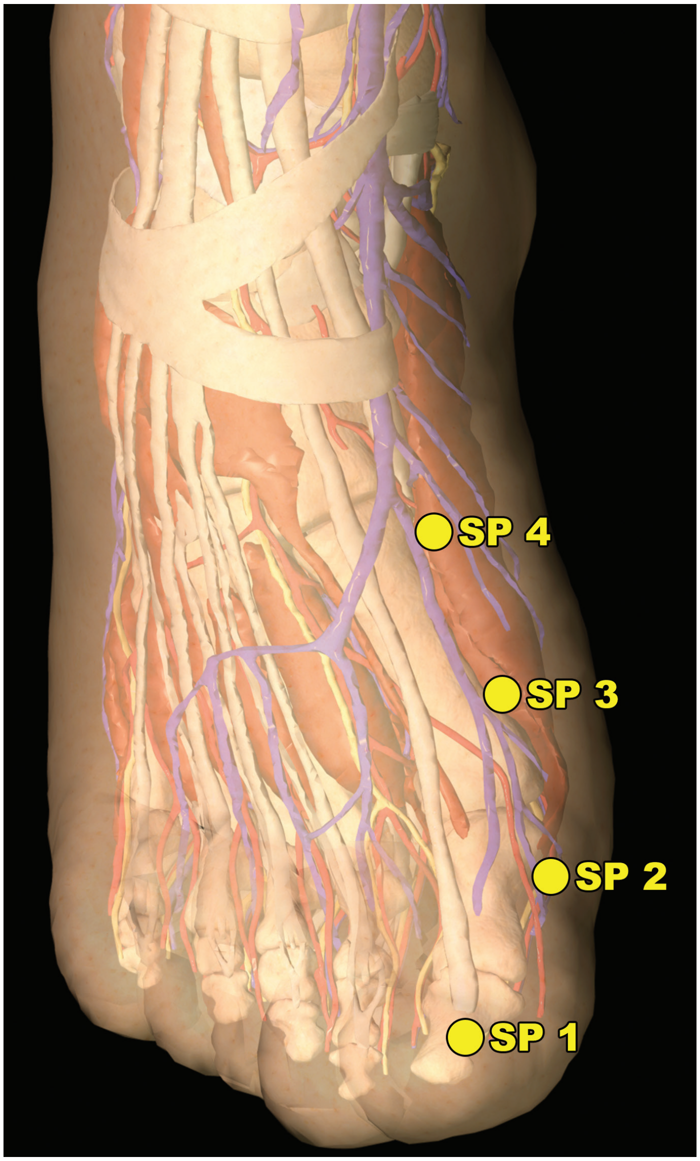


Figure 4-1. SP 1, “Hidden White”, bespeaks the lighter appearance of the skin at this site, along with the fact that it sits alongside the dark-light (dorsal-planar) junction of the medial aspect of the big toe.

Vessels

- **Proper plantar digital artery and vein:** Supply and drain, respectively, the dorsum of the distal phalangeal segment and nail bed. The artery arises from the metatarsal artery, which in turn arises from the plantar arterial arch. The vein drains into the dorsal venous arch and subsequently into the great saphenous vein.

Clinical Relevance: The redness, swelling, and pain of gout in the great toe may respond to blood-letting and cupping of SP 1 or SP 2.[5]

Indications and Potential Point Combinations

- **Bleeding disorders: hematemesis, epistaxis, hematuria, hematochezia, menorrhagia, metrorrhagia:** SP 1, SP 10, GV 20.
- **Fever, seizures:** SP 1, LR 2, ST 36.

Evidence-Based Applications

- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of **primary Raynaud’s syndrome**, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[1]
- A case series using needling, bleeding, and cupping to treat **erysipelas** reported “good results” using SP 10, SP 1, and “visible veins”.[2]
- Fifteen minutes of electroacupuncture stimulation applied to SP 1 and LR 1 appeared to constitute the optimal setting for treating **acute pain in the pelvic limbs.**[3]

References

1. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud’s syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine.* 1997;241:119-124.
2. Sang J, Wang S, and Lu X. Needling and cupping used to treat 20 cases of erysipelas. *Journal of Traditional Chinese Medicine.* 2003;23(2):115-116.
3. Leung AY, Kim SJ, Schulteis G, et al. The effect of acupuncture duration on analgesia and peripheral sensory thresholds. *BMC Complementary and Alternative Medicine.* 2008; 8:18.
4. Seok HY, Eun M-Y, Yang HW, et al. Medial plantar proper digital neuropathy caused by a ganglion cyst. *Am J Phys Med and Rehabil.* 2012. [Epub ahead of print]. DOI: 10.1097/PHM.0b013e31825f1abb
5. Zhang S-J, Liu J-P, and He K-Q. Treatment of acute gouty arthritis by blood-letting cupping plus herbal medicine. *J Trad Chin Med.* 2010;30(1):18-20.

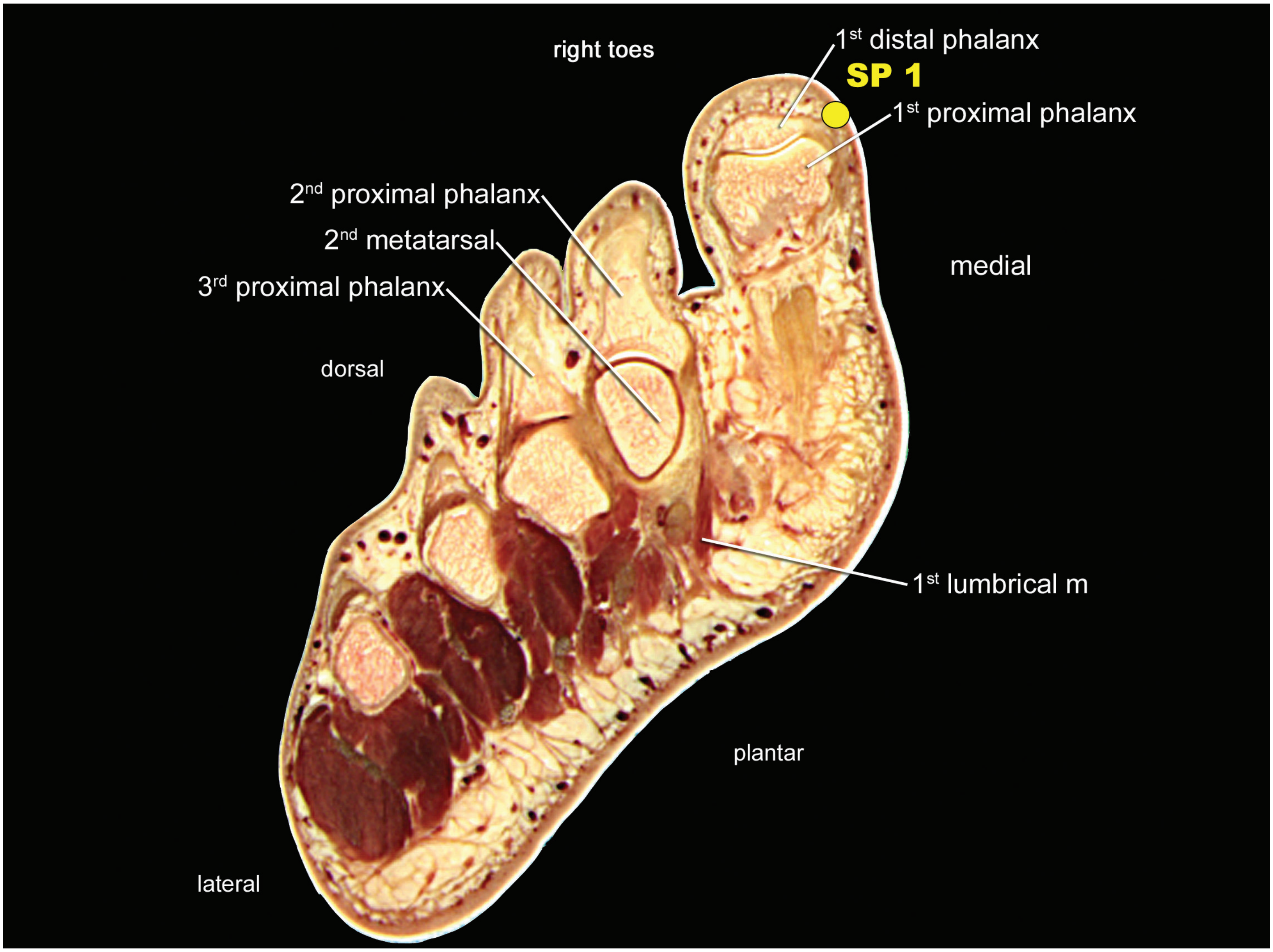

right toes
1st distal phalanx
SP 1
1st proximal phalanx
2nd proximal phalanx
2nd metatarsal
3rd proximal phalanx
medial
dorsal
1st lumbrical m
plantar
lateral

Figure 4-2. The clinical applications for SP 1 generally pertain to autonomic imbalances and sympathetic nervous system arousal, in light of the numerous sensory nerves and small vessels rich with nervi vasorum embedded here.

SP 2

Da Du "Great Metropolis" or "Great Prominence"

On the medial surface of the foot, in a depression distal to the first metatarsophalangeal joint, at the dorsal/plantar skin junction. Easy to find be sliding the fingertip in a distal direction over the medial aspect of the ball of the foot.

Tendons

- **Abductor hallucis tendon:** Abducts the great toe. However, its physiologic role in hallux abduction may be less important than its contribution to proper gait mechanics. The abductor hallucis assists the posterior tibial tendon in supporting and elevating the arch of the foot.[1]

Clinical Relevance: The arch of the foot reduces forces in the joints, ligaments, and muscles of the foot. The abductor hallucis muscle demonstrates significant myoelectric activity during the late stance and toe-off phases of the gait.[2] This indicates that it may help decelerate flattening of the arch following heel strike and, in contrast, elevate the arch before toe-off. Dysfunction in the abductor hallucis muscle may compromise its ability to dynamically support the arch. Local acupuncture at myofascial trigger points in the abductor hallucis as well as its attachments (e.g., SP 2) may improve its biomechanics and mechanoreceptor input.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Medial plantar nerve (larger terminal branch of tibial nerve, L5-S3):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle. At the 1st metatarsophalangeal (MTP) joint, fibers from the medial plantar nerve form the plantar proper digital nerve to the hallux. The nerve may experience compression where it cross over the medial and plantar aspects of the MTP joint on the plantar surface of the hallux in the vicinity of SP 2 and SP 3. Tight shoes may precipitate a focal neuropathy that can become chronic. Anatomic compression may result from abnormal bony ridges (e.g., bunions) or tethers that form after repetitive trauma goes unabated, leading to proliferation and hyalination of connective tissue.

Clinical Relevance: The plantar proper digital nerve to the hallux can become compressed or entrapped, prompting the onset of perineural fibrosis, leading to "Joplin's neuroma".[3] Multiple additional pathologic changes take place when compressive or

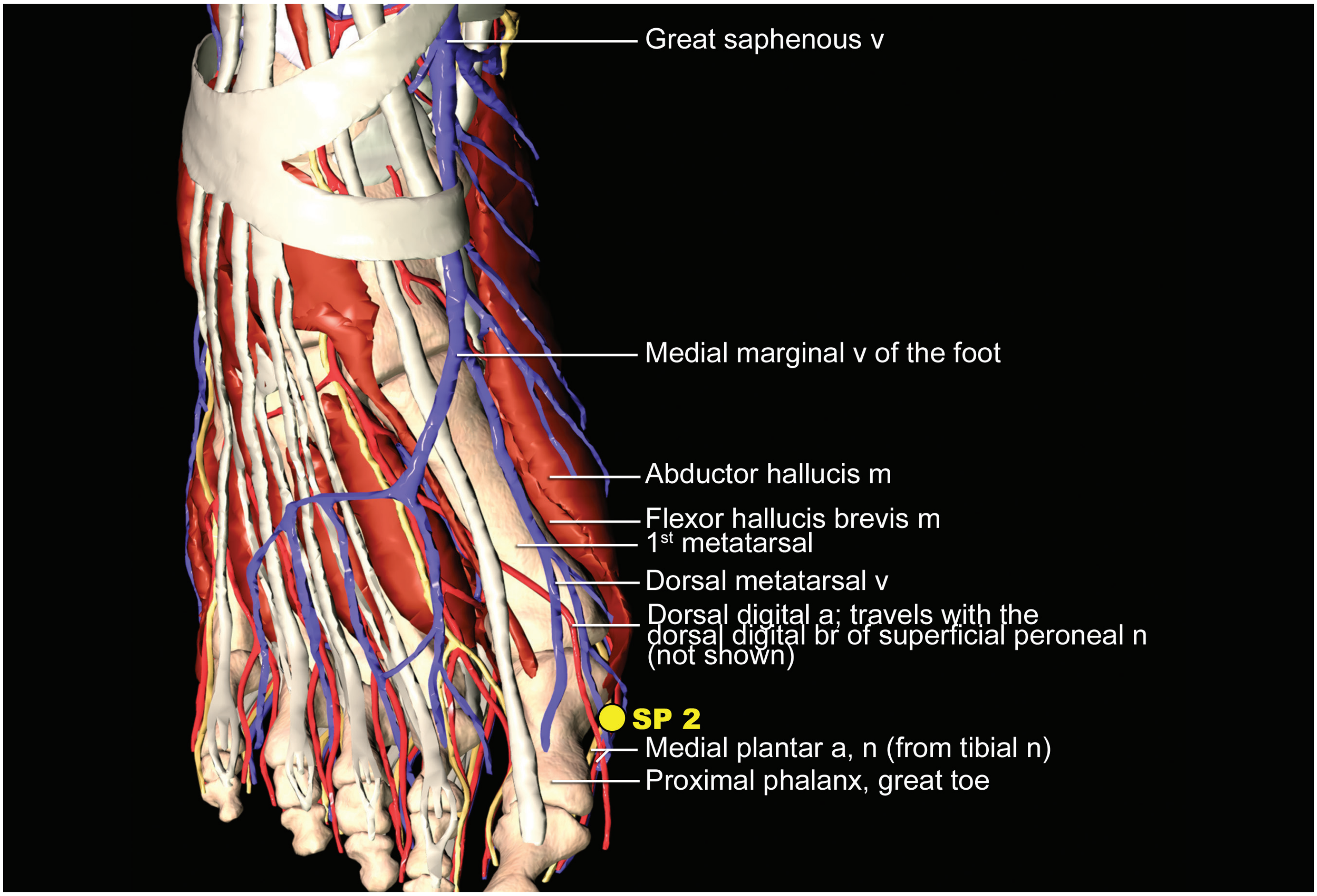

Great saphenous v
Medial marginal v of the foot
Abductor hallucis m
Flexor hallucis brevis m
1st metatarsal
Dorsal metatarsal v
Dorsal digital a; travels with the dorsal digital br of superficial peroneal n (not shown)
SP 2
Medial plantar a, n (from tibial n)
Proximal phalanx, great toe

Figure 4-3. SP 2, "Great Metropolis" or "Great Prominence" refers to the metatarsophalangeal joint of the big toe, which can become even more prominent in cases of bunions and bursitis.

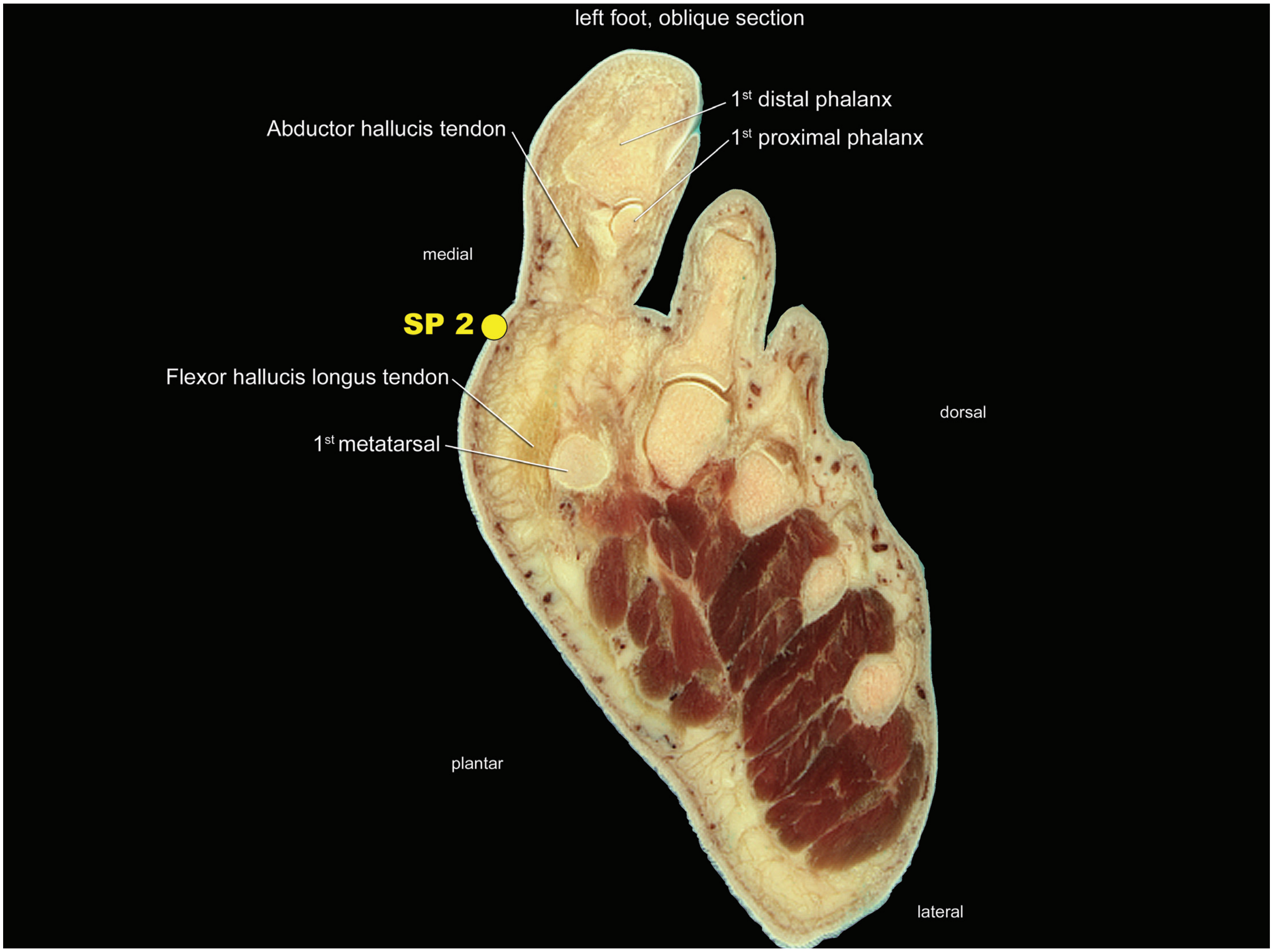


Figure 4-4. SP 2 occupies the distal valley at the 1st metatarsophalangeal joint where an abundance of superficial vessels resides, making this area vulnerable to neurovascular compression by tight-fitting shoes, biomechanical forces, and anatomical compression from bunions and connective tissue aberrancies.

entrapment neuropathy occurs. These include fibrinoid degeneration, focal demyelination, endoneural sclerosis, and edema. In addition, vessel walls fibrose, amorphous eosinophilic deposition ensues, and nerve fibers deteriorate. Pressure impacts sensory fibers more than motor fibers; patients complain of sharp or burning pain, tingling, numbness, and/or paresthesias. Allodynia causes any light touch or pressure to be experienced as pain.

Vessels

- **Medial plantar artery:** This small artery mainly supplies the muscles of the great toe. Most of the plantar digital arteries arise from the medial plantar artery. Its superficial branch provides circulation to the skin on the medial aspect of the sole. This branch gives off smaller digital branches which accompany the digital branches of the medial plantar nerve.
- **Medial marginal vein of the foot:** Joins the great saphenous vein, receiving blood from the superficial veins of the sole which form the plantar venous network.

Clinical Relevance: Entrapment or compression of the plantar proper digital nerve to the hallux (terminal branch of the medial plantar nerve) may induce or follow chronic ischemia from compressed vessels at SP 2.[4] The nerves within the vessel walls, i.e., the nervi vasorum, suffer damage when plantar neuromas develop.

Indications and Potential Point Combinations

- **Pain in or near the first metatarsophalangeal joint:** SP 2, SP 3, consider LR 2, LR 3, ST 39, extensor hallucis longus trigger point; try to determine source of pain and treat accordingly.
- **Pedal edema:** SP 2 and SP 3 (acupressure), SP 6, SP 9, CV 6.

References

1. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International*. 2007; 28(5):617-620.
2. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International*. 2007; 28(5):617-620.
3. Still GP and Fowler MB. Joplin's neuroma or compression neuropathy of the plantar proper digital nerve to the hallux: clinicopathologic study of three cases. *Journal of Foot & Ankle Surgery*. 1998;37(6):524-530.
4. Still GP and Fowler MB. Joplin's neuroma or compression neuropathy of the plantar proper digital nerve to the hallux: clinicopathologic study of three cases. *Journal of Foot & Ankle Surgery*. 1998;37(6):524-530.

SP 3

Tai Bai "Supreme White"

On the medial surface of the foot, in a depression proximal to the 1st metatarsophalangeal joint, at the dorsal/plantar skin junction. Easy to find by sliding the fingertip in a proximal direction over the medial bulge of the big toe.

Tendons and Muscles

- **Abductor hallucis tendon:** Abducts the great toe. However, its physiologic role in hallux abduction may be less important than its contribution to proper gait mechanics. The abductor hallucis assists the posterior tibial tendon in supporting and elevating the arch of the foot.[1]
- **Flexor hallucis brevis muscle:** Flexes the proximal phalanx of the great toe.

Clinical Relevance: The arch of the foot reduces forces in the joints, ligaments, and muscles of the foot. The abductor hallucis muscle demonstrates significant myoelectric activity during the late stance and toe-off phases of the gait.[2] This indicates that it may help decelerate flattening of the arch following heel strike and, in contrast, elevate the arch before toe-off. Dysfunction in the abductor hallucis muscle may compromise its ability to dynamically support the arch. Local acupuncture at myofascial trigger points in the abductor hallucis as well as its attachments (e.g., SP 2) may improve its biomechanics and mechanoreceptor input.

Trigger point pathology in the region of SP 3 sends referred pain distad toward the metatarsophalangeal (MTP) join, great toe, and medial second toe.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Medial plantar nerve (larger terminal branch of tibial nerve, L5-S3):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle. At the 1st MTP joint, fibers from the medial plantar nerve form the plantar proper digital nerve to the hallux. The nerve may experience compression where it cross over the medial and plantar aspects of the MTP joint on the plantar surface of the hallux in the vicinity of SP 2 and SP 3. Tight shoes may precipitate a focal neuropathy that can become chronic. Anatomic compression may result from abnormal bony ridges (e.g., bunions) or tethers that form after repetitive trauma goes unabated, leading to proliferation and hyalination of connective tissue.

Clinical Relevance: The plantar proper digital nerve to the hallux can become compressed or entrapped, prompting the onset of perineural fibrosis, leading to "Joplin's neuroma".[3] Multiple additional pathologic changes take place when compressive or entrapment neuropathy occurs. These include fibrinoid degeneration, focal demyelination, endoneural sclerosis, and edema. In addition, vessel walls fibrose, amorphous eosinophilic deposition ensues, and nerve fibers deteriorate. Pressure impacts sensory fibers more than motor fibers; patients complain of sharp or burning pain, tingling, numbness, and/or paresthesias. Allodynia causes any light touch or pressure to be experienced as pain. Patients with gout may suffer from medial and dorsal plantar hallucal entrapment if a large tophus compresses these nerves.[4]

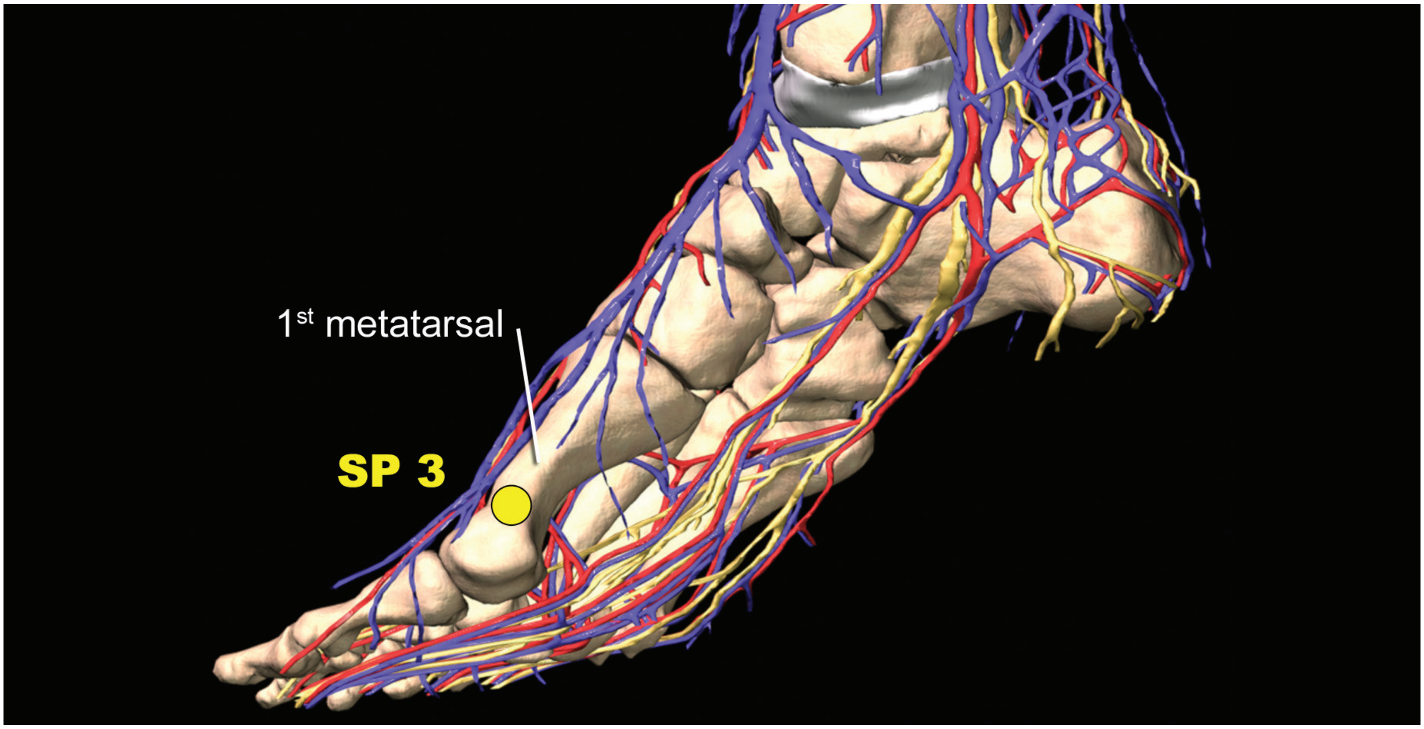


Figure 4-5. SP 3, "Supreme White" lines up with other SP channel points along the dorsal/plantar junction of the medial foot where the color changes from dark (dorsal) to light (plantar).

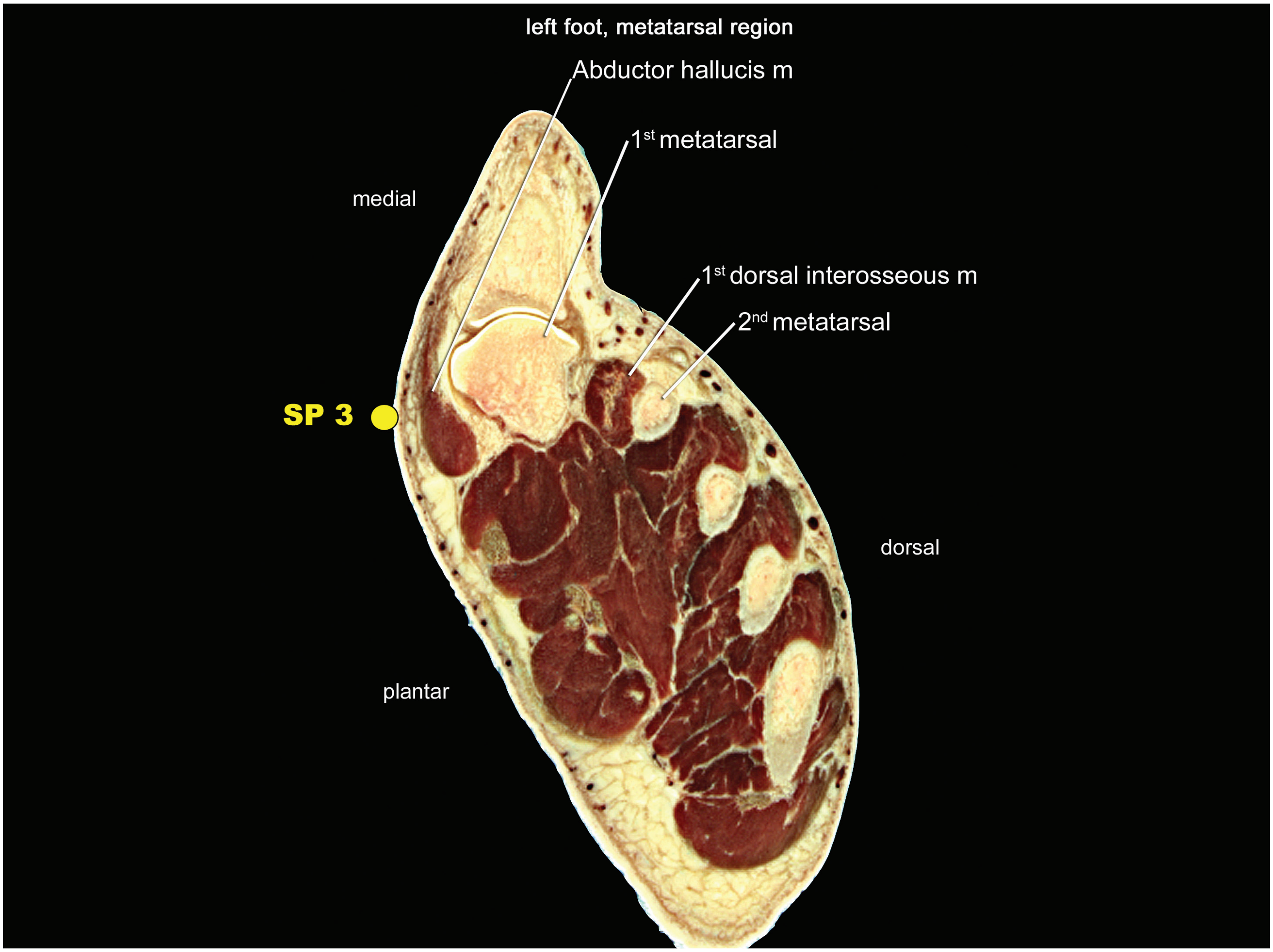


Figure 4-6. SP 3 relates to the abductor hallucis muscle.

Vessels

- **Medial plantar artery:** This small artery mainly supplies the muscles of the great toe. Most of the plantar digital arteries arise from the medial plantar artery. Its superficial branch provides circulation to the skin on the medial aspect of the sole. This branch gives off smaller digital branches which accompany the digital branches of the medial plantar nerve.
- **Medial marginal vein of the foot:** Joins the great saphenous vein, receiving blood from the superficial veins of the sole which form the plantar venous network.

Clinical Relevance: Entrapment or compression of the plantar proper digital nerve to the hallux (terminal branch of the medial plantar nerve) may induce or follow chronic ischemia from compressed vessels at SP 2.[5] The nerves within the vessel walls, i.e., the nervi vasorum, suffer damage when plantar neuromas develop.

Indications and Potential Point Combinations

- **Foot pain in the first metatarsophalangeal region:** SP 3, SP 2, SP 4, LR 2.
- **Diabetic neuropathy:** SP 3, SP 2, Bafeng, ST 36.

Evidence-Based Applications

- Shallow needling at SP 3, SP 4, ST 36, ST 25, CV 9, and CV 6 improved **diarrhea** in children, possibly by enhancing immune function and regulating motility.[6]

References

1. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International*. 2007; 28(5):617-620.
2. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International*. 2007; 28(5):617-620.
3. Still GP and Fowler MB. Joplin's neuroma or compression neuropathy of the plantar proper digital nerve to the hallux: clinicopathologic study of three cases. *Journal of Foot & Ankle Surgery*. 1998;37(6):524-530.
4. Delfaut EM, Demondion X, Bieganski A, et al. Imaging of foot and ankle nerve entrapment syndromes: from well-demonstrated to unfamiliar sites. *Radiographics*. 2003;23(3): 613-623.
5. Still GP and Fowler MB. Joplin's neuroma or compression neuropathy of the plantar proper digital nerve to the hallux: clinicopathologic study of three cases. *Journal of Foot & Ankle Surgery*. 1998;37(6):524-530.
6. Lin Y, Zhou Z, Shen W, et al. Clinical and experimental studies on shallow needling technique for treating childhood diarrhea. *J Tradit Chin Med*. 1983;13(2):107-114.

SP 4

Gong Sun "Grandfather Grandson"

On the medial surface of the foot, in a depression distal to the base of the 1st metatarsal bone at the dorsal/plantar skin junction. First locate SP 3, and then slide the finger in a proximal direction along the first metatarsal until it reaches a notch just distal to the base.

Tendons and Muscles

- **Abductor hallucis muscle:** Abducts the great toe. However, its physiologic role in hallux abduction may be less important than its contribution to proper gait mechanics. The abductor hallucis assists the posterior tibial tendon in supporting and elevating the arch of the foot.[5]
- **Flexor hallucis brevis muscle:** Flexes the proximal phalanx of the great toe. Accessible with deep needling of SP 4.
- **Flexor hallucis longus tendon:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It also assists the ankle in plantarflexion.
- **Tibialis anterior tendon:** Dorsiflexes and inverts the foot.

Clinical Relevance: The arch of the foot reduces forces in the joints, ligaments, and muscles of the foot. The abductor hallucis muscle demonstrates significant myoelectric activity during the late stance and toe-off phases of the gait.[6] This indicates that it may help decelerate flattening of the arch following heel strike and, in contrast, elevate the arch before toe-off. Dysfunction in the abductor hallucis muscle may compromise its ability to dynamically support the arch. Local acupuncture at myofascial trigger points in the abductor hallucis as well as its attachments (e.g., SP 2) may improve its biomechanics and mechanoreceptor input.

Trigger point pathology in the flexor hallucis brevis muscle in the vicinity of SP 4 issues referred pain to the 1st MTP joint and distad to the great toe and medial aspect of the second toe.

Flexor hallucis longus dysfunction, or FHL stenosing tenosynovitis, often accompanies or resembles flexor hallucis longus tendinitis, plantar fasciitis, and tarsal tunnel syndrome.[7]

Nerves

- **Medial plantar nerve (larger terminal branch of tibial nerve, L5-S3):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: The medial plantar nerve may become entrapped as it runs along the plantar surface of the flexor digitorum longus tendon and passes through the "Master Knot of Henry". It then branches to course along the medial and lateral aspects of the flexor hallucis longus tendon.[8] "Jogger's foot" is associated with a medial plantar nerve entrapment where it branches within the narrow space created by the abductor hallucis muscle and the anatomical crossover of the flexor hallucis longus and flexor digitorum longus tendons, the site known as the "Master Knot of Henry".[9] Jogger's foot may result from running with excessive pronation or a high medial arch. The patient experiences dysesthesia and pain along the plantar aspects of the first and second toes. Maximal tenderness occurs at the medial arch.

Vessels

- **Medial plantar artery:** This small artery mainly supplies the muscles of the great toe. Most of the plantar digital arteries arise from the medial plantar artery. Its superficial branch provides circulation to the skin on the medial aspect of the sole. This branch gives off smaller digital branches which accompany the digital branches of the medial plantar nerve.
- **Medial marginal vein of the foot:** Joins the great saphenous vein, receiving blood from the superficial veins of the sole which form the plantar venous network.

Clinical Relevance: Tension in the intrinsic foot musculature along the medial aspect can compress small nerves and vessels, exacerbating the problem.

Indications and Potential Point Combinations

- **Genitourinary problems:** SP 4, SP 6, PC 6, CV 4, CV 6, KI 3, BL 23, BL 28.
- **Digestive disorders:** vomiting, borborygmi, diarrhea, dysentery, abdominal bloating: SP 4, SP 6, ST 36, CV 12,
- **Medial foot pain:** SP 4, SP 3. Check for trigger points in the tibialis anterior (ST 36), extensor hallucis longus (GB 37, GB 38), flexor hallucis brevis (SP 3), and adductor hallucis (KI 2) muscles.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[1]
- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis**.[2]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia (OAT syndrome)**.[3]
- SP 4 and PC 6 in combination appear to work synergistically in regulating cardiac and gastric functional activities in rats with experimentally induced **acute myocardial ischemia (AMI)** by promoting recovery of normal electrical activity and through its influence on nitric oxide synthase activity in the myocardium, gastric antrum, and duodenum.[4]

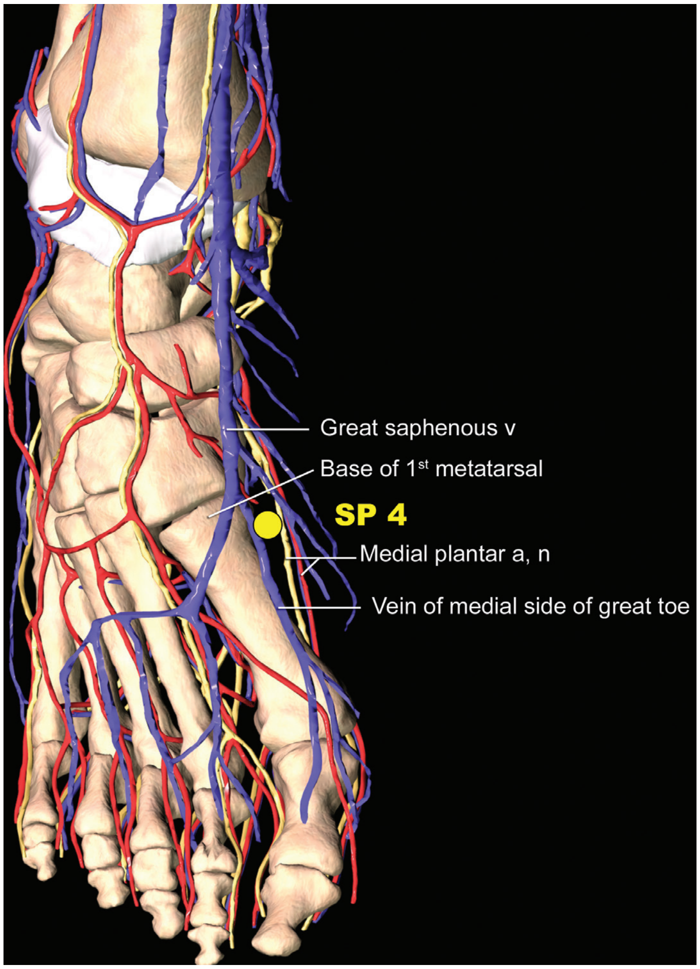


Figure 4-7. SP 4, the "Grandfather Grandson" point, is where the small veins (grandsons) of the medial foot meet the great saphenous vein (the grandfather).

References

1. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
2. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine.* 2004;24(3):163-165.
3. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.
4. Wang S-B, Chen S-P, Gao Y-H, et al. Effects of electroacupuncture on cardiac and gastric activities in acute myocardial ischemia rats. *World J Gastroenterol.* 2008;14(42):6496-6502.
5. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International.* 2007; 28(5):617-620.
6. Wong YS. Influence of the abductor hallucis muscle on the medial arch of the foot: a kinematic and anatomical cadaver study. *Foot & Ankle International.* 2007; 28(5):617-620.
7. Oloff LM and Schulhofer SD. Flexor hallucis longus dysfunction. *The Journal of Foot & Ankle Surgery.* 1998;37(2):101-109.
8. Schon LC and Baxter DE. Neuropathies of the foot and ankle in athletes. *Clin Sports Med.* 1990;9(2):489-509.
9. Delfaut EM, Demondion X, Bieganski A, et al. Imaging of foot and ankle nerve entrapment syndromes: from well-demonstrated to unfamiliar sites. *Radiographics.* 2003;23(3): 613-623.

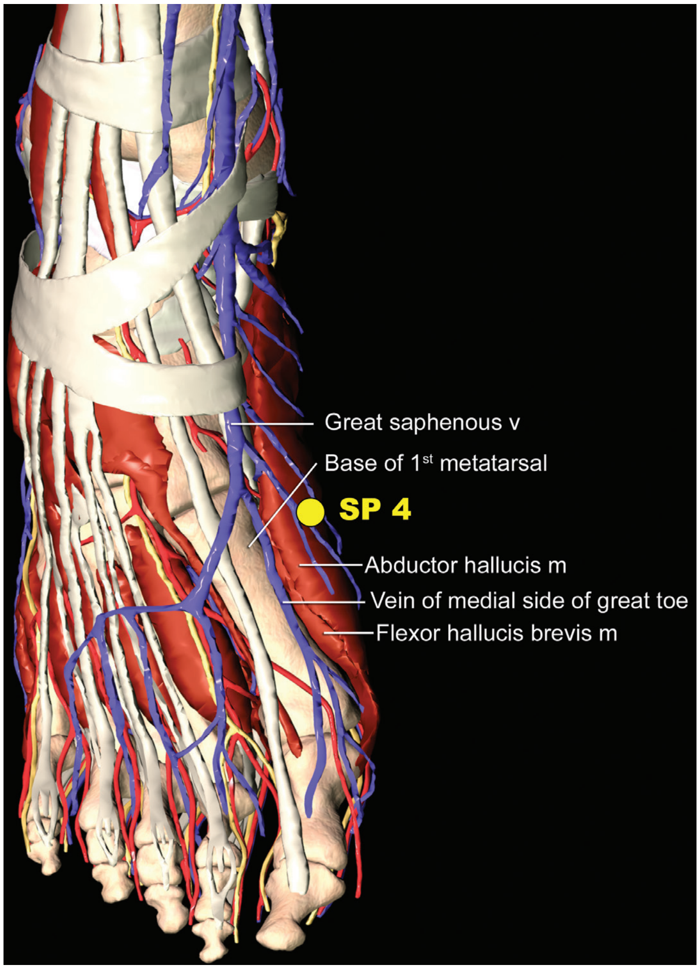


Figure 4-8. Muscles in the leg and foot display different susceptibility to form muscle cramps; the latter cramp more readily. Of the two muscles on the medial aspect of the foot along the SP channel, the abductor hallucis (AH) has a higher likelihood of cramping than the flexor hallucis brevis (FHB). (Minetto MA and Botter A. Elicitability of muscle cramps in different leg and foot muscles. Muscle Nerve, 2009.). When treating medial foot pain, carefully palpate all muscles to better isolate the source of muscle cramping.

SP 5

Shang Qiu "Shang Mound" or "Shang Hill"

On the medial surface of the foot, in the depression distal and inferior to the medial malleolus, midway between the tuberosity of the navicular bone and the prominence of the malleolus.

Note: Since the ankle joint lies deep to this point (as does the great saphenous vein), caution is warranted so as to avoid intra-articular insertion or damage to the vein.

Connective Tissues

- **Anterior tibiotalar and tibionavicular ligaments:** Four medial ligaments fan out from the tibia's medial malleolus. They attach to the talus, calcaneus, and navicular bones. These ligaments include the anterior and posterior tibiotalar, the tibionavicular, and the tibiocalcaneal ligaments. Collectively, they comprise the deltoid ligament.

Clinical Relevance: Joint stability requires fine interactions of static and dynamic components.[1] The aforementioned ligaments along with joint surface congruity limit joint translation while proprioceptive control over compressive and directional forces fall under the purview of nerves. Ligaments house mechanoreceptors, including Ruffini endings, Pacinian corpuscles, and Golgi-like endings (rare), as well as free nerve endings and various unclassifiable corpuscles. Sensory corpuscles and blood vessels occur, for the most part, close to ligamentous insertions onto bone, along with epiligamentous areas that provide support for the neurovascular bundles traveling into the ligament. Because most ligamentous disruption occurs in areas lacking neurovascular structures, proprioceptors and vessels are spared and thus can help heal a rupture ligament. Partial deafferentation of a ligament caused by damage to the sensory endings in the joint capsule and ligament may induce a functional instability in the ankle joint, leading to loss of position sense, reduced strength, delayed reaction time, and impaired control over posture. Acupuncture directed at restoring appropriate sensory input in periarticular structures at locations such as SP 5 may aid in restoring proprioceptive sensitivity to augment stabilization of the ankle joint.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: The distal saphenous nerve at the ankle may be injured during arthroscopy, fixation of distal tibia medial malleolar fractures, invasive approach to tarsal tunnel syndrome, and other surgical approaches to the ankle.[2]

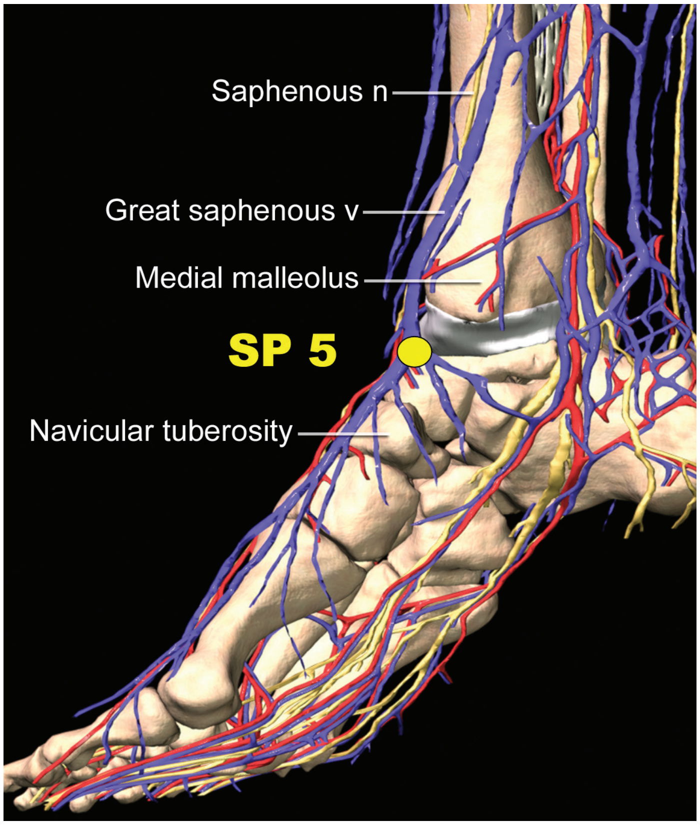


Figure 4-9. The hill in the name "Shang Hill" for SP 5 refers to the medial malleolus.

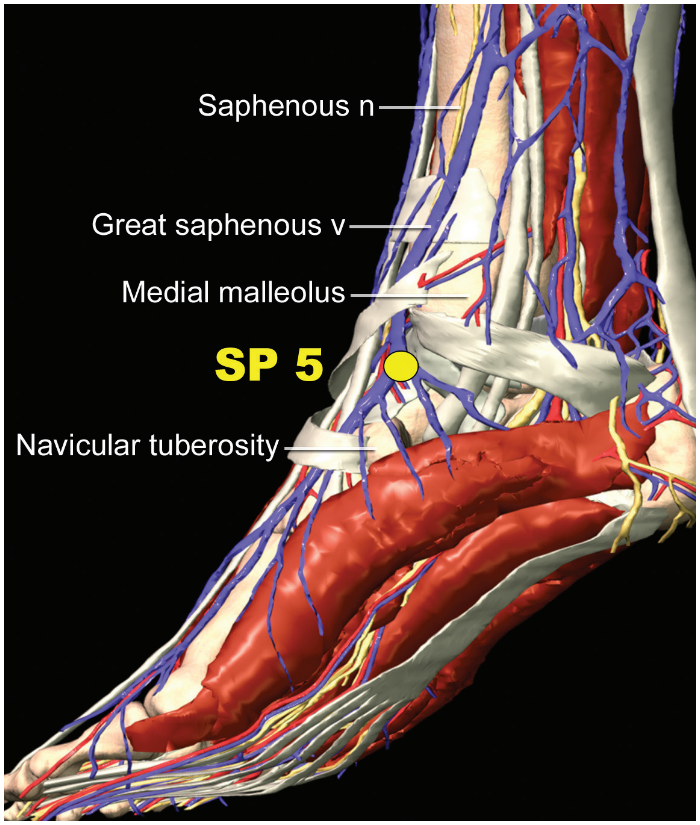


Figure 4-10. The proximity fo the ankle joint and the great saphenous vein to SP 5 anatomically justify its indications of ankle pain and foot swelling. The proximity of the ankle joint suggests caution when needling in order to avoid joint entry.

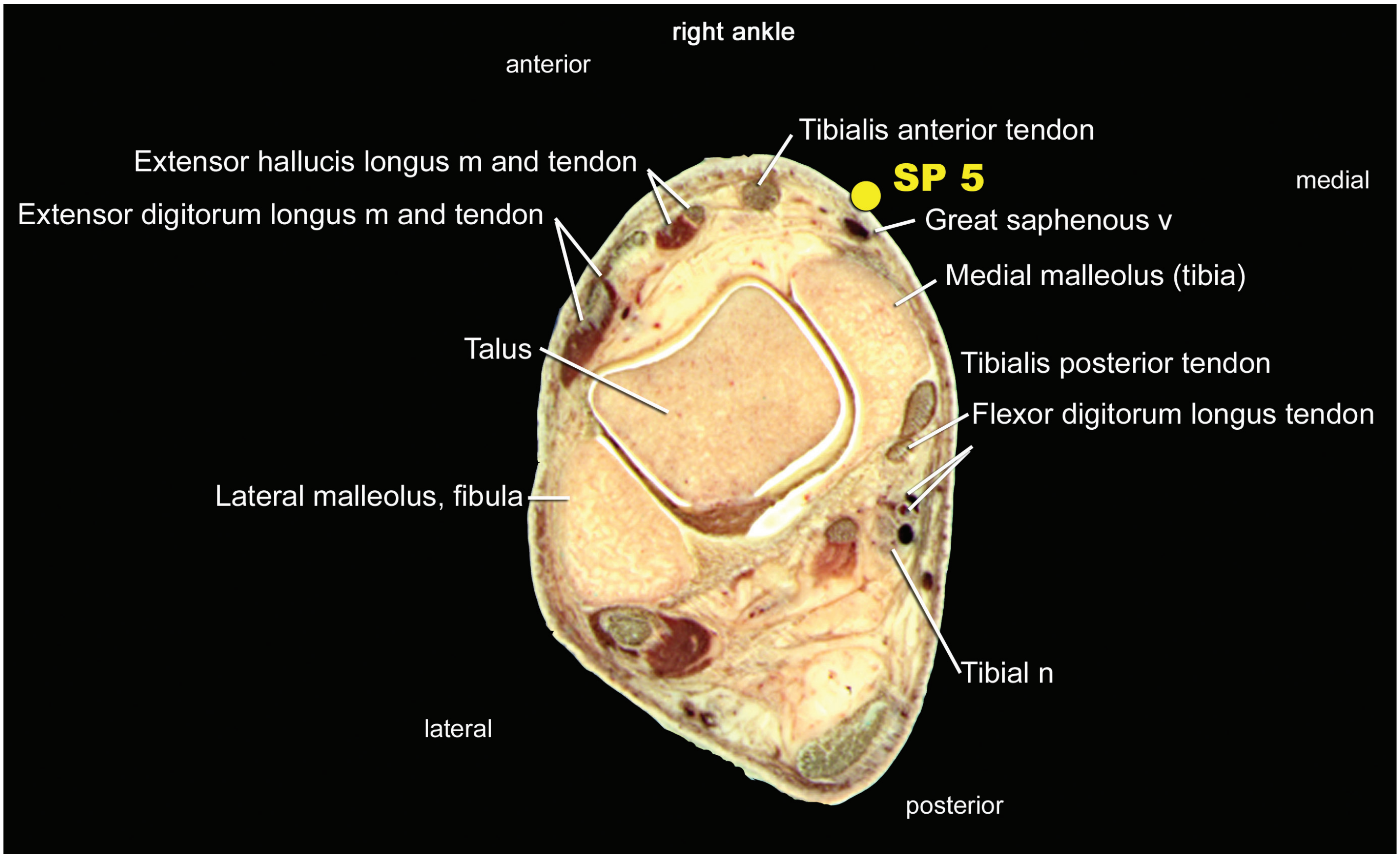

right ankle
anterior
Tibialis anterior tendon
Extensor hallucis longus m and tendon
SP 5
medial
Great saphenous v
Extensor digitorum longus m and tendon
Medial malleolus (tibia)
Talus
Tibialis posterior tendon
Flexor digitorum longus tendon
Lateral malleolus, fibula
Tibial n
lateral
posterior

Figure 4-11. Amidst the many tendons present, SP 5 remains faithful to its venous association, shown here over the great saphenous vein.

Vessels

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch. Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein.
- **Medial tarsal artery:** Arises from the dorsalis pedis artery; supplies the medial ankle (tarsal) area.
- **Medial malleolar arterial and venous network:** Provides and drains blood to and from the medial malleolar region, respectively.

Clinical Relevance: Sympathetic fibers travel with the peripheral nerves to supply arteries and larger veins with nervi vasorum.[3]

The great saphenous vein is often targeted during procedures designed to treat varicose veins. Stripping of the great saphenous vein may lead to saphenous nerve injury.[4] Should saphenous nerve injury occur, acupuncture and related techniques may aid in the recovery of this peripheral nerve.

Indications and Potential Point Combinations

- **Local pain:** SP 5; check for trigger points in the flexor digitorum longus trigger point (LR 7 region), medial head of the gastrocnemius muscle (BL 55 region),and especially the tibialis anterior (ST 36).
- **Venous insufficiency, pain from varicosities and circulatory compromise:** SP 5, Bafeng (web spaces between the toes), SP 6, ST 36, CV 6.

References

1. Rein S, Hagert E, Hanisch U, et al. Immunohistochemical analysis of sensory nerve endings in ankle ligaments: a cadaver study. *Cells Tissues Organs.* DOI: 10.1159/000339877.
2. Mercer D, Morrell NT, Fitzpatrick J, et al. The course of the distal saphenous nerve: a cadaveric investigation and clinical implications. *Iowa Orthop J.* 2011;31:231-235.
3. Dellon AL, Hoke A, Williams EH, et al. The sympathetic innervation of the human foot. *Plast Reconstr Surg.* 2012;129(4):905-909.
4. Kostas TT, Ioannou CV, Veligrantakis M, et al. The appropriate length of great saphenous vein stripping should be based on the extent of reflux and not on the intent to avoid saphenous nerve injury. *J Vasc Surg.* 2007;46(6):1234-1241.

SP 6

San Yin Jiao "Three Yin Intersection"

On the medial side of the leg, on the posterior border of the tibia, 3 cun proximal to the prominence of the medial malleolus.

Can stimulate labor; avoid in pregnancy until time of parturition.[22]

Muscles

- **Flexor digitorum longus muscle:** The flexor digitorum longus flexes the lateral four pedal digits and plantarflexes the ankle. It helps support the longitudinal arch of the foot.
- **Flexor hallucis longus muscle:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It also assists the ankle in plantarflexion.
- **Posterior tibialis muscle:** This muscle inverts the foot and provides ankle plantarflexion. Called the "runner's nemesis".

Clinical Relevance: Exercise produces functional sympatholysis.[23] A trigger point in the soleus at SP 6 refers pain along the proximal lower leg toward the calf but even more strongly toward the heel and plantar aspect of the mid-foot. A trigger point in the flexor hallucis longus within reach of a needle inserted into SP 6 refers strongly to the medial and plantar aspects of the big toe.

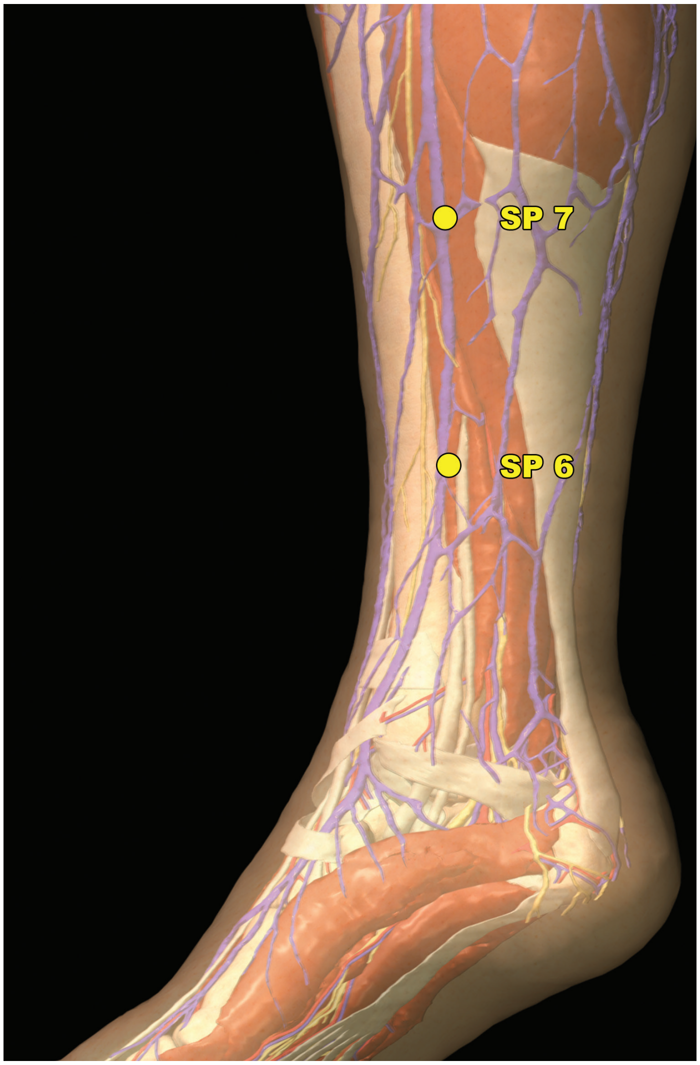


Figure 4-12. SP 6, "Three Yin Intersection", lives three cun proximal to the medial malleolus, on the Yin, or inner, side of the leg, where the SP channel intersects with the LR and KI channels.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee. At SP 6, the tibial nerve occupies the location known as the "high tarsal tunnel".[24] Nerve compression can result from myofascial restriction involving the flexor digitorum longus and flexor hallucis longus, the soleus, and tibialis posterior.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Women treated with percutaneous tibial nerve stimulation for overactive bladder syndrome may experience a transient sensory deficit in the region of SP 1, SP 2, to SP 3. Acupuncture along the SP line may aid in the recovery of sensory nerve function in the tibia.[25] The fact that sacral spinal segments contribute significantly to the fiber composition of the tibial nerve helps explain why stimulation of points such as SP 6 and KI 3 neuromodulate pelvic organ function, and why these points appears so often in needling protocols for genitourinary concerns and voiding dysfunction. In particular, segments supplying the tibial nerve as it innervates the flexor hallucis longus and flexor digitorum longus arise from S2 and S3, the most caudal segments associated with the tibial nerve.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch.

Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein. A rich, mixed, vascular network (vasa vasorum) and attendant nerve accompany the great saphenous vein from ankle to knee.[26]

- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin from the superficial veins. Because the perforating veins traverse this fascia at an oblique angle, muscular contraction and pressure within the compartment compress them. This promotes venous return to the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[27]

Indications and Potential Point Combinations

- **Immune and endocrine stimulation:** SP 6, ST 36, GV 14, LI 11, LI 4.
- **Promotes menstrual flow:** SP 6, ST 36, CV 4, BL 25.
- **Reproductive problems:** dysmenorrhea, leukorrhea, orchitis, hernia, spermatorrhea: SP 6, SP 4, PC 6, ST 29, SP 30, CV 3, CV 4.
- **Micturition disorders:** SP 6, KI 3, BL 28, BL 23.
- **Lower abdominal pain:** SP 6, ST 36, CV 6, CV 12.
- **Diarrhea and abdominal distension:** SP 6, ST 36, CV 12, BL 25.
- **Calf pain:** SP 6, palpate tibialis posterior muscle trigger point (near BL 55) for referred pain extending to the ankle and foot.

Evidence-Based Applications

- The four points LI 11, SP 10, SP 6, and ST 36 treat **urticaria.**[1]
- Acupuncture at SP 6 produced a strong vasoconstriction in the ipsilateral leg and a slight **vasoconstriction** in the contralateral leg with no change in the arms. Stimulation of ST 36 produced a superficial vasoconstriction in the skin of both legs but no change in the arms. Stimulation of PC 6 or LI 11 caused ipsilateral vasoconstriction in the arms only. This information suggests a topographical representation in the neural segments responsible for the change in sympathetic activity.[2]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[3]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with **Sjögren's syndrome.**[4]
- Acupuncture-like transcutaneous nerve stimulation at SP 6, ST 36, LI 4, and CV 24 improves whole saliva production in patients with **radiation-induced xerostomia** in head-and-neck cancer patients treated with radical radiotherapy.[5]
- Case report of improvement with acupuncture at LR 3, KI 3, SP 6, and ST 36 for **sweating associated with malignancy**, unresponsive to other measures.[6]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes.**[7]
- Electroacupuncture at CV 4, GV 20, SP 6, KI 3, and HT 7 may have afforded a modulating positive effect on **psychogenic and non-psychogenic erectile dysfunction.** It improved the quality of erection and restored sexual activity in 39% of patients.[8]
- Transcutaneous electrical nerve stimulation at SP 6 and LR 3 significantly increased the frequency and strength of **uterine contractions** in post-dates pregnant women.[9]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combi nation with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome**, thereby offering an alternative to pharmacologic induction of ovulation.[10]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction.**[11]

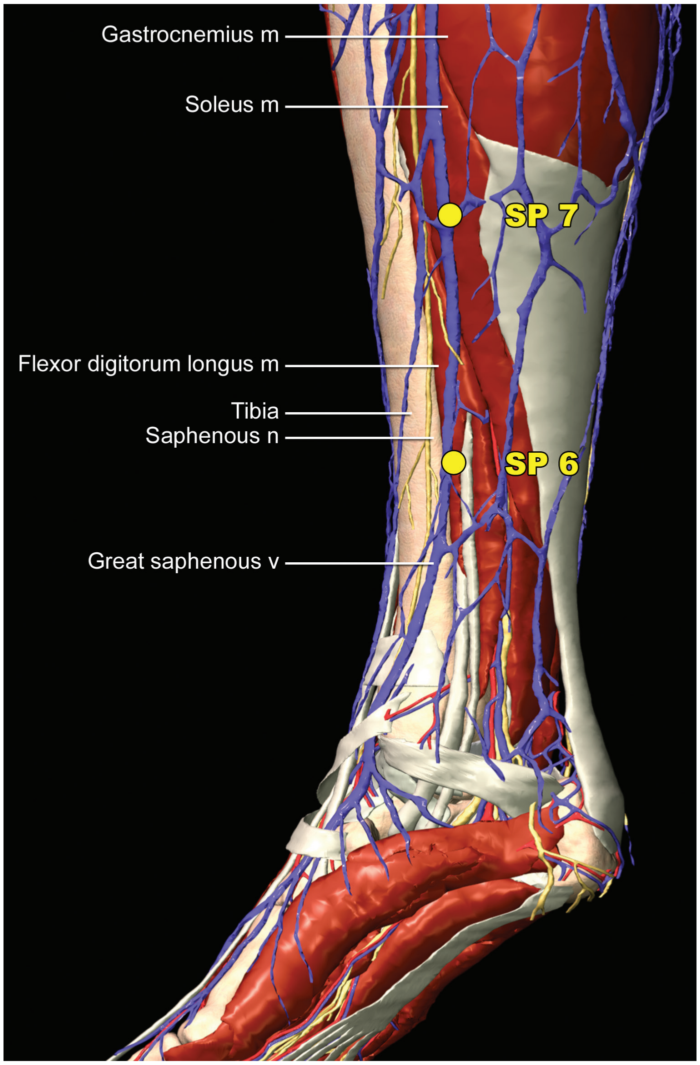


Figure 4-13. The autonomic indications for SP 6 pertain to both the sympathetic regulatory activities of the nervi vasorum associated with the greater saphenous vein and the neurologic reflexes that take place between the local innervation (tibial and saphenous nerves) and the spinal cord.

- Acupressure at SP 6 has been shown to be effective for **decreasing labor pain and shortening the length of delivery time** in women during labor.[12]
- SP 6 regulated cyclooxygenase-2 (COX-2) expression in pregnant rats, **inhibiting uterine motility.**[13]
- Acupuncture at LI 4 and SP 6 can shorten the time interval between estimated date of confinement (EDC) and actual delivery time. Helps **support cervical ripening.**[14]
- Needling GB 34, ST 36, SP 6, and BL 67 may help decrease the **need for labor induction and cesarean section.**[15]
- Acupuncture at SP 6 and LI 4 was shown to **increase cervical dilatation** without causing changes in human chorionic gonadotropin (HCG).[16]
- Acupuncture at SP 6 provided an immediate and effective means of pain and anxiety reduction in adolescent girls with **primary dysmenorrhea.**[17]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage

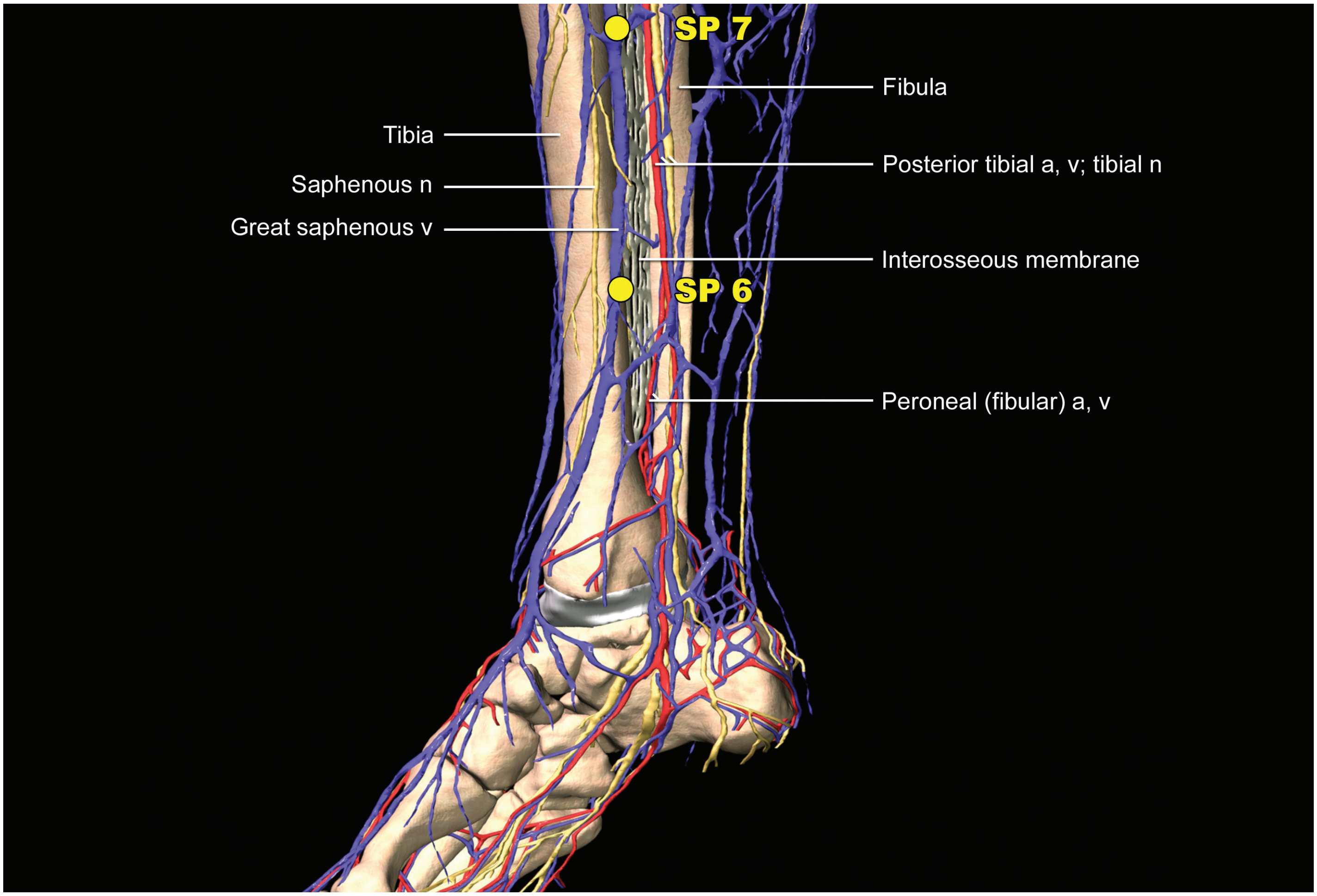


Figure 4-14. The three "Yin" channels crossing at San Yin Jiao ("Three Yin Intersection") refer to the great saphenous vein, the tibial nerve, and the saphenous nerve. These anatomical structures correspond to three acupuncture channels, to which they roughly correspond to SP, KI, and LR, respectively.

of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia (OAT syndrome).**[18]

- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[19]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in **improvement in sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[20]
- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[21]

References

1. Chen C-J and Yu H-S. Acupuncture treatment of urticaria. *Arch Dermatol.* 1998;134:1397-1399.
2. Lin M-T, Chandra A, and Chen-Yen S-M. Effects of needle stimulation of acupuncture loci Nei-Kuan (EH-6), Tsu-San-Li (St-36), San-Yin-Chiao (Sp-6) and Chu-Chih (LI-11) on cutaneous temperature and pain threshold in normal adults. *Am J Chin Med.* 1982;9(4):305-314.
3. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.* 1995;13(2):91-92.
4. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation.* 1993;20:541-548.
5. Wong RKW, Jones GW, Sagar SM, Babjak A-F, and Whelan T. A Phase I-II study in the use of acupuncture-like transcutaneous nerve stimulation in the treatment of radiation-induced xerostomia in head-and-neck cancer patients treated with radical radiotherapy. *Int J Radiation Oncology Biol Phys.* 2003;57(2):472-480.
6. Hallam C and Whale C. Acupuncture for the treatment of sweating associated with malignancy. *Acupuncture in Medicine.* 2003;21(4):155-156.
7. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society.* 1995;2(1):3-12.
8. Kho HG, Sweep CGJ, Chen X, Rabsztyn PRI, and Meuleman EJH. The use of acupuncture in the treatment of erectile dysfunction. *International Journal of Impotence Research.* 1999;11:41-46.
9. Dunn PA, Rogers D, and Halford K. Transcutaneous electrical nerve stimulation at acupuncture points in the induction of uterine contractions. *Obstetrics & Gynecology.* 1989;73:286-290.
10. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand.* 2000;79:180-188.
11. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.
12. Lee MK, Chang SB, and Kang D-H. Effects of SP6 acupressure on labor pain and length of delivery time in women during labor. *Journal of Alternative and Complementary Medicine.* 2004;10(6):959-965.
13. Kim K-S, Na CS, Hwang WJ, Lee BC, Shin KH, and Pak SC. Immunohistochemical localization of cyclooxygenase-2 in pregnant rat uterus by Sp-6 acupuncture. *American Journal of Chinese Medicine.* 2003;31(3):481-488.

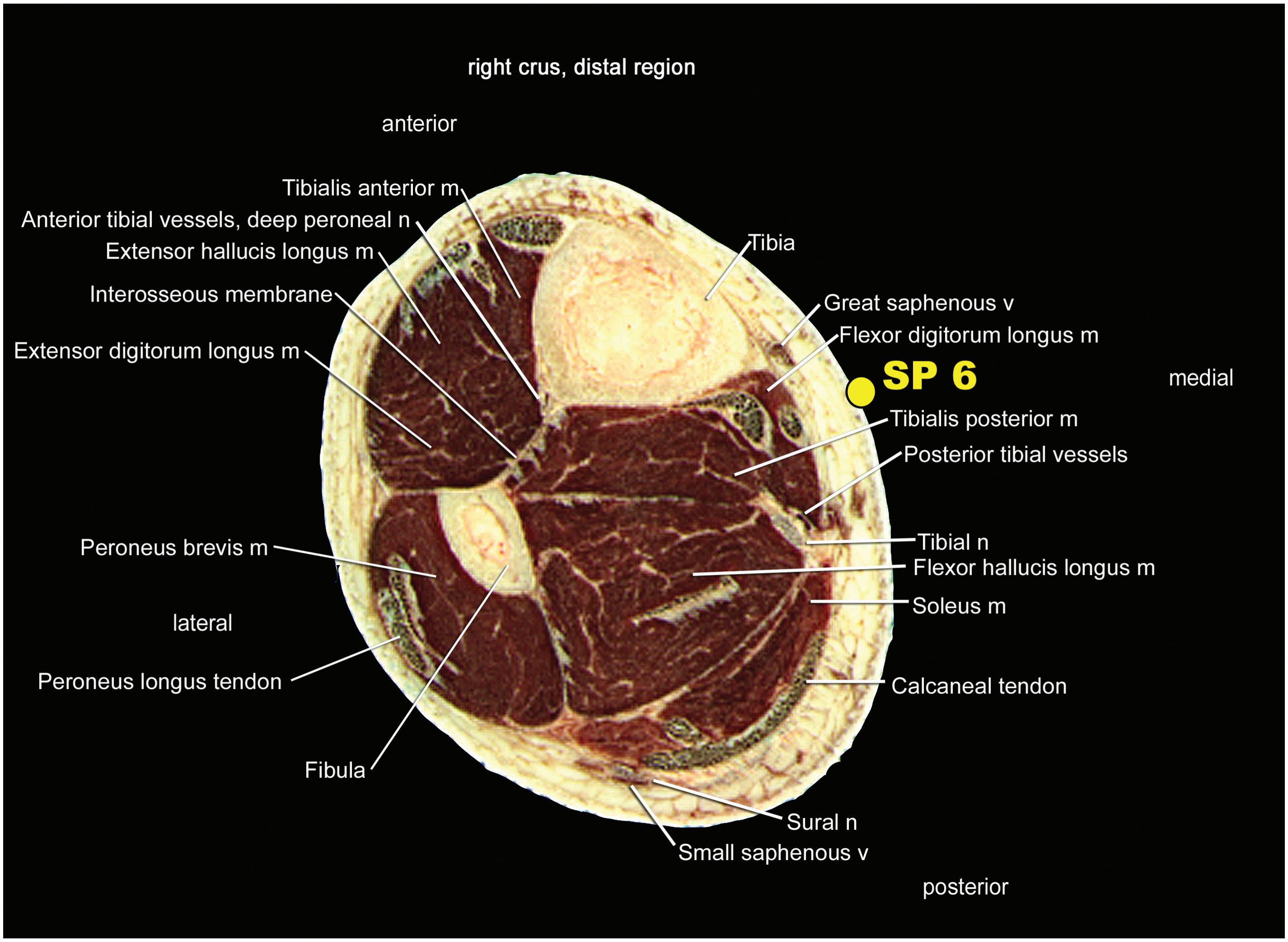

right crus, distal region
anterior
Tibialis anterior m
Anterior tibial vessels, deep peroneal n
Extensor hallucis longus m
Interosseous membrane
Extensor digitorum longus m
Tibia
Great saphenous v
Flexor digitorum longus m
SP 6
medial
Tibialis posterior m
Posterior tibial vessels
Peroneus brevis m
Tibial n
Flexor hallucis longus m
lateral
Soleus m
Peroneus longus tendon
Calcaneal tendon
Fibula
Sural n
Small saphenous v
posterior

Figure 4-15. This cross section level with SP 6 exposes the structures accessible to an acupuncture needle, namely the flexor digitorum longus, tibialis posterior, and flexor hallucis longus, depending on the angle of insertion. The ovoid brown structures housed within the flexor digitorum longus and tibialis posterior represent each muscle's respective tendon forming as the structure descends the limb.

14. Rabl M, Ahner R, Bitschnau M, Zeisler H, and Husslein P. Acupuncture for cervical ripening and induction of labor at term – a randomized controlled trial. *Wiener Klinische Wochenschrift*. 2001;113(23-24):942-946.

15. Duke K and Don M. Acupuncture use for pre-birth treatment. A literature review and audit-based research. *Complementary Therapies in Clinical Practice*. 2005;11:121-126.

16. Ying Y-K, Lin J-T, and Robins J. Acupuncture for the induction of cervical dilatation in preparation for first-trimester abortion and its influence on HCG. *Journal of Reproductive Medicine*. 1985;30(7):530-534.

17. Chen H-M and Chen C-H. Effects of acupressure at the Sanyinjiao point on primary dysmenorrhoea. *Journal of Advanced Nursing*. 2004;48(4):380-387.

18. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.

19. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.

20. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility*. 2005;84(1):141-147.

21. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine*. 2005;25(3):177-181.

22. Liu YL and Jin ZG. Clinical observation of the impacts and safety of electroacupuncture at Sanyinjiao (SP 6) on labor. *Zhongguo Zhen Jiu*. 2012;32(5):409-412.

23. Mortensen SP, Nyberg M, Winding K, et al. Lifelong physical activity preserves functional sympatholysis and purinergic signaling in the human leg. *J Physiol*. 2012;590(Pt 23):6227-6236.

24. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. Instructional Course Lectures. 1993;42:185-194.

25. Yoong W, Shah P, Dadswell R, et al. Sustained effectiveness of percutaneous tibial nerve stimulation for overactive bladder syndrome: 2-year follow-up of positive responders. *Int Urogynecol J*. DOI 10.1007/s00192-012-1936-3.

26. Nayak BB, Thatte RL, Thatte MR, et al. A microvascular study of the great saphenous vein in man and the possible implications for survival of venous flaps. *British Journal of Plastic Surgery*. 2000;53:230-233.

27. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology*. 2011;26(3):114-118.

SP 7

Lou Gu "Dripping Valley"

On the medial side of the leg, on the posterior border of the tibia, 6 cun proximal to the prominence of the medial malleolus, or 3 cun proximal to SP 6.

Muscles

- **Gastrocnemius muscle:** The gastrocnemius muscle raises the heel during ambulation. It flexes the leg at the knee, and plantarflexes the ankle if the knee is extended.
- **Soleus muscle:** Steadies the leg on the foot and plantarflexes the ankle, regardless of the position of the knee.
- **Flexor digitorum longus muscle:** The flexor digitorum longus flexes the lateral four pedal digits and plantarflexes the ankle. It helps support the longitudinal arch of the foot.
- **Flexor hallucis longus muscle:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It also assists the ankle in plantarflexion.
- **Posterior tibialis muscle:** This muscle inverts the foot and provides ankle plantarflexion.
- **Plantaris tendon:** Assists the gastrocnemius muscle in knee flexion and ankle plantarflexion.

Clinical Relevance: Trigger point pathology in the flexor digitorum longus near SP 7 refers pain down the spleen channel to the medial malleolus as well as the central plantar region of the foot. Needling into the tibialis posterior at this level may accentuate the referred pain and translate it more caudal along the gastrocnemius, to the calcaneal tendon, and over the plantar aspect of the foot.

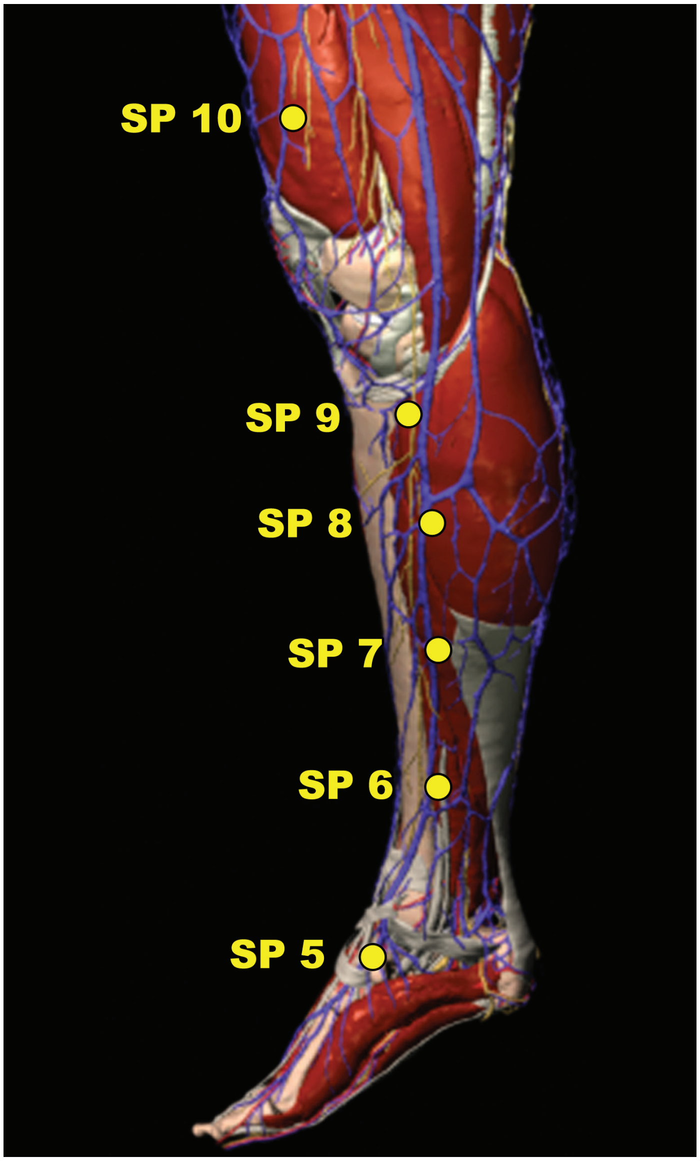


Figure 4-16. SP 7, "Leaking Valley", sits about mid-calf. This SP point follows the trend of its neighbors, hugging the tibia and the great saphenous vein while relating closely to the tibial and saphenous nerves. The similarity of structures associated with these points explains their frequently overlapping indications.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: As shown in Figure 4-17, the tibial nerve sits within reach of a needle entering SP 7. This presents the opportunity to neuromodulate both its motor aspects as well as issue input to the spinal cord segments that govern genitourinary activities.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch. Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin from the superficial veins. Because the perforating veins traverse this fascia at an oblique angle, muscular contraction and pressure within the compartment compress them. This promotes venous return to the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[1]

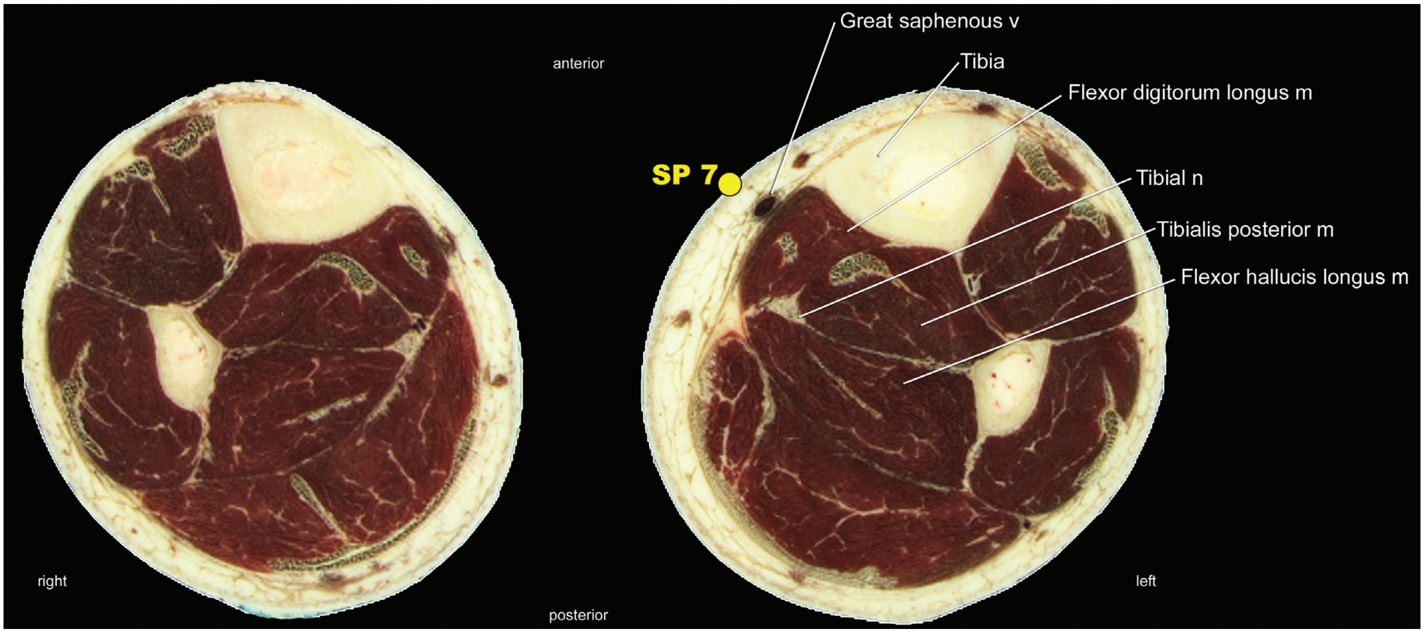

anterior
Great saphenous v
Tibia
Flexor digitorum longus m
SP 7
Tibial n
Tibialis posterior m
Flexor hallucis longus m
right
left
posterior

Figure 4-17. The name "Leaking Valley" for SP 7 describes the gulley, or valley, just caudal to the tibia, housing the great saphenous vein. Needling the vessel itself, as would have happened early in acupuncture's history, would have allowed blood to exit the vein and course down the valley. "Leaking Valley also could refer to an early physiologic idea that blood or fluid from this region leaked into the interstitial spaces to form pedal edema. In some ways, they were correct in terms of the linkage between venous insufficiency and valvular incompetence.

Indications and Potential Point Combinations

- **Local numbness or pain:** SP 7, BL 55, SP 6, KI 6. Evaluate for trigger points in the flexor digitorum longus, flexor hallucis longus, and tibialis posterior muscles.
- **Micturition disorders:** SP 7, SP 6, KI 3, BL 28, CV 3.

References

1. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology.* 2011;26(3):114-118.

SP 8

Di Ji "Earth Pivot"

On the medial side of the leg, on the posterior border of the tibia, 3 cun distal to SP 9, on the line connecting SP 9 and the medial malleolus.

Muscles

- **Gastrocnemius muscle:** The gastrocnemius muscle raises the heel during ambulation. It flexes the leg at the knee, and plantarflexes the ankle if the knee is extended.
- **Soleus muscle:** Steadies the leg on the foot and plantarflexes the ankle, regardless of the position of the knee.
- **Flexor digitorum longus muscle:** The flexor digitorum longus flexes the lateral four pedal digits and plantarflexes the ankle. It helps support the longitudinal arch of the foot.
- **Flexor hallucis longus muscle:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It also assists the ankle in plantarflexion.
- **Posterior tibialis muscle:** This muscle inverts the foot and provides ankle plantarflexion.
- **Plantaris tendon:** Assists the gastrocnemius muscle in knee flexion and ankle plantarflexion.

Clinical Relevance: Trigger point pathology in the flexor digitorum longus near SP 8 refers pain down the spleen channel to the medial malleolus as well as the central plantar region of the foot. Needling into the tibialis posterior at this level may accentuate the referred pain and translate it more caudal along the gastrocnemius, to the calcaneal tendon, and over the plantar aspect of the foot.

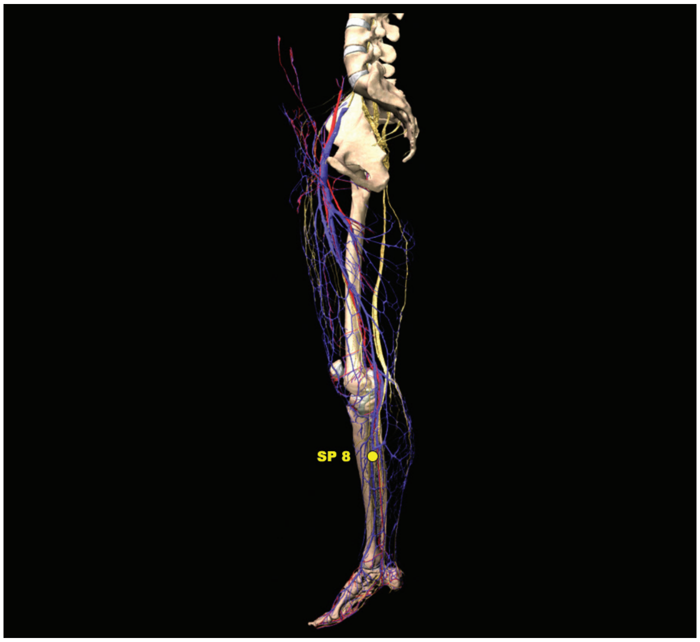


Figure 4-18. As with the other SP points on the calf, SP 8 follows the great saphenous vein and, a bit less directly, the tibial nerve.

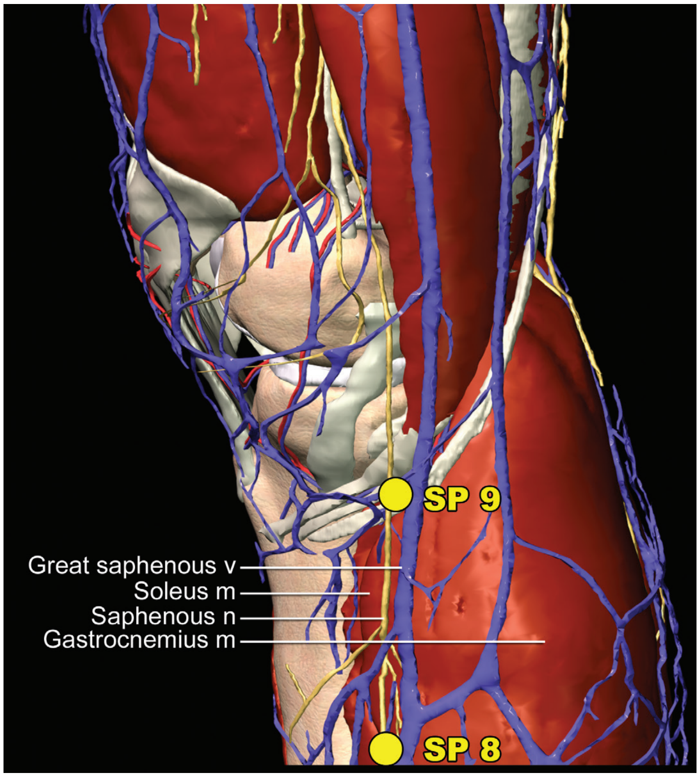


Figure 4-19. Chinese medicine divides the body into sections corresponding to "top, middle, and bottom", calling them "sky, man, and earth". As the "Earth Pivot", this point hinges between man and earth regions, and indications for its inclusion in treatment protocols relate to lower abdomen and pelvic activities such as digestion and reproduction. SP 8 as "Earth's Pivot" or "Earth's Crux" harkens back to the time in early China when acupuncturists regarded SP 8 as holding dominance over the lower region of the body, in the same way that SP 21 ("Great Embracement") oversees the upper body and ST 25 ("Celestial Pivot") the midsection. Alternatively, if one translates the "ji" in Di Ji as "cure" instead of "crucial point", then the name Di Ji becomes "Earth Cure". Pelvic limb points treat digestive disorders due to their linkage with the nucleus tractus solitarius and lumbosacral spinal cord segments. In Chinese medicine, the "Earth" domain refers to the process of digestion and assimilation. Thus, curing "Earth" problems refers to alleviating ailments such as diarrhea and irritable bowel syndrome.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: As shown in Figure 4-20, the tibial nerve sits within reach of a needle entering SP 8. This presents the opportunity to neuromodulate both its motor aspects as well as issue input to the spinal cord segments that govern genitourinary activities.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The

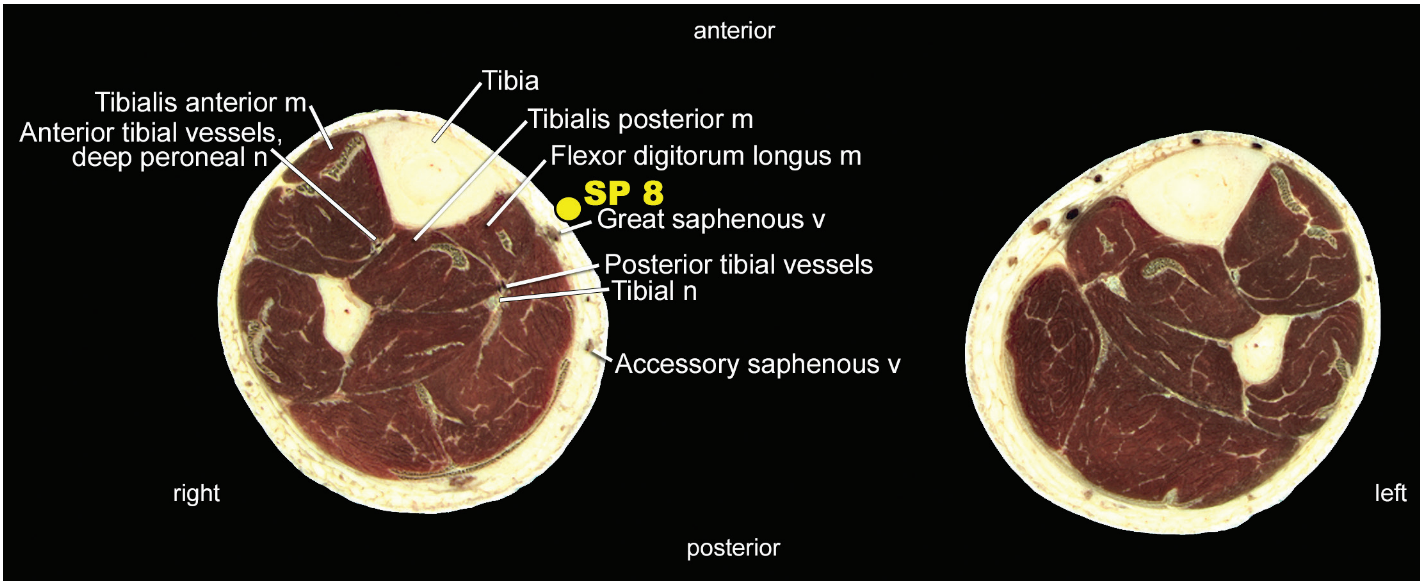


Figure 4-20. SP 8 lies close to the trigger point in the flexor digitorum longus muscle; pain here refers down the SP channel to SP 5 and then to the region surrounding KI 1 at the bottom of the foot.

posterior tibial artery provides a nutrient artery to the tibia.

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch. Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin from the superficial veins. Because the perforating veins traverse this fascia at an oblique angle, muscular contraction and pressure within the compartment compress them. This promotes venous return to the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[2]

Indications and Potential Point Combinations

- **Menstrual and urogenital disorders:** SP 8, SP 6, CV 4, BL 23.
- **Acute digestive disorders, such as poor appetite, abdominal pain and distension:** SP 8, SP 6, ST 36, GV 20.
- **Urinary retention or incontinence:** SP 8, SP 6, KI 3, BL 27, BL 28.
- **Venous problems, especially edema:** SP 8, SP 6, SP 10, ST 36, BL 23, GV 20.

Evidence-Based Applications

- Case series reports SP 8 effective for **medial thigh pain, abdominal aching and distension, and chest pain on exertion.**[1]

References

1. Luan J. Clinical application of point Diji. *Journal of Traditional Chinese Medicine*. 2004;24(2):122-123.
2. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology*. 2011;26(3):114-118.

SP 9

Yin Ling Quan "Yin Mound Spring"

On the medial side of the leg, in the depression posterior and inferior to the medial tibial condyle, between the posterior border of the tibia and the medial head of the gastrocnemius muscle.

Muscles and Tendons

- **Semimembranosus tendon:** Flexes the leg. Extends the thigh. When the knee is flexed, the semimembranosus muscle rotates the leg medially. When the thigh and leg are flexed, the semimembranosus extends the trunk.
- **Gastrocnemius muscle:** The gastrocnemius muscle raises the heel during ambulation. It flexes the leg at the knee, and plantarflexes the ankle if the knee is extended.
- **Semitendinosus tendon:** Flexes the leg. Extends the thigh. When the knee is flexed, the semitendinosus muscle rotates the leg medially. Then the thigh and leg are flexed, the semitendinosus extends the trunk.
- **Popliteus muscle:** Unlocks the knee and weakly flexes it.

Clinical Relevance: The "pes anserinus" ("foot of the goose") on the leg embodies the insertion of the conjoined tendons of the sartorius, gracilis, and semitendinosus muscles at SP 9. The pes anserinus is superficial to the tibial insertion of the medial collateral ligament. The bursa that separates the pes anserinus from the medial collateral ligament may become inflamed or irritated from overuse or injury leading to pain, swelling, and tenderness to palpation. "Pes anserine bursitis" has been proposed as a cause of chronic knee pain and weakness; palpation of the knee and surrounding regions should help identify contributing factors and trigger point pathology. Although many patients with this problem are athletes, pes anserine bursitis or swelling in this region may represent an extra-articular manifestation of gout,[12] mineralized fibroma of the tendon sheath,[13] or cystic periarticular knee lesions. The source of knee pain at SP 9 may be ambiguous, meaning that the term "pes anserinus tendino-bursitis syndrome" may be inaccurate if other structures are indeed involved.[14] The syndrome involves pain in the medial aspect of the knee, especially when ascending or descending stairs, tenderness to palpation, and possibly local edema. Differential diagnosis includes medial meniscus injury, osteoarthritis of the medial knee, radiculopathy of the L3-L4 nerve roots, and medial collateral ligament lesion.

Nerves

- **Anterior femoral cutaneous nerve (L2-L4):** Supplies the skin on the anterior and medial thigh regions.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Sciatic nerve (L4-S3):** Supplies the hamstring muscles (i.e., the

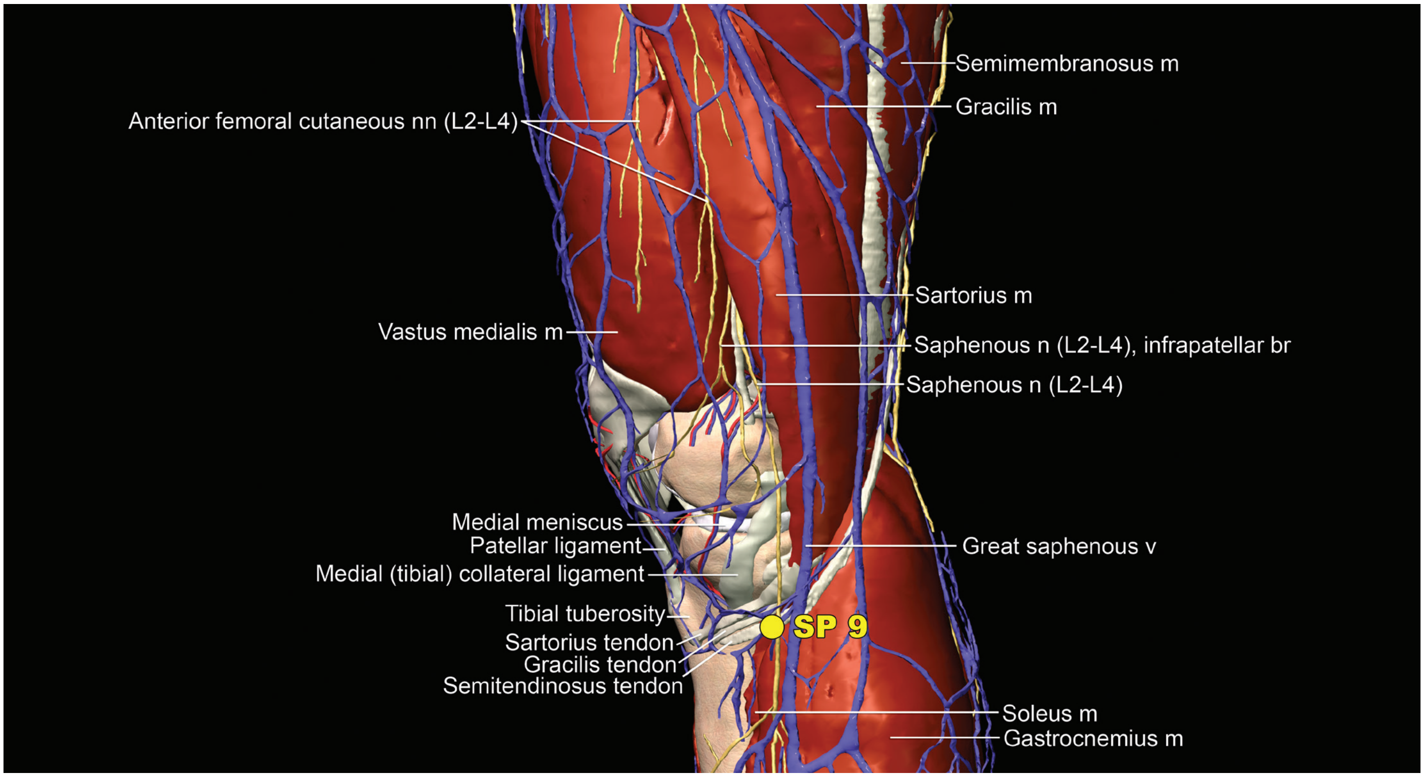


Figure 4-21. Regarding the name for SP 9 of "Yin Mound Spring", the "Mound" refers to the knee, "Yin" finds the locus on the medial aspect, and "Spring" alludes to the great saphenous vein. This view illustrates the pes anserinus, comprising a number of tendons, rich with proprioceptors that assist in knee stabilization, where they insert onto the tibia at SP 9. The gracilis tendon is located immediately superior to the semitendinosus insertion; the sartorius tendon overlaps the gracilis to form the pes anserinus. A bursa separates the pes anserinus from the medial collateral ligament. In addition to the fact that SP 9 overlies the confluence of three different tendons, in so doing it also relates to their three unique innervations, namely the obturator (for the gracilis), the tibial portion of the sciatic (for the semitendinosus), and the femoral (for the sartorius). Finally, note that many of the vessels comprising the genicular anastomosis appear in this image.

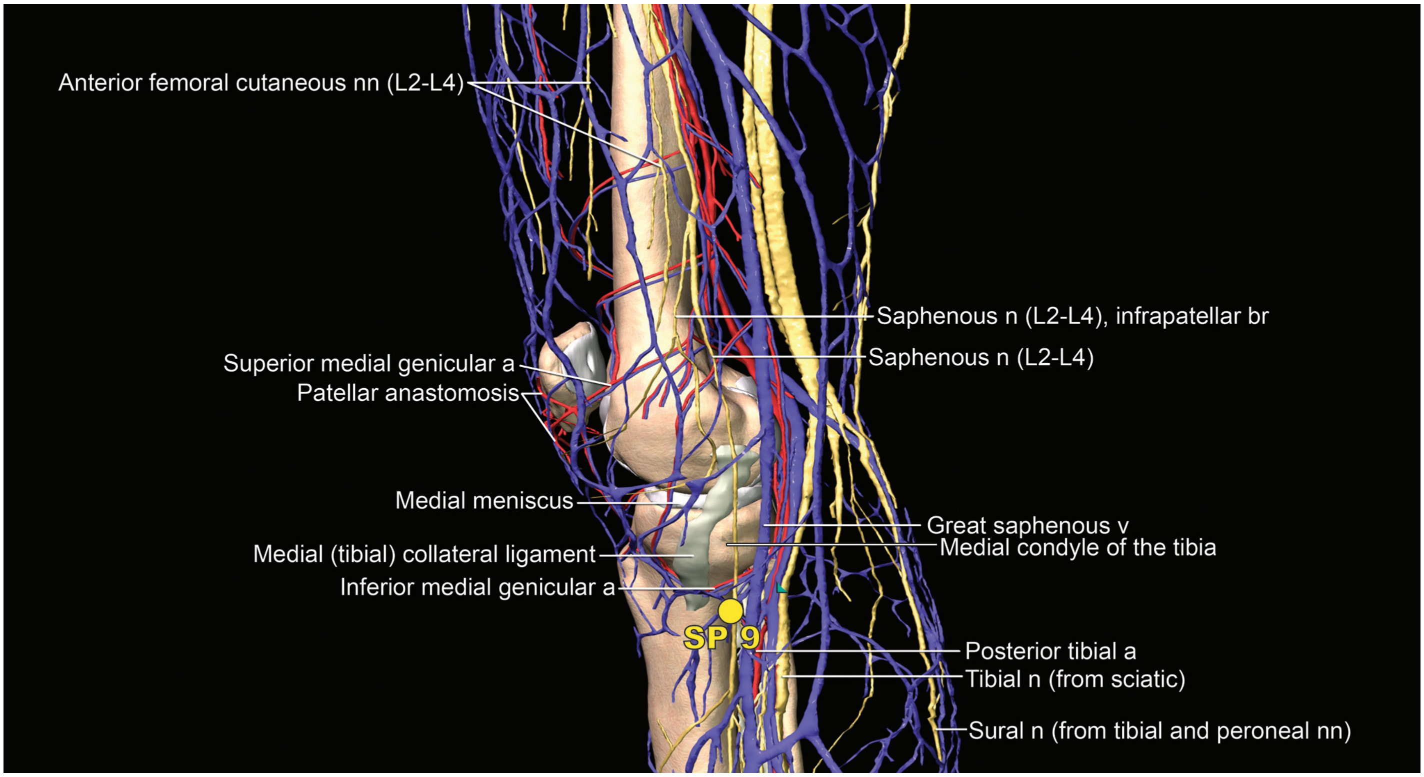

Anterior femoral cutaneous nn (L2-L4)
Saphenous n (L2-L4), infrapatellar br
Saphenous n (L2-L4)
Superior medial genicular a
Patellar anastomosis
Medial meniscus
Great saphenous v
Medial condyle of the tibia
Medial (tibial) collateral ligament
Inferior medial genicular a
SP 9
Posterior tibial a
Tibial n (from sciatic)
Sural n (from tibial and peroneal nn)

Figure 4-22. The saphenous nerve runs through SP 9, issuing branches to the skin and fascia of the anteromedial knee, leg, and foot, along the SP channel. The vascular associations of SP 9 show here as well, including the inferior medial genicular artery, the patellar anastomosis, and the great saphenous vein.

semimembranosus, semitendinosus, and long head of the biceps femoris muscles) by its tibial division (L5-S2). (The short head of the biceps femoris muscle is supplied by the common peroneal division (L5-S2).)

- **Tibial nerve (S1, S2):** This branch of the sciatic nerve supplies the soleus, gastrocnemius, plantaris, and popliteus muscles.

Clinical Relevance: Despite their common final destination, each muscle contributing to the pes anserinus carries a distinct innervation. That is, the femoral nerve supplies the sartorius, the obturator nerve innervates the gracilis, and the tibial portion of the sciatic nerve supplies the semitendinosus. Thus, needling or otherwise stimulating the point SP 9 impacts three different nerves.

John Hilton (1805-1878) was one of the first to note that patients with hip disease may also experience knee pain due to the common innervation of both joints.[15] He also lectured on his own "Hilton's Law", which states, "The same trunks of nerves, whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertions of the same muscles; and – what at this moment more especially merits our attention – the interior of the joint receives its nerves from the same source." Thus, the fact that the femoral, obturator, and tibial portion of the sciatic nerve all supply movers of the knee means, according to this law, that they each send branches to the overlying skin as well as the joint itself. This anatomical "law" highlights the relevance of SP 9 in treating disorders of the knee, including pain and proprioceptive abnormalities.

Vessels

- **Inferior medial genicular artery:** The inferior medial genicular artery participates in the formation of the genicular anastomosis – a network of vessels around the knee. It does so with the help of the other genicular arteries, including the lateral superior, medial superior, and lateral inferior arteries and three additional contributors: the descending genicular branch of the femoral artery, the descending branch of the lateral femoral circumflex artery, and the anterior recurrent branch of the anterior tibial artery. Genicular branches of the popliteal artery also supply the knee joint capsule and the ligaments of the knee. Supplies the patellar tendon, patella, and infrapatellar fat pad. Vessels in the vicinity of SP 9 contribute to the peripatellar anastomatic network (also known as "rete patellae" and the infrapatellar fat pad (of Hoffa).[16]
- **Popliteal artery:** Muscular branches of the popliteal artery supply the hamstring and gastrocnemius muscles, as well as the soleus and plantaris muscles.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch. Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein.
- **Medial inferior veins of the knee:** One of several deep veins around the knee that drain into the popliteal vein.

Clinical Relevance: Articular structures such as the knee receive abundant blood supply by means of anastomotic networks. However, numerous surgical procedures and trauma put the vascular supply of the patella at risk. They may acutely alter flow through direct vascular insult (e.g., pseudoaneurysm)

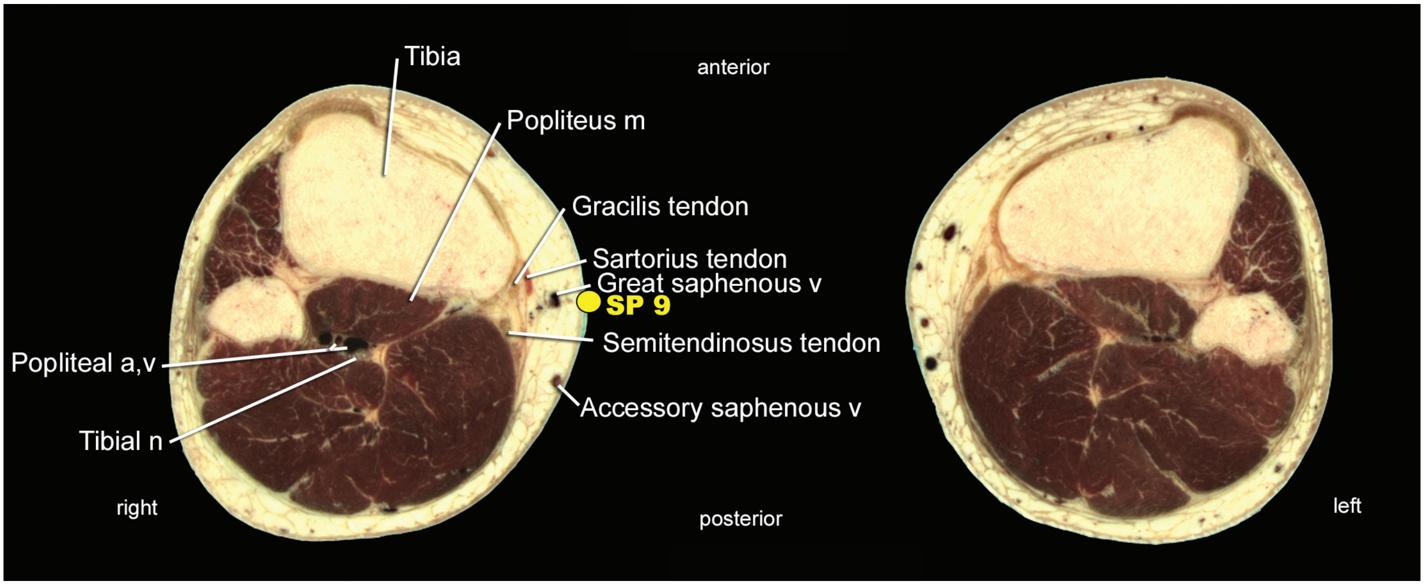


Figure 4-23. The depression palpable at SP 9 appears in this cross section as a triangular space between the tibia and the prominent muscle belly caudal (posterior) to the point, the medial head of the gastrocnemius muscle. Housed in the depression lives the pes anserinus, comprising the gracilis, sartorius, and semitendinosus tendons.

or, over the long term, drive sympathetic nerve stimulation, peripheral or central nervous system sensitization in chronic pain states. Acupuncture in this region may aid in restoring proper circulation by neuromodulating nervi vasorum and central nervous system pathways.

Similarly, blood flow compromise to the patellar tendon may put that structure at risk of developing patellar tendinopathy and, conceivably, rupture.[17]

Perhaps most importantly, the anterior cruciate ligament and supporting structures derives its blood supply from the genicular periarticular vascular plexus.[18] Soft tissues within the knee (i.e., the infrapatellar fat pad and synovium) mediate the blood supply to both cruciate ligaments. As such, negative impacts to these sites may impair nutrition to the cruciate ligaments and contribute to their degradation.

Varicose great saphenous veins contain unmyelinated C fibers in the external portion of the media as well as the internal part of the adventitia.[19] Histiocytes and other inflammatory cells exist scattered within the media. These findings provide evidence for the existence of a neurologic medium through which nociceptive signals from the vein reach the spinal cord and brain. Mast cells and concomitant inflammatory cells may serve to activate C fibers in the vessel wall of the varicose vein. The presence of nerves and inflammatory cells suggests an avenue through which neuromodulation through acupuncture and related techniques may impart healing effects for a disturbed milieu.

Indications and Potential Point Combinations

- **Knee pain:** SP 9, SP 10, ST 34, ST 36. Depending on the location of pain, check for trigger points in proximal muscles. For popliteal pain, palpate hamstrings in the BL 36, BL 37 region. Quadriceps triggers can send pain along the ST and SP channels; check SP 10 in the vastus medialis for cranial knee pain.
- **Edema of lower extremities, venous insufficiency:** SP 9, SP 8, SP 10, CV 6, ST 36.

Evidence-Based Applications

- Unilateral acupuncture for advanced **osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[1]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes.**[2]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combination with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome**, thereby offering an alternative to pharmacologic induction of ovulation.[3]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[4]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis** in women.[5]
- Acupuncture at LR 3, SP 6, SP 9, and ST 36 benefited patients with **chronic painful peripheral diabetic neuropathy**.[6]
- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis**, using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[7]
- Acupuncture at LI 4, ST 36, SP 6, and SP 9 reduced **discomfort and anxiety in patients undergoing colonoscopy.**[8]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[9]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per

ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[10]

- Acupuncture to SP 9, SP 6, CV 2, CV 3, CV 4, BL 23, BL 28, BL 32, and BL 39 demonstrated effectiveness in patients with **urinary retention** according to a case series.[20]
- Electroacupuncture at 2Hz applied to SP 9 increased **blood flow and perfusion in the spleen but not the liver,** while the same stimulation applied to LR 8 caused increased in the liver but not the spleen.[21]
- A study evaluating the effects of various acupuncture points on **stomach and heart electrical activity** found that SP 9, ST 36, SI 6, TH 5, LR 3, and LI 11 affected stomach activity more than other points tested, HT 5, GB 34, SP 9, and SI 6 influenced the electrointestinogram the most, and SP 9, LI 11, TH 5, and ST 36 increased electrocardiogram amplitude, while LR 3 decreased it.[22]
- **Reduces alpha-motoneuron excitability,** as measured with the Soleus H-reflex, when needled manually with GB 34 for 15 minutes.[11]

References

1. Tillu A, Roberts C, and Tillu S. Unilateral versus bilateral acupuncture on knee function in advanced osteoarthritis of the knee – a prospective randomized trial. *Acupuncture in Medicine*. 2001;19(1):15-18.
2. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society*. 1995;2(1):3-12.
3. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand*. 2000;79:180-188.
4. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care*. 1998;16:37-39.
5. Alraek T and Baerheim A. "An empty and happy feeling in the bladder…": health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine*. 2001;9(4):219-223.
6. Abuaisha BB, Costanzi JB, and Boulton AJM. Acupuncture for the treatment of chronic painful peripheral diabetic neuropathy: a long-term study. *Diabetes Research and Clinical Practice.* 1998;29:115-121.
7. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology*. 1999;38:346-354.
8. Fanti L, Gemma M, Passaretti S, Guslandi M, Testoni PA, Casati A, and Torri G. Electroacupuncture analgesia for colonoscopy: a prospective, randomized, placebo-controlled study. *American Journal of Gastroenterology*. 2003;98(2):312-316.
9. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine*. 1998;18(3):188-191.
10. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.
11. Chan AKS, Vujnovich A, and Bradnam-Roberts L. The effect of acupuncture on alpha-motoneuron excitability. *Acupuncture & Electrotherapeutics Res., Int. J.* 2004;29:53-72.
12. Grover RP and Rakhra KS. Pes anserine bursitis – an extra-articular manifestation of gout. *Bull NYU Hosp Jt Dis.* 2010;68(1):46-50.
13. Le Corroller T, Bouvier-Labit C, Sbihi A, et al. Mineralized fibroma of the tendon sheath presenting as a bursitis. *Skeletal Radiol.* 2008;37:1141-1145.
14. Helfenstein M and Kuromoto J. Anserine syndrome. *Rev Bras Reumatol.* 2010;50(3):313-327.
15. Brand RA. John Hilton, 1805-1878. *Clin Orthop Relat Res.* 2009;467:2208-2209.
16. Nemschak G and Pretterklieber ML. The patellar arterial supply via the infrapatellar fat pad (of Hoffa): a combined anatomical and angiographical analysis. *Anatomy Research International.* 2012, Article ID 713838. DOI 10.1155/2012/713838.
17. Pang J, Shen S, Pan WR, et al. The arterial supply of the patellar tendon: anatomical study with clinical implications for knee surgery. *Clinical Anatomy.* 2009;22:371-376.
18. Arnoczky SP. Blood supply to the anterior cruciate ligament and supporting structures. *Orthop Clin North Am.* 1985;16(1):15-28.
19. Vital A, Carles D, Serise J-M, et al. Evidence for unmyelinated C fibres and inflammatory cells in human varicose saphenous vein. *Int J Angiol.* 2010;19(2):e73-e77.
20. Zhang D. Thirty-six cases of urinary retention treated by acupuncture. *Journal of Traditional Chinese Medicine.* 2008;28(2):83-85.
21. Chou WC, Liu HJ, Lin YW, et al. 2 Hz electro-acupuncture at yinlingquan (SP9) and ququan (LR8) acupoints induces changes in blood flow in the liver and spleen. *Am J Chin Med.* 2012;40(1):75-84.
22. Chang X-R, Yan J, Shen J, et al. Effects of acupuncture at the acupoints of 12 meridians on gastrointestinal and cardiac electricity in healthy adults. *J Acupunct Meridian Stud.* 2010;3(3):165-172.

SP 10

Xue Hai "Sea of Blood"

On the medial side of the thigh, in a tender depression on the bulge of the vastus medialis muscle, 2 cun proximal to the superomedial angle of the patella.

(Alternate point location method: With the patient's left knee flexed and the practitioner facing the patient, the practitioner locates the point by cupping the knee with her right hand; SP 10 lies at the tip of the practitioner's fully extended thumb, laying at 45° from the index finger).

Muscles

- **Sartorius muscle:** The sartorius flexes, laterally rotates, and abducts the thigh at the hip joint. Flexes the leg at the knee.
- **Adductor magnus muscle:** Adducts the thigh. Comprises two parts – the adductor part and the hamstrings part. The adductor part flexes the thigh while the hamstrings part extends it.
- **Vastus medialis muscle:** Extends the leg at the knee joint. Dubbed the "buckling knee muscle" by Travell and Simons, the vastus medialis harbors trigger points that not only cause pain but also inhibit muscle function, leading to unexpected knee buckling.[1]

Clinical Relevance: Trigger points in the adductor magnus muscle at SP 10 and proximal to it refer pain along the remainder of the SP channel, from SP 10 to the groin.

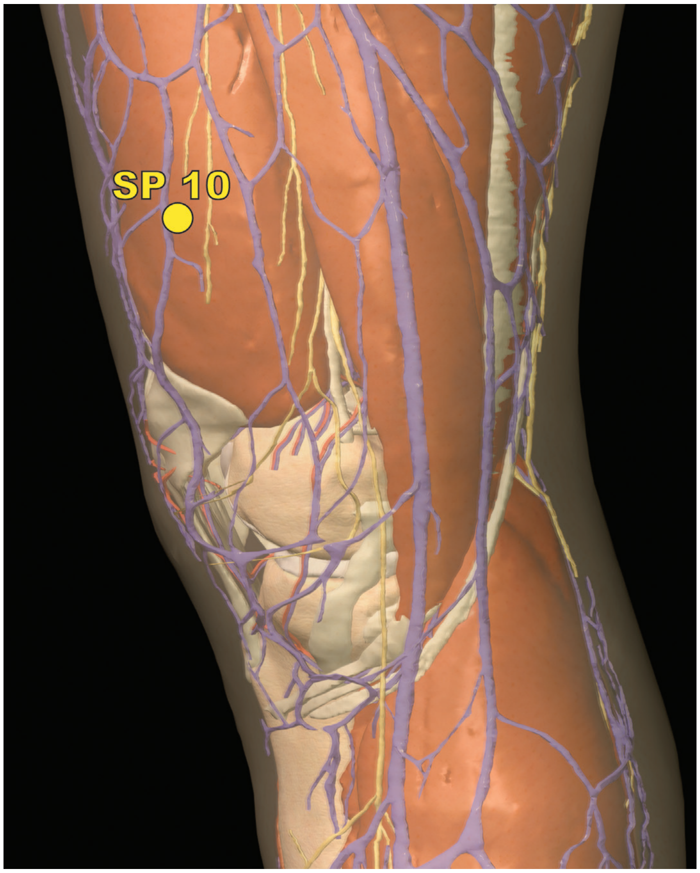


Figure 4-24. The indications for SP 10, the "Sea of Blood", relating to genitourinary problems likely stems from the spinal segmental overlap of the nerve supply for this point with that of the pelvic viscera.

Neuromuscular and strength training programs designed to target the quadriceps (including the vastus medialis muscle) improve limb strength and performance in middle-aged patients with degenerative meniscus tears.[13] Introducing acupuncture for neuromodulation and pain control may further support these improvements.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Anterior femoral cutaneous nerve (from the femoral nerve, L2-L4):** Supplies the skin on the thigh's anterior and medial aspects.
- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus (the adductor part) and obturator externus muscles.
- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. It supplies the skin on the anteromedial thigh and supplies the hip and knee joints. It supplies the anterior thigh muscles, including the sartorius muscle.

Clinical Relevance: Most sources indicate that the saphenous nerve is purely sensory. Various surgical procedures and traumatic events may injure it and compromise its function. Strenuous exercise may also negatively impact the nerve by causing a nerve entrapment.[14] Sites where the saphenous nerve may become entrapped include 1) The adductor canal where the saphenous nerve splits from the femoral and courses independently along the fascial channel through the adductor canal, and 2) The locus where the nerve leaves the adductor canal to exit the fascial layer between the sartorius and gracilis muscles. Conceivably, neuropathy of the saphenous nerve can lead to persistent, medial knee pain.[15] Palpating for myofascial restriction in the medial thigh may aid in determining the site of saphenous nerve compression or entrapment.

Vessels

- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.
- **Perforating veins:** Drain blood from the thigh muscles.
- **Deep vein of the thigh:** The perforating veins terminate in the deep vein of the thigh.
- **Descending genicular artery, articular branch:** This artery arises from the femoral artery and gives rise to muscular and articular branches. It anastomoses with the superior and inferior medial genicular arteries. The descending genicular artery passes through the opening in the adductor magnus tendon to branch into a saphenous and articular branch. The saphenous branch of the descending genicular artery follows the saphenous nerve along the medial aspect of the knee and the SP channel. The articular branches anastomoses with the medial superior genicular artery within the substance of the

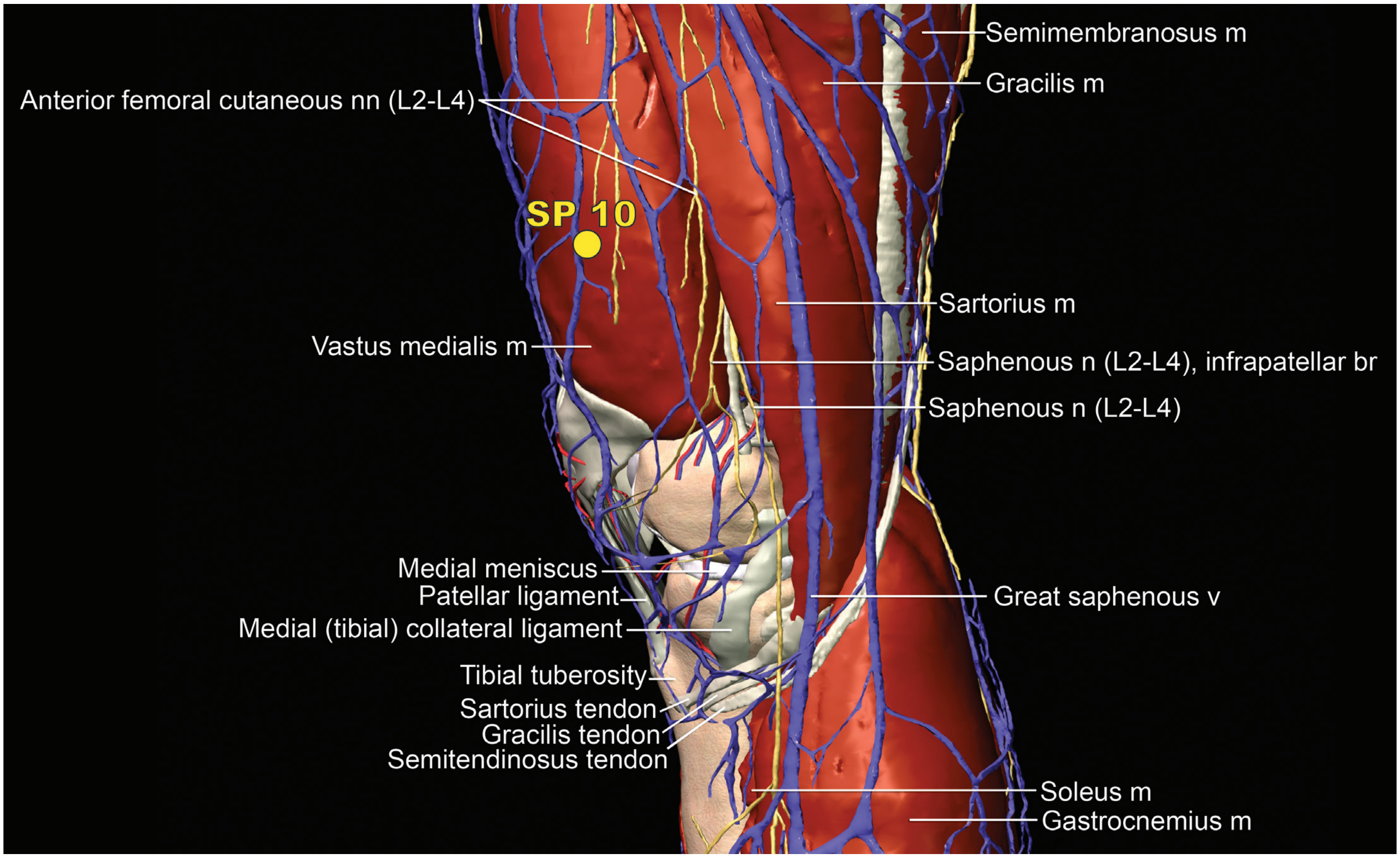

Semimembranosus m
Gracilis m
Anterior femoral cutaneous nn (L2-L4)
SP 10
Sartorius m
Vastus medialis m
Saphenous n (L2-L4), infrapatellar br
Saphenous n (L2-L4)
Medial meniscus
Patellar ligament
Great saphenous v
Medial (tibial) collateral ligament
Tibial tuberosity
Sartorius tendon
Gracilis tendon
Semitendinosus tendon
Soleus m
Gastrocnemius m

Figure 4-25. As opposed to most other acupuncture points whose locations coincide with muscle cleavage planes or other myofascial intersections that harbor neurovascular highways, SP 10 lands on the bulge of the vastus medialis muscle near two sensory nerve pathways.

vastus medialis muscle, not far from SP 10.

Clinical Relevance: SP 10 often appears in treatment protocols for knee pain, including that from anterior cruciate ligament injury. Blood supply to the knee in general arrives from branches of the descending genicular artery, the medial and lateral superior genicular arteries, the medial and lateral inferior genicular arteries, the middle genicular artery, and the anterior and posterior tibial recurrent arteries.[16]

Indications and Potential Point Combinations

- **Knee pain:** SP 10, SP 9, ST 34, ST 36, GB 34, Xiyan (on either side of the patellar ligament, Heding (at the apex of the patella). The trigger point in the vastus medialis muscle refers to the anteromedial knee. Consider myofascial contributions to knee pain from elsewhere, too, coupled with potential arthrodial problems. Additional trigger points.
- **Menstrual and gynecologic disorders such as menorrhagia, irregular menstruation, dysmenorrhea:** SP 10, SP 6, BL 32, BL 23, GV 4, GV 20, CV 6.
- **Skin disorders:** urticaria, eczema, and allergy: SP 10, ST 36, LI 4, LI 11, GV 14, SP 6.

Evidence-Based Applications

- The four points LI 11, SP10, SP 6, and ST 36 treat **acute urticaria.**[2]
- A case series using needling, bleeding, and cupping to treat **erysipelas** reported "good results" using SP 10, SP 1, and "visible veins".[3]
- Repeated acupuncture at ST 36, LI 11, SP 10, and GV 14 significantly decreased leukocyte and lymphocyte values in healthy humans, although cortisol and norepinephrine plasma levels remained unchanged. The mechanism whereby acupuncture affected **leukocyte circulation** was unknown.[4]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[5]
- A case series evaluating acupuncture for **poison ivy contact dermatitis** reported effectiveness with the acupuncture points SP 10, LI 11, and ST 36.[6] These points were also effective in reducing the severity and preventing recurrences of **herpes simplex infections**[7] **and in clearing psoriasis lesions.**[8]
- Unilateral acupuncture for **advanced osteoarthritis of the knee** was effective as bilateral acupuncture, using SP 9, SP 10, ST 34, ST 36, and LI 4 on the ipsilateral hand.[9]
- Acupuncture at CV 17, CV 12, CV 6, ST 36, and SP 10 conferred protective effects on **cognitive impairments caused by multiinfarction dementia** in rats, suggesting it may benefit patients with vascular dementia.[10]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation:

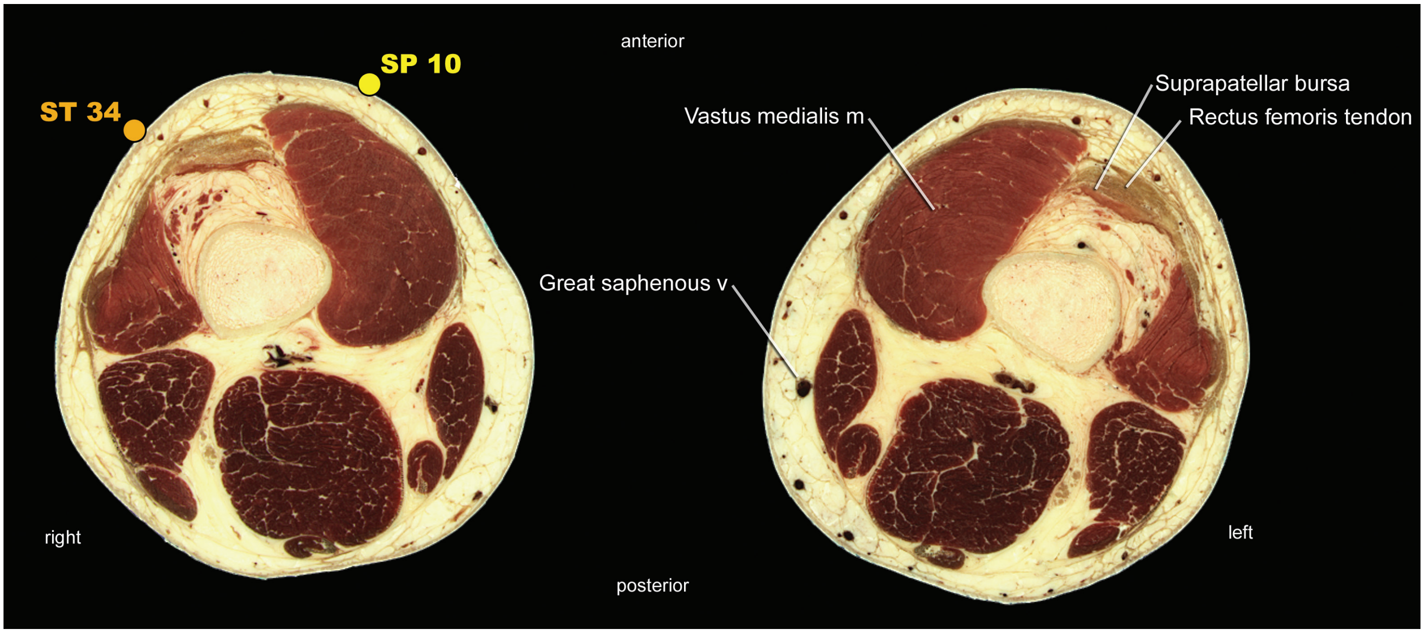


Figure 4-26. Although SP 10 is a "Sea of Blood" point, the great saphenous vein has diverged from the SP channel at this level. The appellation likely refers to the influence of SP 10 on menstruation rather than a vascular passageway.

LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[11] • Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in **improvement in sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[12]

References

1. Travell JG and Simons DG. Volume 2. *Myofascial Pain and Dysfunction. The Trigger Point Manual. The Lower Extremities.* Baltimore: Williams & Wilkins, 1983. Pp. 250-251.
2. Chen C-J and Yu H-S. Acupuncture treatment of urticaria. Arch Dermatol. 1998;134:1397-1399.
3. Sang J, Wang S, and Lu X. Nedling and cupping used to treat 20 cases of erysipelas. *Journal of Traditional Chinese Medicine.* 2003;23(2):115-116.
4. Kou W, Bell JD, Gareus I, Pacheco-Lopez G, Goebel MU, Spahn G, Stratmann M, Janssen OE, Schedlowski M, and Dobos GJ. Repeated acupuncture treatment affects leukocyte circulation in healthy young male subjects: a randomized single-blind two-period crossover study. *Brain, Behavior, and Immunity.* 2005;19:318-324.
5. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.* 1995;13(2):91-92.
6. Lioa SJ. Acupuncture for poison ivy contact dermatitis. *Acupuncture & Electrotherapeutics Res., Int J.* 1988;13:31-39.
7. Liao SJ. Acupuncture treatment for herpes simplex infections. *Acupuncture & Electrotherapeutics Res., Int J.* 1991;16:135-142.
8. Liao SJ and Liao TA. Acupuncture treatment for psoriasis: a retrospective case report. *Acupuncture & Electrotherapeutics Res., Int J.* 1992;17:195-208.
9. Tillu A, Roberts C, and Tillu S. Unilateral versus bilateral acupuncture on knee function in advanced osteoarthritis of the knee – a prospective randomized trial. *Acupuncture in Medicine.* 2001;19(1):15-18.
10. Yu J, Liu C, Zhang X, and Han J. Acupuncture improved cognitive impairment caused by multi-infarct dementia in rats. *Physiology and Behavior.* 2005 (in press).
11. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
12. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility.* 2005;84(1):141-147.
13. Stensrud S, Roos EM, Risberg MA, et al. A 12-week exercise therapy program in middle-aged patients with degenerative meniscus tears: a case series with 1 year follow up. *J Orthop Sports Phys Ther.* 2012;42(11):919-931.
14. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of the Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.
15. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain *Bull Hosp Jt Dis.* 1993;52(2):31-33.
16. Arnoczky SP. Blood supply to the anterior cruciate ligament and supporting structures. *The Orthopedics Clinics of North America.* 1985;16(1):15-28.

SP 11

Ji Men "Winnower Gate" or "Basket Gate"

On the medial aspect of the thigh, 6 cun proximal to SP 10, on the line between SP 10 and SP 12.

Muscles

- **Sartorius muscle:** The sartorius flexes, laterally rotates, and abducts the thigh at the hip joint. Flexes the leg at the knee.
- **Adductor magnus muscle:** Adducts the thigh. Comprises two parts – the adductor part and the hamstrings part. The adductor part flexes the thigh while the hamstrings part extends it.
- **Adductor longus muscle:** Adducts the thigh.
- **Adductor brevis muscle:** Adducts the thigh. Can also flex the thigh.
- **Vastus medialis muscle:** Extends the leg at the knee joint.

Clinical Relevance: Trigger points in the adductor magnus muscle at SP 11 refers pain proximad, toward the groin, as well as distad, toward the knee, following the SP channel. Finding SP 11 more medial and posterior (caudal) than depicted in Figure 4-28 would more directly impact the adductors.

Neuromuscular and strength training programs improve limb strength and performance in middle-aged patients with degenerative meniscus tears who have not undergone surgical repair.[1] Introducing acupuncture for neuromodulation and pain control may further support these improvements.

The quadriceps group may weaken following anterior cruciate ligament injury and reconstruction.[2] Inhibition of quadriceps muscle function, especially that of the vastus medialis, contributes to this weakness. Intra-articular swelling negatively impacts vastus medialis strength. Neuromodulating with acupuncture and related techniques may help repair strength and coordination by stimulating muscle afferents near SP 11 and SP 10.

The vastus medialis counterbalances the lateral pull of the vastus lateralis on the patella. An imbalance in timing of the muscle contraction of both muscles may lead to patellofemoral tracking problems, lateral subluxation of the patella, retropatellar pain, and articular cartilage degeneration.[3] Patellar malalignment can lead to tension in the hamstrings, iliotibial band, hip rotators, quadriceps muscle group, and calcaneal tendon. Acupuncture and related techniques applied to the vastus medialis (as at SP 11 and SP 10) and the vastus lateralis (ST 32, ST 33, and 34) may aid in rebalancing firing patterns within the quadriceps group.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Anterior femoral cutaneous nerve (from the femoral nerve, L2-L4):** Supplies the skin on the thigh's anterior and medial aspects.
- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus (the adductor part) and obturator externus muscles.

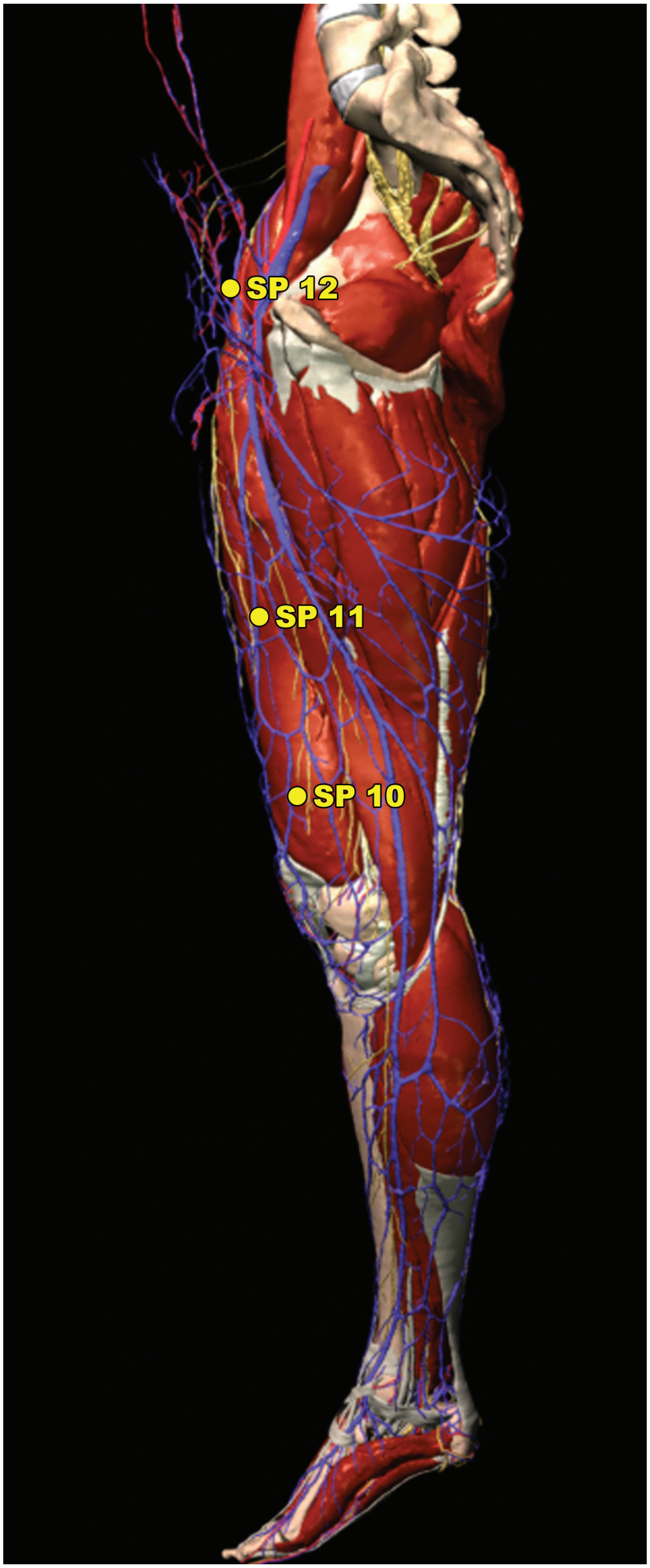


Figure 4-27. The name for SP 11, "Winnower Gate", indicates that this point lands where the winnowing basket would sit as the person doing the winnowing squats and holds the basket between the thighs. Note the obvious diagonal groove descending at this level from the cranial to caudal thigh that could couch such a basket. "Winnowing" refers to the process of separating the wheat (or other grains) from the chaff.

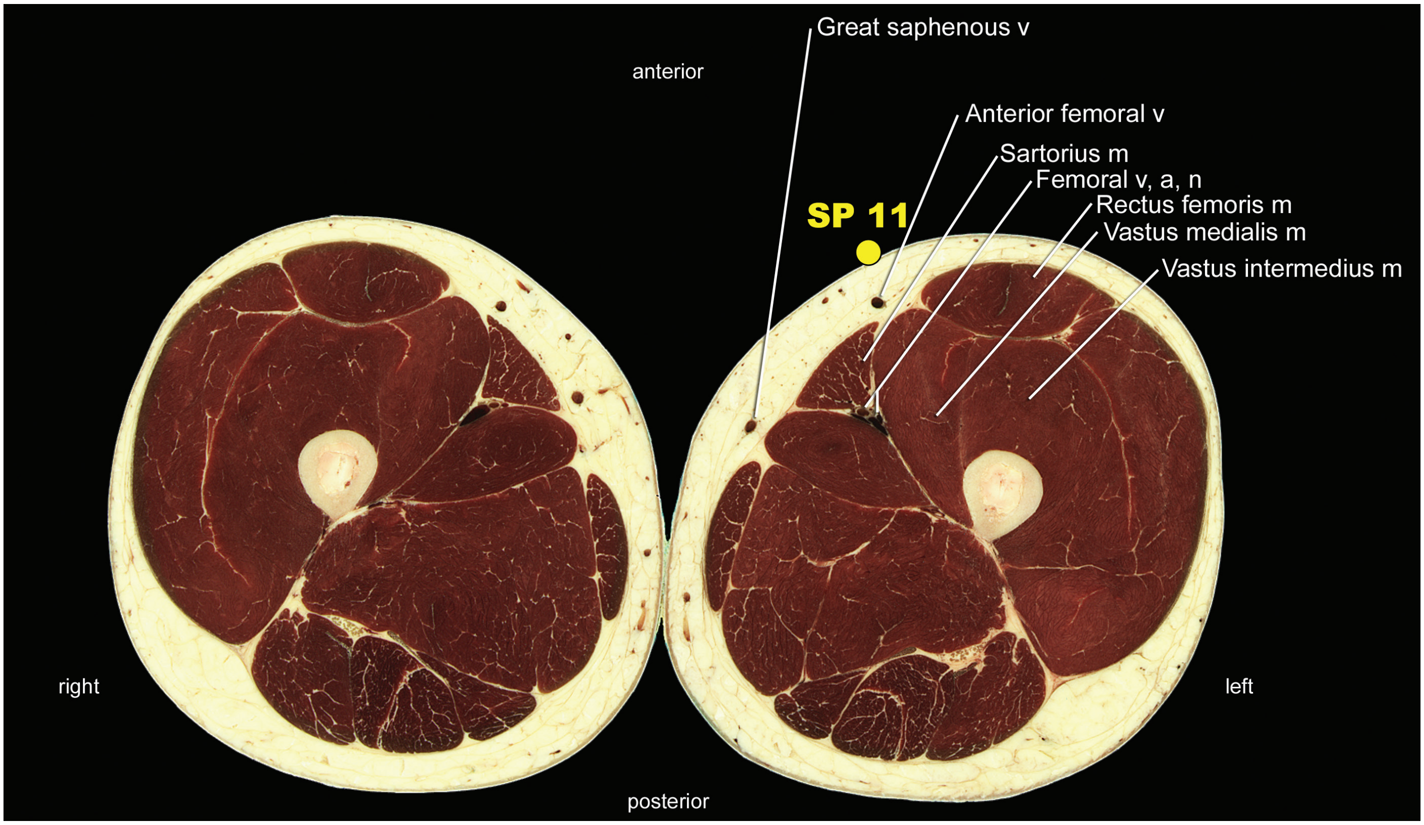


Figure 4-28. At SP 11, the SP channel relates more closely to the anterior femoral vein and the femoral nerve, artery, and vein, leaving the close relationship it shared with the great saphenous vein below the knee.

- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. It supplies the skin on the anteromedial thigh and supplies the hip and knee joints. It supplies the anterior thigh muscles, including the sartorius muscle.

Clinical Relevance: Most sources indicate that the saphenous nerve is purely sensory. Various surgical procedures and traumatic events may injure it and compromise its function. Strenuous exercise may also negatively impact the nerve by causing a nerve entrapment.[4] Sites where the saphenous nerve may become entrapped include 1) The adductor canal where the saphenous nerve splits from the femoral and courses independently along the fascial channel through the adductor canal, and 2) The locus where the nerve leaves the adductor canal to exit the fascial layer between the sartorius and gracilis muscles. Conceivably, neuropathy of the saphenous nerve can lead to persistent, medial knee pain.[5] Palpating for myofascial restriction in the medial thigh may aid in determining the site of saphenous nerve compression or entrapment.

Vessels

- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.
- **Perforating veins:** Drain blood from the thigh muscles.
- **Deep vein of the thigh:** The perforating veins terminate in the deep vein of the thigh.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch. Along its course it anastomoses with the small saphenous vein and finally empties into the femoral vein.

Clinical Relevance: The SP channel follows either the great saphenous vein or, as shown in Figure 4-28, the anterior femoral vein and femoral artery and vein.

Indications and Potential Point Combinations

- **Urinary retention, anuresis, dysuria, cystitis:** SP 11, SP 6, KI 3, BL 28, BL 32, GV 3.
- **Inguinal inflammation, pain, non-cancer-related inguinal lymphadenopathy:** SP 11, tender inguinal region points (LR 12, ST 29, ST 30, SP 12,SP 13), KI 27.
- **Local thigh pain:** SP 11, check for trigger points in the adductors, the sartorius, and the vastus medialis muscle.

References

1. Stensrud S, Roos EM, Risberg MA, et al. A 12-week exercise therapy program in middle-aged patients with degenerative meniscus tears: a case series with 1 year follow up. *J Orthop Sports Phys Ther.* 2012;42(11):919-931.
2. Zalta J. Massage therapy protocol for post-anterior cruciate ligament reconstruction patellofemoral pain syndrome: a case report. *International Journal of Therapeutic Massage* and Bodywork. 2008;1(2):11-21.
3. Zalta J. Massage therapy protocol for post-anterior cruciate ligament reconstruction patellofemoral pain syndrome: a case report. *International Journal of Therapeutic Massage and Bodywork.* 2008;1(2):11-21.
4. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of the Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.
5. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain *Bull Hosp Jt Dis.* 1993;52(2):31-33.

SP 12

Chong Men "Surging Gate"

On the inguinal region, just proximal to the inguinal ligament, lateral to the external iliac artery.

(Alternate location: on the base of the femoral triangle, just inferior to the inguinal ligament, lateral to the femoral artery.) Approximately the site of femoral nerve block.[1]

Caution with deep needling: Several prominent neurovascular structures exist beneath this point, as seen in Figure 4-30.

Muscles

- **Iliopsoas muscle:** The main flexor of the thigh. If the thigh is maintained in a fixed position, the iliopsoas muscle flexes the trunk against the hip. The iliopsoas also serves as a postural muscle that prevents hyperextension of the hip when an individual stands.
- **Sartorius muscle:** The longest single muscle in the body, the sartorius courses the length of the thigh, having formed the lateral border of the femoral triangle at its origin. The sartorius assists in hip flexion, abduction, and lateral rotation. It also helps flex the knee. Take a peek at KI 1 on your own foot and you've just demonstrated all four actions of the sartorius.

Clinical Relevance: The best way to consider the impact of SP 12 on local musculature is to view the cross section at this level, depicted in Figure 4-30. This image illustrates how superficial needling can impact the sartorius muscle with the needle angled in a lateral direction or the iliopsoas muscle when angled perpendicular to the body. A more extreme and deep needle insertion may touch the pectineus muscle but risks injury of the externa iliac artery and vein as well as the femoral nerve. Trigger points from the iliopsoas cause pain sensation to travel up the ipsilateral paraspinal lumbar musculature and down the middle anterior portion of the thigh. Sartorius trigger points send pain along the muscle itself. Pectineus pain from trigger point pathology stays in the region over the muscle in the groin.

Nerves

- **Subcostal nerve (T12):** Supplies the skin in this region. The subcostal nerve communicates with the iliohypogastric, providing a nerve branch to the pyramidalis muscle and a lateral cutaneous branch that supplies sensation to the hip. The subcostal nerve, i.e., the anterior division of the 12th thoracic spinal nerve, is larger than the other intercostal nerves.
- **Iliohypogastric nerve (Superior branch of the ventral (anterior) ramus of L1 spinal nerve; occasionally receives contributions from T12, the subcostal nerve):** The iliohypogastric nerve branches into anterior and lateral cutaneous nerves. The lateral branch supplies the skin over the iliac crest while the anterior branch supplies the skin superior to the pubic region. This nerve also innervates the internal oblique and transverse abdominal muscles. The right and left sympathetic trunks receive white rami communicantes from the ventral rami of the L1-L3 spinal nerves and send gray rami communicantes to these nerves. This provides for the opportunity to engage in sympathetic neuromodulation by sending afferent input into the L1 spinal cord segment through SP 12 and the anterior branch of the iliohypogastric nerve.
- **Ilioinguinal nerve (Inferior branch of the ventral (anterior) ramus of L1 spinal nerve; occasionally receives contributions from T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.
- **Genitofemoral nerve (L1, L2):** Divides into genital and femoral branches. The femoral branch supplies the skin overlying the femoral triangle. The genital branch supplies the labia majora in females and the scrotum in males.
- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. It supplies the skin on

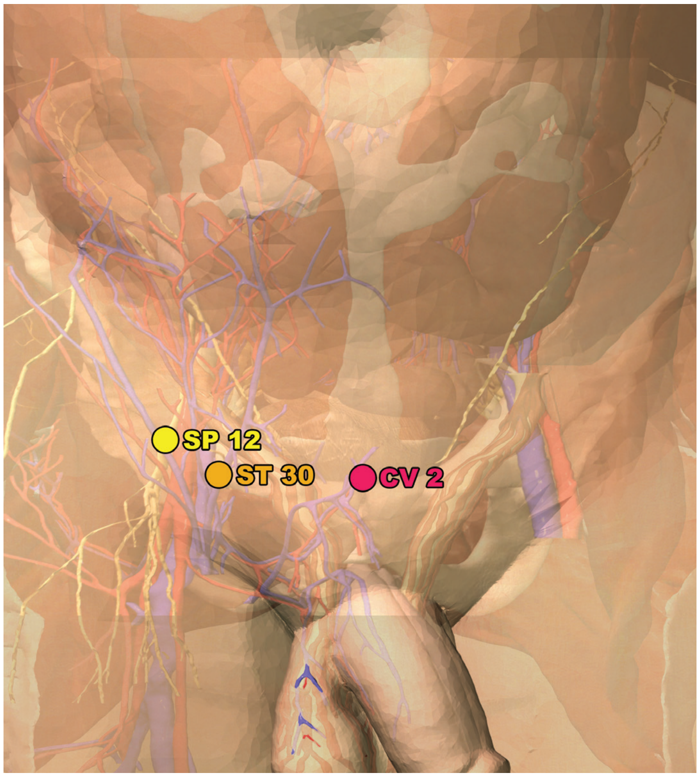


Figure 4-29. For SP 12, "Surging Gate" describes the pulsating femoral artery at the gateway to the pelvis where vessels and nerves are entering and exiting the pelvis. SP 12 marks the site where SP line points' visceral impact surges to the fore and musculoskeletal connections become less important. The anatomy explains why: SP 12 to SP 21 exist on the abdomen and thorax. Structures beneath the body wall carry on the vegetative functions of digestion, elimination, reproduction, circulation, and respiration. While certain applications for body wall pain and nerve entrapment will also fall under the purview of SP line truncal points, the main benefits will derive from somatovisceral reflex modulation.

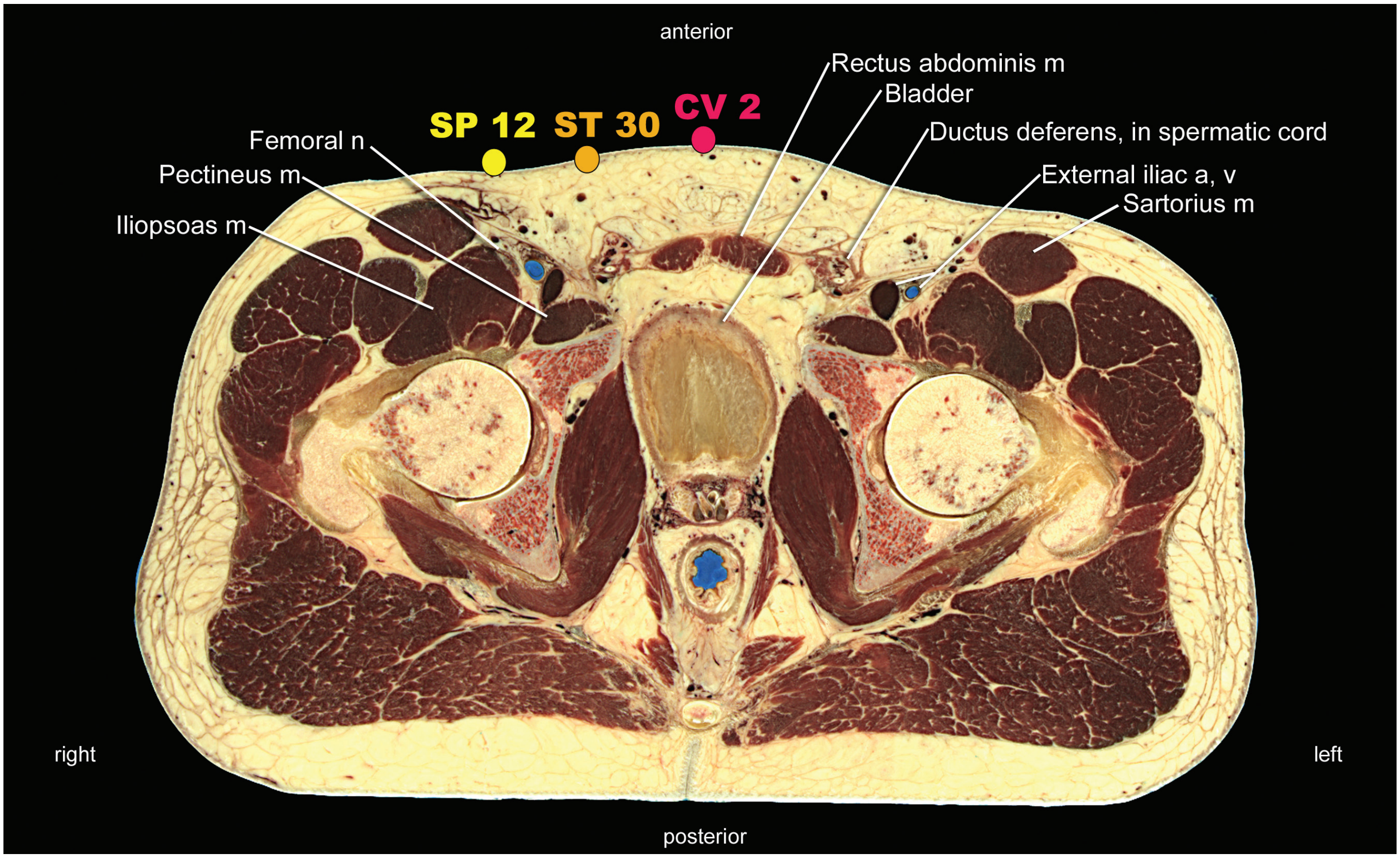


Figure 4-30. This cross section at the level of SP 12 compares the structures within the reach of an acupuncture needle to those associated with its neighbors, ST 30 and CV 2. Of note as well is how the SP channel has moved to lateral to the ST line.

the anteromedial thigh and supplies the hip and knee joints. Its anterior (or superior) branch supplies the anterior thigh muscles, including sensory, motor, and proprioceptive function for the sartorius muscle.

Nerves: The multiplicity of nerves supplying this region speaks to the multifaceted effects of SP 12. Many of the nerves reflex to pelvic organs and genitourinary function through spinal segmental overlap of somatic and sympathetic pathways. The lumbar plexus, comprised of the ventral rami of L1 through L4 spinal nerves and accompanied by a branch of the T12 spinal nerve ventral ramus, forms several of the nerves that provide nerve input to SP 12. They include the: iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.[3] The jobs these nerves do in terms of communicating between the soma and viscera along with supplying sensation, motor function, and proprioception to muscles of the pelvis and lower limb, make SP 12 a neural traffic highway ferrying signals up and down, in and out.

Vessels

- **Superficial epigastric artery**: Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior epigastric artery**: Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall. It arises from the external iliac artery just superior to the inguinal ligament.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.
- **Superficial circumflex iliac artery:** Provides blood to the subcutaneous tissue and skin overlying the inferior region of the anterolateral abdominal wall. Arises from the femoral artery.
- **Superficial circumflex iliac vein:** This vein, along with the superficial epigastric vein, provides a collateral route for return of abdominopelvic venous blood when the inferior vena cava becomes obstructed or ligated. Like the superficial epigastric and the inferior and superior epigastric veins, the superficial circumflex iliac vein lacks valves, and thus serves as conduits for venous return to the heart. Usually, the superficial circumflex iliac veins and the superficial epigastric veins would serve as tributaries of the great saphenous vein, which drains into the inferior vena cava (IVC). Since these veins anastomose in the subcutaneous tissues of the anterolateral body wall with tributaries of the axillary vein (usually the lateral thoracic vein), blood can flow through this subcutaneous collateral circulation

pathway instead of the great saphenous vein/IVC if that drainage route becomes unavailable. This subcutaneous collateral pathway is called the thoracoepigastric vein.

- **Deep circumflex iliac artery:** Supplies the iliacus muscle and the inferior region of the anterolateral abdominal wall.
- **External iliac artery:** Gives rise to the inferior epigastric and deep circumflex iliac artery.

Clinical Relevance: The various superficial venous channels that course over the abdomen provide alternative sources of vascular access if attempts at peripheral venipuncture fail for patients with portal hypertension due to liver cirrhosis or other causes. Accessing superficial vessels avoids the risks associated with pursuing central venous access.[4] Inferior vena caval obstruction (e.g., from thrombosis or tumor) or its congenital absence can cause the paraumbilical and abdominal subcutaneous veins to become patent.[5] The continued close relationship between the SP channel and underlying veins serves as a reminder of acupuncture's origins as a bloodletting procedure.

Indications and Potential Point Combinations

- **Orchitis:** SP 12, ST 29, SP 6, CV 2.
- **Endometriosis:** SP 12, SP 4, SP 6, CV 4, PC 6.
- **Postpartum hemorrhage:** SP 12, SP 10, CV 4.
- **Pain of inguinal hernia repair:** SP 12, SP 13, ST 30, ST 29, CV 2.
- **Restricted range of motion of the hip, local pain:** Check for local trigger points and sources of referred pain, including SP 12 over the pectineus, SP 11 over the adductor magnus and the vastus medialis muscles.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[2]

References

1. Schulz-Stübner S, Henszel A, and Hata JS. A new rule for femoral nerve blocks. *Regional Anesthesia and Pain Medicine*. 2005;30(5):473-477.
2. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research*. 2003;31:552-556.
3. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *American Surgeon*. 2010;76(3):253-262.
4. Turc J, Gergele L, Attof R, et al. Case report. A new site for venous access: superficial veins of portal collateral circulation. *American Journal of Emergency Medicine*. 2012;30:258.e1-258.e2.
5. Schnedl WJ, Reittner P, Krause R, et al. Patent abdominal subcutaneous veins caused by congenital absence of the inferior vena cava: a case report. *Journal of Medical Case Reports*. 4:223. Accessed on 09-19-12 at http://jmedicalcasereports.com/content/pdf/1752-1947-4-223.pdf

SP 13

Fu She "Bowel Abode"

On the lower abdomen, on the lateral border of the rectus abdominis muscle (linea semilunaris), 4 cun lateral to the anterior midline, level with CV 3.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: Rectus sheath hematoma can result from hemorrhage into the rectus muscle due to rupture of either the superior or inferior epigastric arteries or their branches, as well as a tear of the rectus abdominis muscle. Fascial strains may affect this region as well, caused by strenuous exercise or stretching, such as with yogic postures.[1] Rectus sheath hematoma may be more common in women on oral anticoagulants who strain during defecation or coughing.[2] Acupuncture and related techniques may lessen fascial restrictions, pain, inflammation, and myofascial dysfunction in tissues associated with the rectus sheath.

Muscles

- **External oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis aponeurosis:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence who have difficulty exercising the pelvic floor muscles.[3] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence.

Nerves

- **Subcostal nerve (T12):** Supplies the skin in this region.
- **1st lumbar nerve (L1):** Contributes to nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the

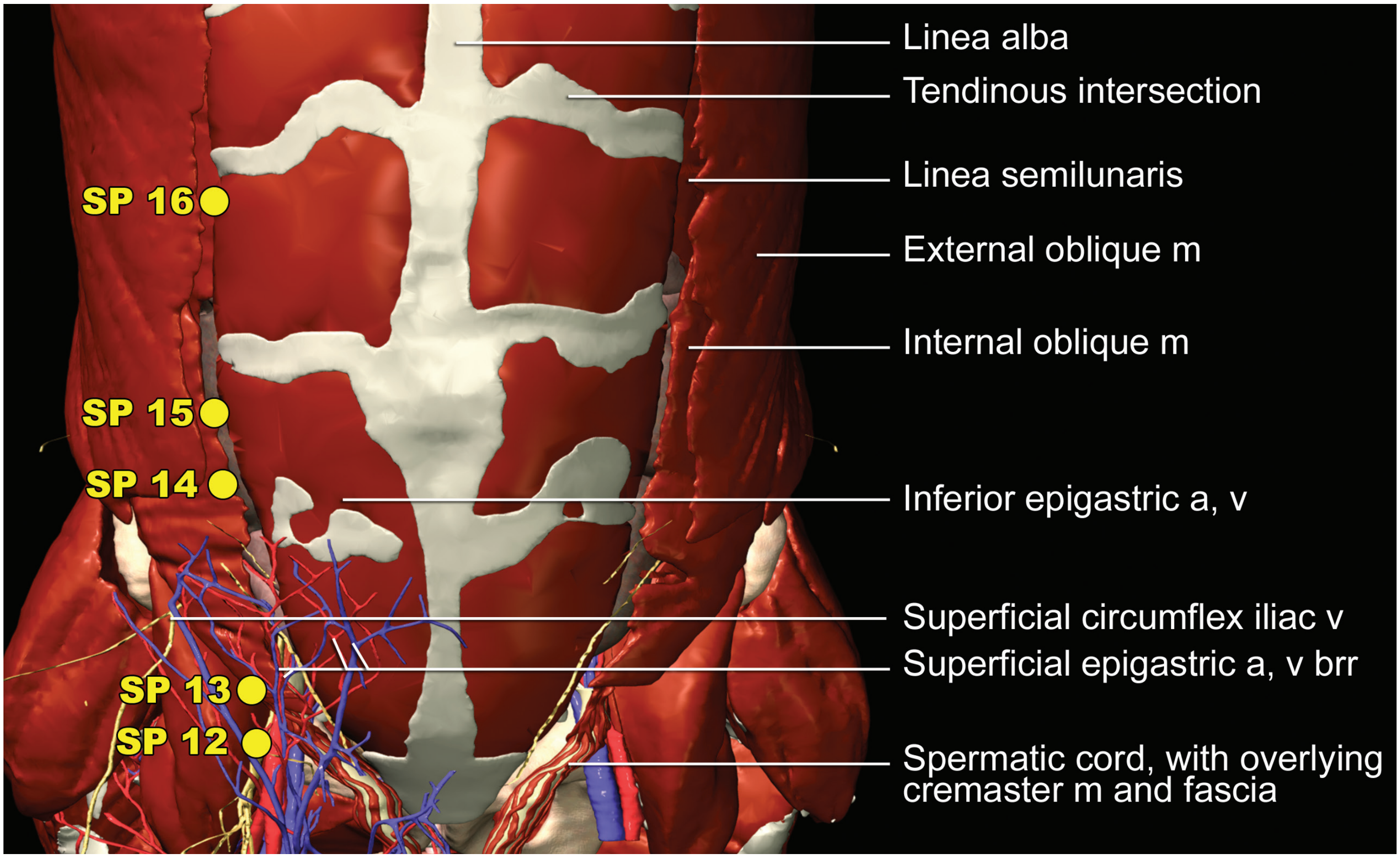


Figure 4-31. SP 13, "Bowel Abode" indicates the value of this point for treating bowel-related dysfunction. In fact, even on this muscle layer, the underlying intestines can be seen through the linea semilunaris. The semi-transparent muscle layer reveals the relative locations of the intestines to SP 13. In addition, seeing through the musculature reveals how the inferior epigastric vessels lie deep to the abdominal wall while the superficial epigastric vessels sit above it. Note, as well, the network of nerves and vessels at and around SP 13 that may suffer injury from transverse incisions to the lower abdominal wall.

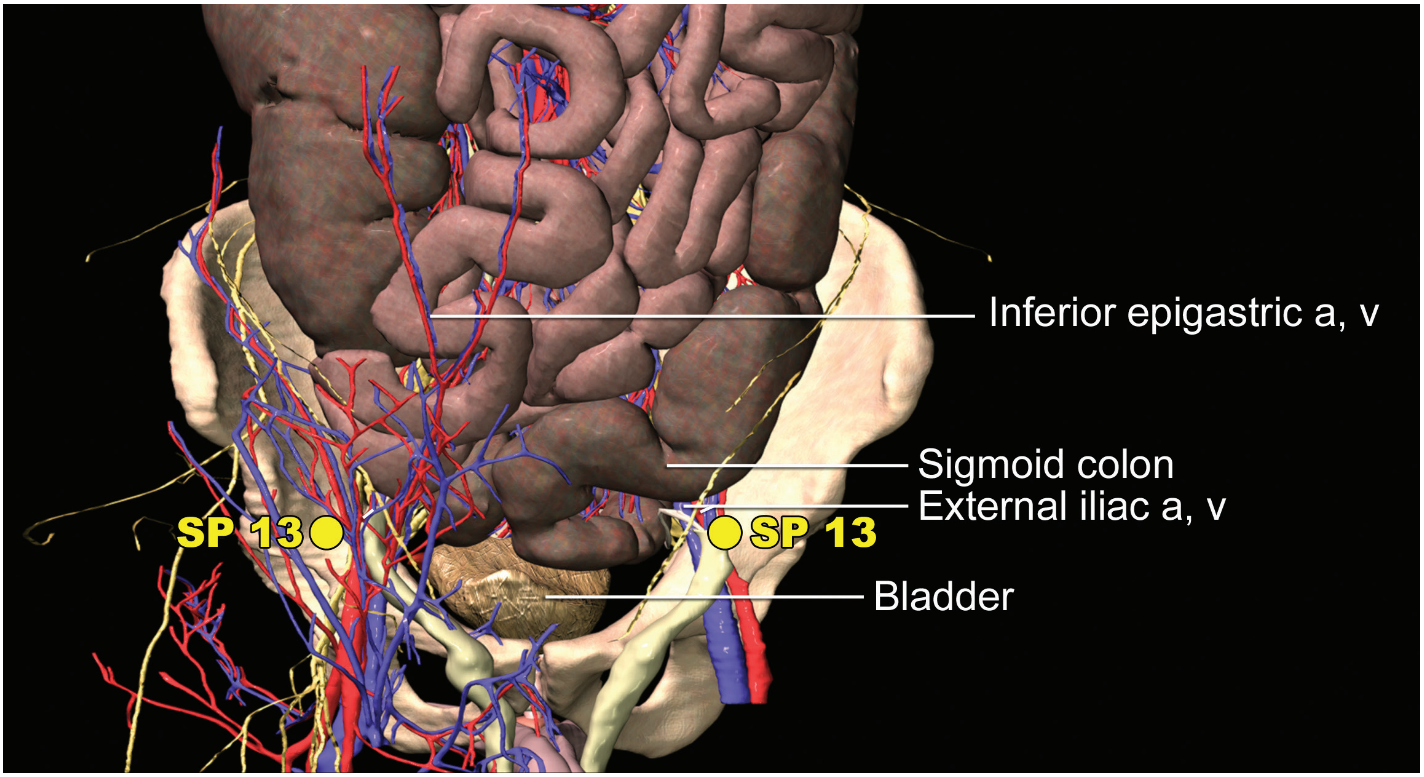


Figure 4-32. Acupuncture stimulation of nerves supplying SP 13, like SP 12, influences pelvic organ function through cutaneovisceral, spinal segmental, and myofascial relationships and connections. The soma at SP 13 receives innervation from the L1 spinal cord segment, allowing the opportunity to modulate autonomic activity in the pelvis via crosstalk with nerves of the lumbar plexus that issue sympathetic fibers to abdominopelvic structures.

periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: The iliohypogastric nerve, one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen, especially when the incision extends lateral to the inferior rectus abdominis muscle. Surgeries with such incisions may include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of SP 13 may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[4] Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

The multiplicity of nerves supplying this region speaks to the multifaceted effects of SP 13. Many of the nerves reflex to pelvic organs and genitourinary function through spinal segmental overlap of somatic and sympathetic pathways. The lumbar plexus, comprised of the ventral rami of L1 through L4 spinal nerves and accompanied by a branch of the T12 spinal nerve ventral ramus, forms several of the nerves that provide nerve input to SP 13. They include the: iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.[5] The jobs these nerves do in terms of communicating between the soma and viscera along with supplying sensation, motor function, and proprioception to muscles of the pelvis and lower limb, make SP 13, like its neighbor SP 12, a neural traffic highway ferrying signals up and down, in and out.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and

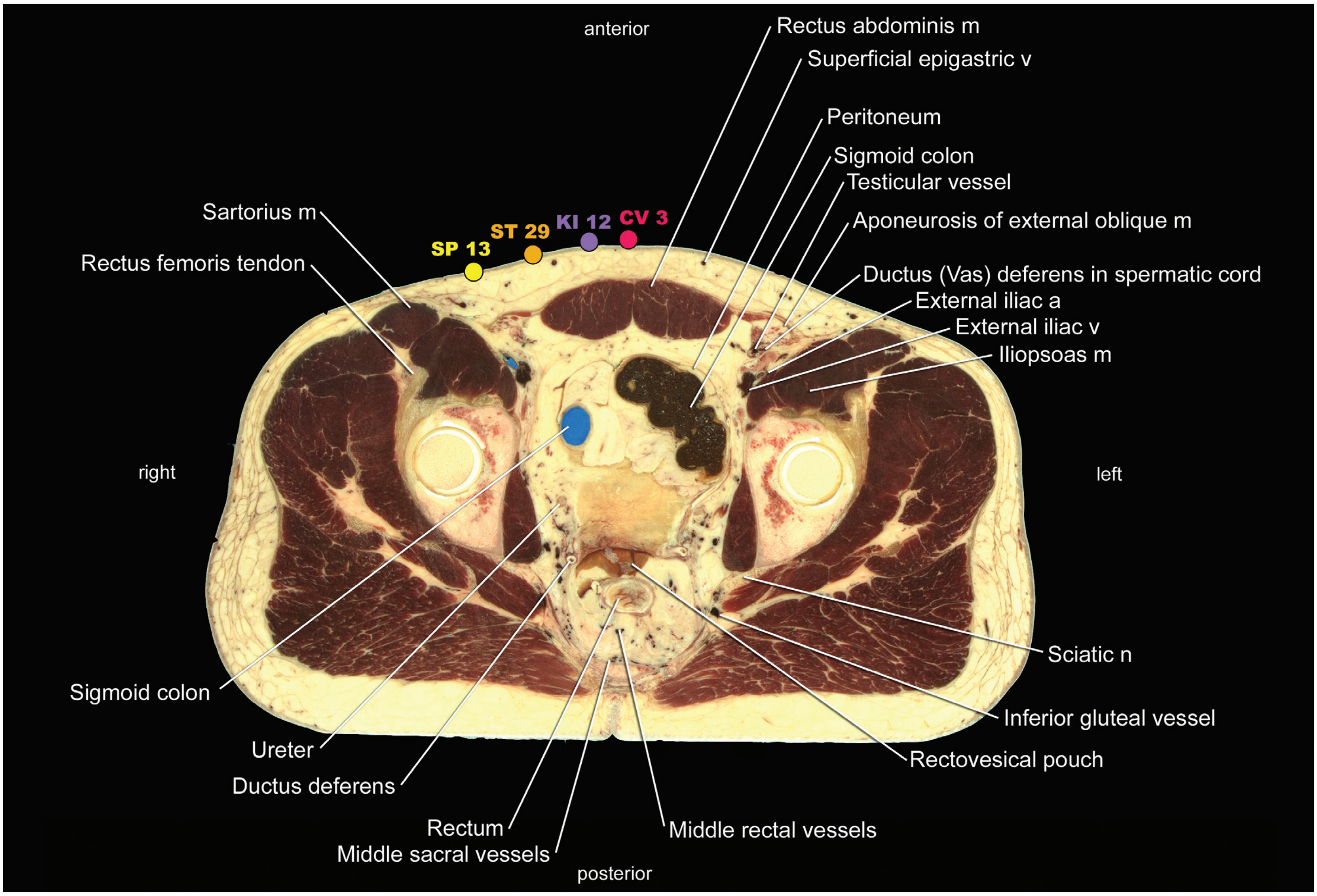

anterior
Rectus abdominis m
Superficial epigastric v
Peritoneum
Sigmoid colon
Testicular vessel
Aponeurosis of external oblique m
Ductus (Vas) deferens in spermatic cord
External iliac a
External iliac v
Iliopsoas m
Sartorius m
Rectus femoris tendon
SP 13
ST 29
KI 12
CV 3
right
left
Sciatic n
Inferior gluteal vessel
Rectovesical pouch
Sigmoid colon
Ureter
Ductus deferens
Rectum
Middle sacral vessels
Middle rectal vessels
posterior

Figure 4-33. SP 13, "Bowel Abode", provides the first cross sectional level in which intestinal organs other than the rectum begin to appear. The iliopsoas muscle sits deep to SP 13, and the sartorius muscle lateral.

from there, into the superior vena cava.

Clinical Relevance: The various superficial venous channels that course over the abdomen provide alternative sources of vascular access if attempts at peripheral venipuncture fail for patients with portal hypertension due to liver cirrhosis or other causes. Accessing superficial vessels avoids the risks associated with pursuing central venous access.[6] Inferior vena caval obstruction (e.g., from thrombosis or tumor) or its congenital absence can cause the paraumbilical and abdominal subcutaneous veins to become patent.[7] The continued close relationship between the SP channel and underlying veins serves as a reminder of acupuncture's origins as a bloodletting procedure.

Indications and Potential Point Combinations

- **Inguinal and hip pain:** SP 13, check for quadratus lumborum trigger points in the BL 21-BL 25 region that could refer to the inguinal/hip/gluteal region.
- **Constipation:** SP 13, CV 6, ST 36, ST 25, BL 25, BL 32, GV 3.
- **Orchitis:** SP 12, ST 29, SP 6, CV 2.
- **Vaginal infection, ovarian pain:** SP 13, ST 30, CV 4, SP 4, PC 6.
- **Endometriosis:** SP 12, SP 4, SP 6, CV 4, PC 6.
- **Postpartum hemorrhage:** SP 12, SP 10, CV 4.
- **Hernia, pain of inguinal hernia repair:** SP 12, SP 13, ST 30, ST 29, CV 2.
- **Restricted range of motion of the hip, local pain:** Check for local trigger points and sources of referred pain, including SP 12 over the pectineus, SP 11 over the adductor magnus and the vastus medialis muscles.

References

1. Choi Y and Lee D. A case of rectus sheath hematoma caused by yoga exercise. *Am J Emerg Med.* 2009;27(7):899.e1-2.
2. Senthilkumaran S, Balamurugan N, Menezes RG, et al. Rectus sheath hematoma: clinical examination is the key. *American Journal of Emergency Medicine.* 2012; Epub ahead of print.
3. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics.* 2009;28:368-373.
4. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference.* November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
5. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *American Surgeon.* 2010;76(3):253-262.
6. Turc J, Gergele L, Attof R, et al. Case report. A new site for venous access: superficial veins of portal collateral circulation. *American Journal of Emergency Medicine.* 2012;30:258.e1-258.e2.
7. Schnedl WJ, Reittner P, Krause R, et al. Patent abdominal subcutaneous veins caused by congenital absence of the inferior vena cava: a case report. *Journal of Medical Case Reports.* 4:223. Accessed on 09-19-12 at http://jmedicalcasereports.com/content/pdf/1752-1947-4-223.pdf

SP 14

Fu Jie "Abdomen Knot" or "Abdominal Bind"

On the lower abdomen, on the lateral border of the rectus abdominis muscle (linea semilunaris), 3 cun proximal to SP 13, 4 cun lateral to the anterior midline, level with CV 7.

Caution needling here. Deep needling may enter the cecum. See Figure 4-36.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: Rectus sheath hematoma can result from hemorrhage into the rectus muscle due to rupture of either the superior or inferior epigastric arteries or their branches, as well as a tear of the rectus abdominis muscle. Fascial strains may affect this region as well, caused by strenuous exercise or stretching, such as with yogic postures.[1] Rectus sheath hematoma may be more common in women on oral anticoagulants who strain during defecation or coughing.[2] Acupuncture and related techniques may lessen fascial restrictions, pain, inflammation, and myofascial dysfunction in tissues associated with the rectus sheath.

Muscles

- **External oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis aponeurosis:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger point pathology in the abdominal oblique muscles such as at SP 14 may send referred pain in various directions across the abdomen, including toward the ipsilateral or contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia, leading to a variety of diagnostic enigmas and confusion.

Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence that have difficulty exercising the pelvic floor muscles.[3] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence.

Nerves

- **11th intercostal nerve:** Supplies the skin in this region.
- **1st lumbar nerve:** Contributes to nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves and L1):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: The iliohypogastric nerve, one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen, especially when the incision extends lateral to the inferior rectus abdominis muscle. Surgeries where this may happen include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of SP 14 may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[4] Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as

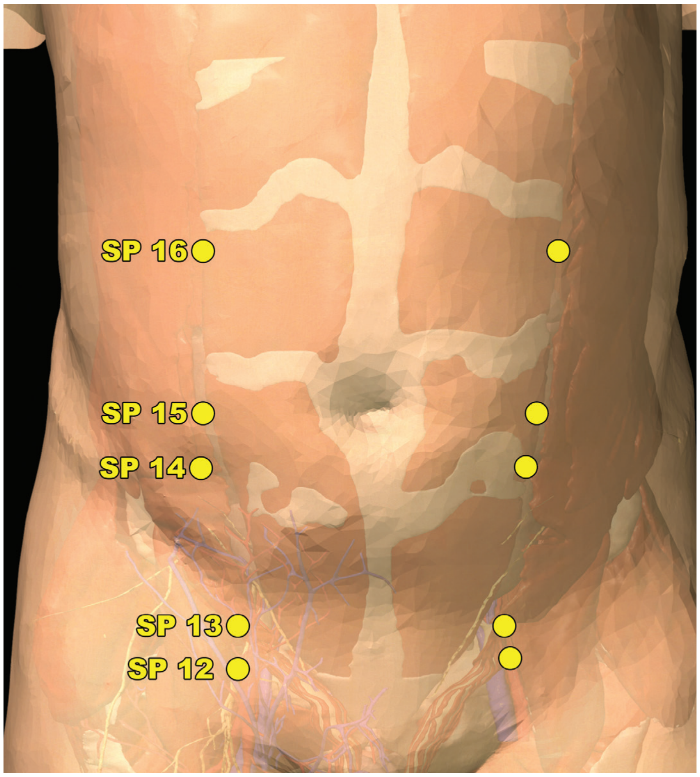


Figure 4-34. SP 14 appears here in the context of its neighbors' locations on the lower abdomen. The line-up of SP points along the linea semilunaris coincides with sites of neurovascular entrapment on the abdominal wall. SP points along the linea semilunaris receive dual cutaneous nerve input; namely 1) the lateral cutaneous branches of the intercostals, subcostal, and iliohypogastric nerves, as well as 2) the anterior cutaneous branches of these same nerves.

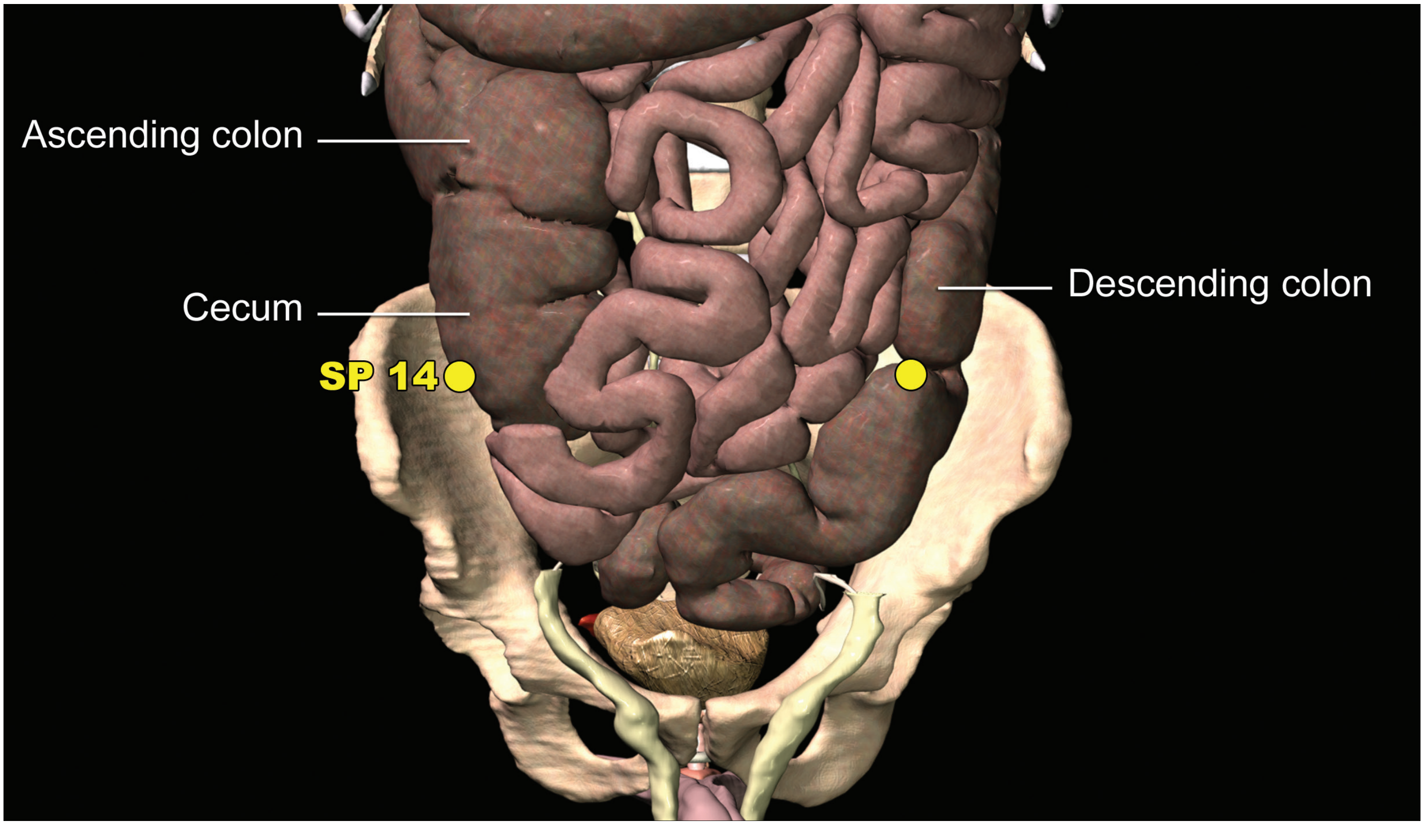


Figure 4-35. SP 14, "Abdominal Bind" or "Abdominal Knot" connotes the cramping, distending discomfort of sluggish colonic motility through structures visualized here, namely the cecum and descending colon.

acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

The SP channel on the abdomen along the linea semilunaris coincides with the most common site of thoracoabdominal nerve entrapment, as the nerve is changing direction to either enter a fibrous tunnel or is passing over either a fibrous or muscular band.[5] Vigorous exercise, traction, or other traumatic events or sources of compression may lead to localized swelling that compromises vascular supply to the nerve, worsening the irritation and neuropathic pain. The pain may cause diagnostic confusion, as it has both acute and chronic aspects and cause diffuse, referred, and/or localized discomfort. In women, the pain may seem to be coming from ovaries or bladder. Men may complain of a hernia or ulcer. Some may believe they have cancer or another "horrible" condition because of the diagnostic confusion and uncertainty they have developed around the condition. Abdominal wall pain that is incorrectly attributed to an intra-abdominal process may lead to unnecessary consultation, testing, and surgery, further complicating the problem and delaying proper diagnosis and care. Abdominal cutaneous nerve entrapment syndrome (ACNES) that radiates to the scrotum or vulva suggests entrapment of the T12/L1 nerve, although trigger point pathology from the adductor musculature should be ruled out, along with inguinal or femoral hernia. Pain may follow the nerves' obliquity, but urolithiasis may also produce the same directionality of pain but with far more severity. Other intra-abdominal pathology that can resemble ACNES includes appendicitis, ovarian dysfunction, cholecystitis (at the T8-9 level) or peptic ulcer disease (also at the T8-9 level). More cranial nerve entrapment can suggest costochondritis, slipping rib syndrome, pleuritis, or involvement of the cutaneous nerves at the levels of T6-T8. On physical examination, patients may point to the neuromuscular foramen along the SP line of the abdomen or claim "That's it" when the examiner palpates this site. Dorsal branches of the spinak nerves may become entrapped at the outer Bladder line and palpation over those exit sites is also warranted. Local treatment can involve needling, pressure, and heat applied to the entrapment sites in order to loosen tissue, deactivate trigger points, and relax the fascia.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the

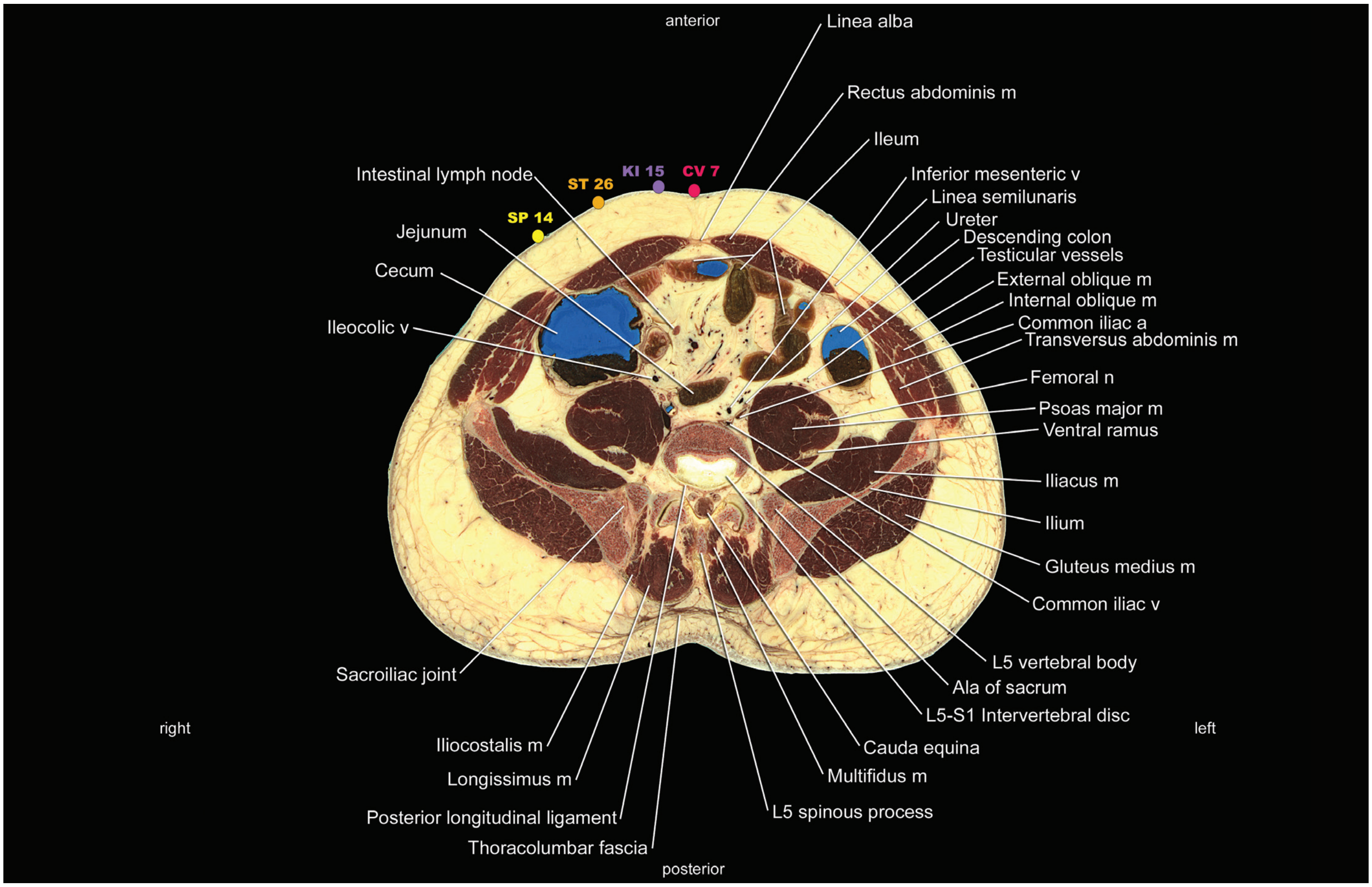

anterior
Linea alba
Rectus abdominis m
Ileum
Intestinal lymph node
ST 26
KI 15
CV 7
SP 14
Jejunum
Cecum
Ileocolic v
Inferior mesenteric v
Linea semilunaris
Ureter
Descending colon
Testicular vessels
External oblique m
Internal oblique m
Common iliac a
Transversus abdominis m
Femoral n
Psoas major m
Ventral ramus
Iliacus m
Ilium
Gluteus medius m
Common iliac v
Sacroiliac joint
L5 vertebral body
Ala of sacrum
L5-S1 Intervertebral disc
right
left
Iliocostalis m
Longissimus m
Posterior longitudinal ligament
Thoracolumbar fascia
Cauda equina
Multifidus m
L5 spinous process
posterior

Figure 4-36. Note how superficial the cecum lies to the linea semilunaris in this cross section. The accessibility of the organ to a needle entering SP 14 warrants caution, especially when treating slender patients that lack the layer of adiposity seen here.

internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The various superficial venous channels that course over the abdomen provide alternative sources of vascular access if attempts at peripheral venipuncture fail for patients with portal hypertension due to liver cirrhosis or other causes. Accessing superficial vessels avoids the risks associated with pursuing central venous access.[6] Inferior vena caval obstruction (e.g., from thrombosis or tumor) or its congenital absence can cause the paraumbilical and abdominal subcutaneous veins to become patent. The continued close relationship between the SP channel and underlying veins serves as a reminder of acupuncture's origins as a bloodletting procedure.

Indications and Potential Point Combinations

- **Inguinal pain, inguinal hernia:** SP 14, SP 13, SP 12, ST 30, CV 2. Myofascial trigger points in the lower lateral abdominal wall musculature, in the vicinity of SP 14, may radiate pain to the groin or testes.
- **Periumbilical abdominal pain, constipation:** SP 14, SP 15, CV 10, CV 12, ST 36.
- **Diarrhea:** Consider contribution from trigger points in the lower lateral abdominal wall musculature, including SP 14.
- **Pseudo-appendicitis pain emanating from a myofascial trigger point on the lateral border of the right rectus abdominis muscle simulating appendicitis pain:** SP 14, SP 15, GB 26, ST 36.

References

1. Choi Y and Lee D. A case of rectus sheath hematoma caused by yoga exercise. *Am J Emerg Med.* 2009;27(7):899.e1-2.
2. Senthilkumaran S, Balamurugan N, Menezes RG, et al. Rectus sheath hematoma: clinical examination is the key. *American Journal of Emergency Medicine.* 2012;30(9):2069-2070.
3. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics.* 2009;28:368-373.
4. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference.* November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
5. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
6. Turc J, Gergele L, Attof R, et al. Case report. A new site for venous access: superficial veins of portal collateral circulation. *American Journal of Emergency Medicine.* 2012;30:258.e1-258.e2.
7. Schnedl WJ, Reittner P, Krause R, et al. Patent abdominal subcutaneous veins caused by congenital absence of the inferior vena cava: a case report. *Journal of Medical Case Reports.* 4:223. Accessed on 09-19-12 at http://jmedicalcasereports.com/content/pdf/1752-1947-4-223.pdf

SP 15

Da Heng "Great Horizontal"

On the lateral limit of the umbilical region, on the linea semilunaris, approximately 4 cun lateral to the umbilicus (CV 8).

Caution needling here. Deep needling may enter the ascending colon. See Figure 4-38.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: Rectus sheath hematoma can result from hemorrhage into the rectus muscle due to rupture of either the superior or inferior epigastric arteries or their branches, as well as a tear of the rectus abdominis muscle. Fascial strains may affect this region as well, caused by strenuous exercise or stretching, such as with yogic postures.[1] Rectus sheath hematoma may be more common in women on oral anticoagulants who strain during defecation or coughing.[2] Acupuncture and related techniques may lessen fascial restrictions, pain, inflammation, and myofascial dysfunction in tissues associated with the rectus sheath.

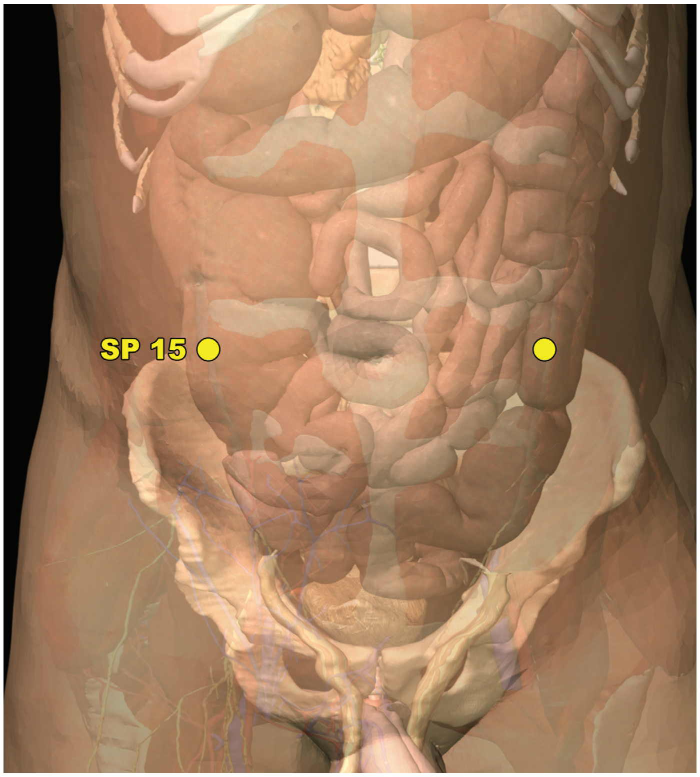


Figure 4-37. The name for SP 15, "Great Horizontal" indicates the point's location level with the umbilicus. Its indications for abdominal pain become evident based on the ascending and descending colon that share this cross section, shown in Figure 4-38.

Muscles

- **External oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis aponeurosis:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger point pathology in the abdominal oblique muscles such as at SP 15 may send referred pain in various directions across the abdomen, including toward the ipsilateral or contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia, leading to a variety of diagnostic enigmas and confusion.

Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence that have difficulty exercising the pelvic floor muscles.[3] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence.

Nerves

- **10th intercostal nerve:** Supplies the skin in this region.
- **1st lumbar nerve:** Contributes to nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves and L1):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: The iliohypogastric nerve, one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen, especially when the incision extends lateral to the inferior rectus abdominis muscle. Surgeries where this may happen include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of abdominal SP points may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[4] Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

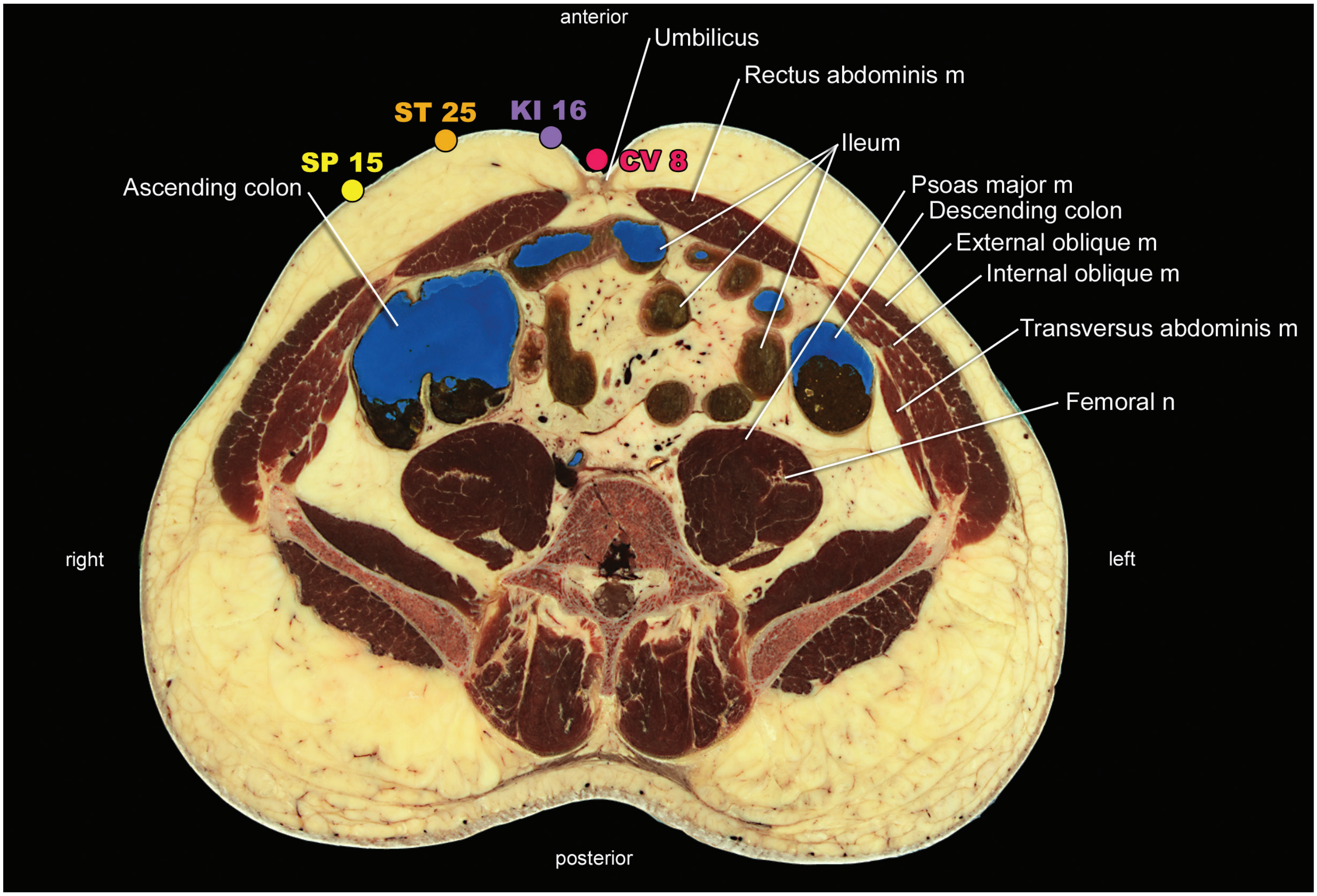


Figure 4-38. The abdomen bulges to create the "Great Horizontal", seen here in cross section.

The SP channel on the abdomen along the linea semilunaris coincides with the most common site of thoracoabdominal nerve entrapment, as the nerve is changing direction to either enter a fibrous tunnel or is passing over either a fibrous or muscular band.[5] Vigorous exercise, traction, or other traumatic events or sources of compression may lead to localized swelling that compromises vascular supply to the nerve, worsening the irritation and neuropathic pain. The pain may cause diagnostic confusion, as it has both acute and chronic aspects and cause diffuse, referred, and/or localized discomfort. In women, the pain may seem to be coming from ovaries or bladder. Men may complain of a hernia or ulcer. Some may believe they have cancer or another "horrible" condition because of the diagnostic confusion and uncertainty they have developed around the condition. Abdominal wall pain that is incorrectly attributed to an intra-abdominal process may lead to unnecessary consultation, testing, and surgery, further complicating the problem and delaying proper diagnosis and care. Abdominal cutaneous nerve entrapment syndrome (ACNES) that radiates to the scrotum or vulva suggests entrapment of the T12/L1 nerve, although trigger point pathology from the adductor musculature should be ruled out, along with inguinal or femoral hernia. Pain may follow the nerves' obliquity, but urolithiasis may also produce the same directionality of pain but with far more severity. Other intra-abdominal pathology that can resemble ACNES includes appendicitis, ovarian dysfunction, cholecystitis (at the T8-9 level) or peptic ulcer disease (also at the T8-9 level). More cranial nerve entrapment can suggest costochondritis, slipping rib syndrome, pleuritis, or involvement of the cutaneous nerves at the levels of T6-T8. On physical examination, patients may point to the neuromuscular foramen along the SP line of the abdomen or claim, "That's it" when the examiner palpates this site. Dorsal branches of the spinal nerves may become entrapped at the outer Bladder line and palpation over those exit sites is also warranted. Local treatment can involve needling, pressure, and heat applied to the entrapment sites in order to loosen tissue, deactivate trigger points, and relax the fascia.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These

valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The various superficial venous channels that course over the abdomen provide alternative sources of vascular access if attempts at peripheral venipuncture fail for patients with portal hypertension due to liver cirrhosis or other causes. Accessing superficial vessels avoids the risks associated with pursuing central venous access.[6] Inferior vena caval obstruction (e.g., from thrombosis or tumor) or its congenital absence can cause the paraumbilical and abdominal subcutaneous veins to become patent.[7] The continued close relationship between the SP channel and underlying veins serves as a reminder of acupuncture's origins as a bloodletting procedure.

Indications and Potential Point Combinations

- **Periumbilical pain, abdominal pain and distension:** SP 15, CV 10, CV 12, ST 36.
- **Digestive problems:** constipation, diarrhea, colon disorders, dysentery, atonic intestine: SP 15, SP 6, ST 36.
- **Pseudo-appendicitis pain emanating from a myofascial trigger point on the lateral border of the right rectus abdominis muscle simulating appendicitis pain:** SP 14, SP 15, GB 26, ST 36.

References

1. Choi Y and Lee D. A case of rectus sheath hematoma caused by yoga exercise. *Am J Emerg Med.* 2009;27(7):899.e1-2.
2. Senthilkumaran S, Balamurugan N, Menezes RG, et al. Rectus sheath hematoma: clinical examination is the key. *American Journal of Emergency Medicine.* 2012;30(9):2069-2070.
3. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics.* 2009;28:368-373.
4. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference.* November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
5. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
6. Turc J, Gergele L, Attof R, et al. Case report. A new site for venous access: superficial veins of portal collateral circulation. *American Journal of Emergency Medicine.* 2012;30:258.e1-258.e2.
7. Schnedl WJ, Reittner P, Krause R, et al. Patent abdominal subcutaneous veins caused by congenital absence of the inferior vena cava: a case report. *Journal of Medical Case Reports.* 4:223. Accessed on 09-19-12 at http://jmedicalcasereports.com/content/pdf/1752-1947-4-223.pdf

SP 16

Fu Ai "Abdominal Lament"

On the upper abdomen, on the linea semilunaris, approximately 4 cun lateral to the anterior midline, level with CV 11, 3 cun proximal to SP 15. Because abdominal girths vary so dramatically between individuals, the most accurate manner of SP point location on the abdomen involves locating the linea semilunaris rather than counting cun.[1]

Caution needling here. Deep needling may enter the transverse colon, but the transversus abdominis muscle offers an extra layer of protection from needle entry into the intestine. See Figure 4-40.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: Rectus sheath hematoma can result from hemorrhage into the rectus muscle due to rupture of either the superior or inferior epigastric arteries or their branches, as well as a tear of the rectus abdominis muscle. Fascial strains may affect this region as well, caused by strenuous exercise or stretching, such as with yogic postures.[2] Rectus sheath hematoma may be more common in women on oral anticoagulants who strain during defecation or coughing.[3] Acupuncture and related techniques may lessen fascial restrictions, pain, inflammation, and myofascial dysfunction in tissues associated with the rectus sheath.

Muscles

- **External oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Transversus abdominis aponeurosis:** Compresses and supports the abdominal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Trigger point pathology in the abdominal oblique muscles such as at SP 15 may send referred pain in various directions across the abdomen, including toward the ipsilateral or contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia, leading to a variety of diagnostic enigmas and confusion.

Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence that have difficulty exercising the pelvic floor muscles.[4] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence.

Nerves

- **7th through 9th intercostal nerve:** Supplies the skin in this region.
- **1st lumbar nerve:** Contributes to nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves and L1):** Innervate the anterior abdominal

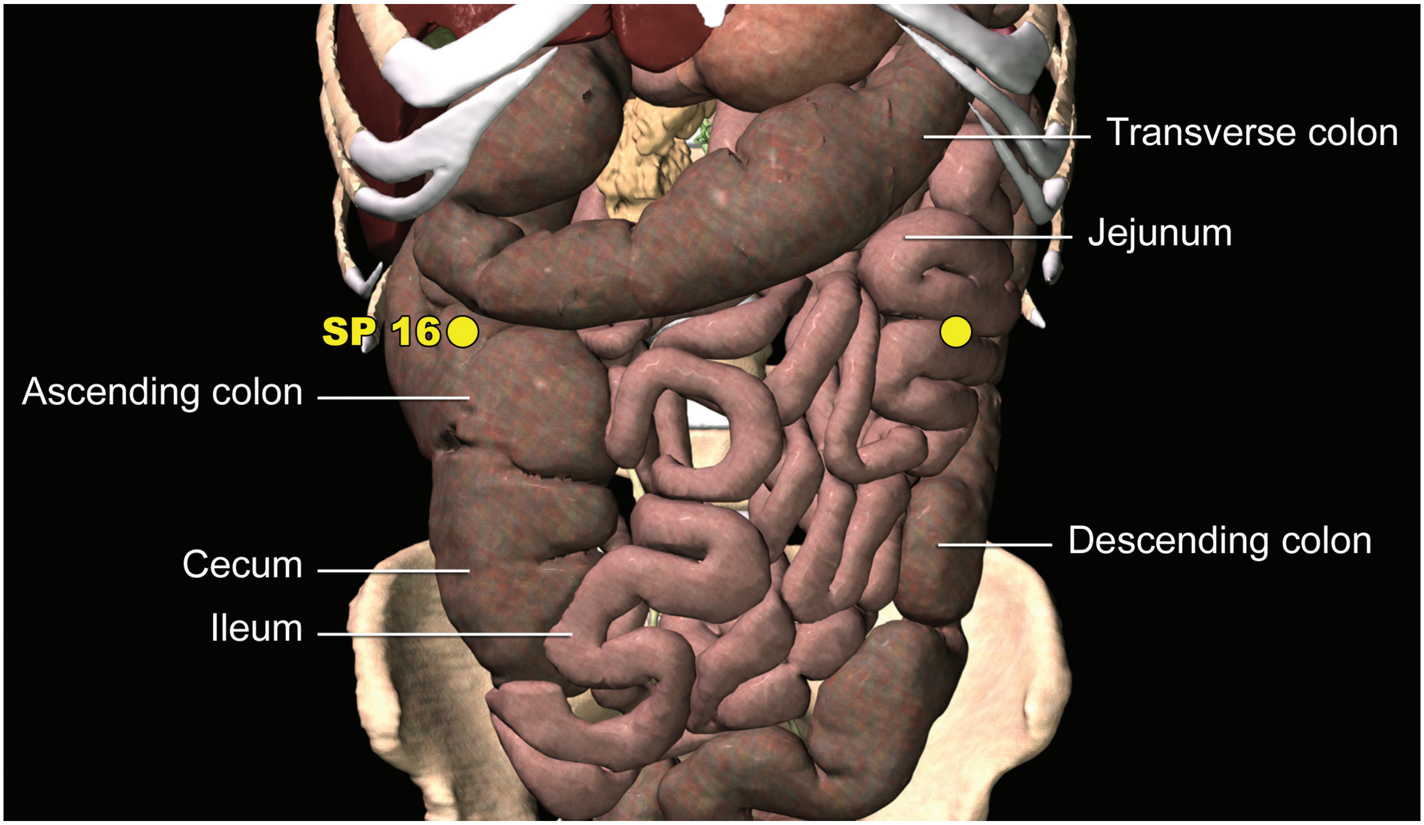


Figure 4-39. Abdominal Lament", SP 16, lands where a patient experiencing abdominal pain may double over.

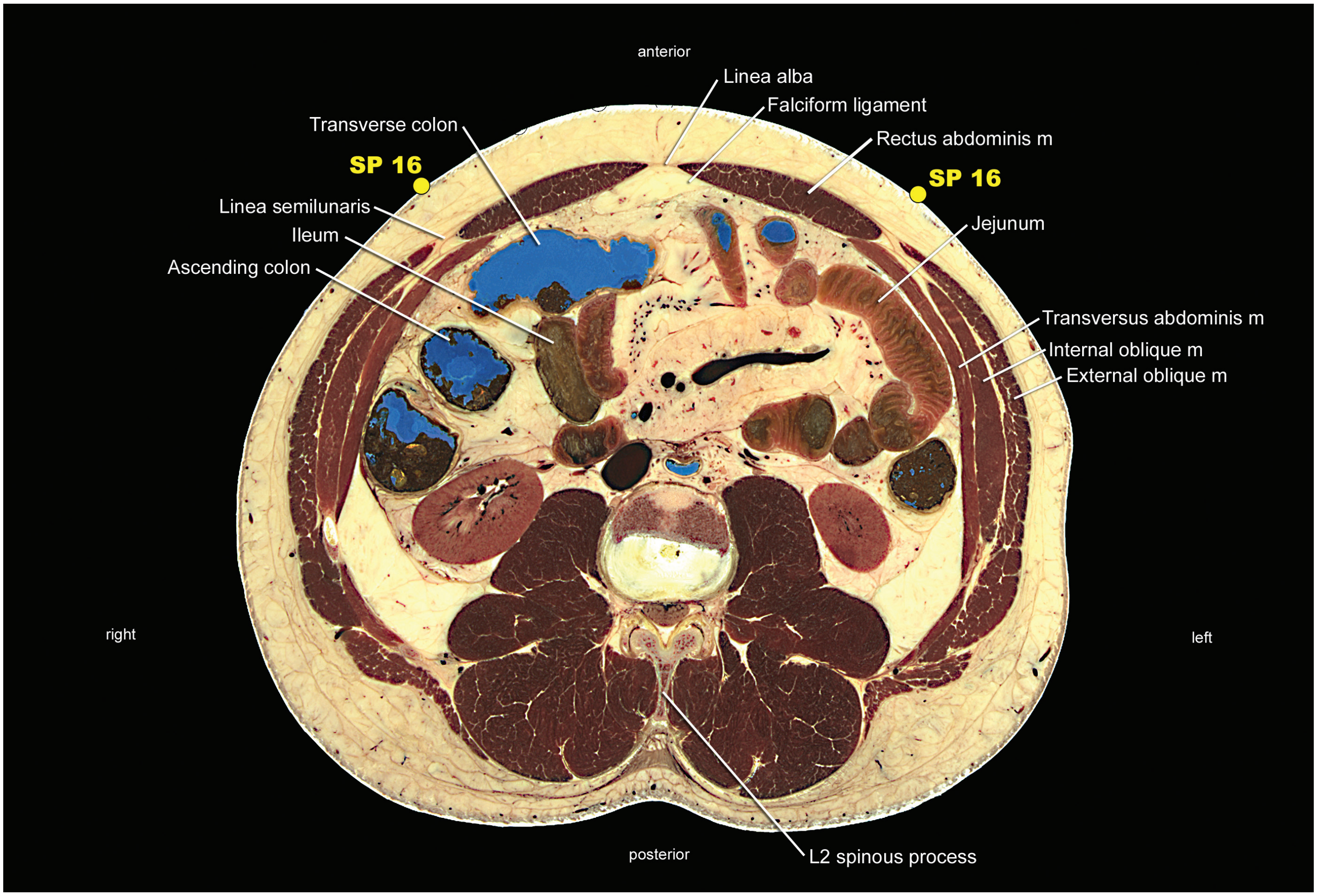


Figure 4-40. In this cross section at the level of SP 16, or "Abdominal Lament", the transverses abdominis muscle provides an additional layer of protection between the skin and the colon, although caution remains warranted.

muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: The iliohypogastric nerve, one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen, especially when the incision extends lateral to the inferior rectus abdominis muscle. Surgeries where this may happen include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of the abdominal SP points may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[5] Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

The SP channel on the abdomen along the linea semilunaris coincides with the most common site of thoracoabdominal nerve entrapment, as the nerve is changing direction to either enter a fibrous tunnel or is passing over either a fibrous or muscular band.[6] Vigorous exercise, traction, or other traumatic events or sources of compression may lead to localized swelling that compromises vascular supply to the nerve, worsening the irritation and neuropathic pain. The pain may cause diagnostic confusion, as it has both acute and chronic aspects and cause diffuse, referred, and/or localized discomfort. In women, the pain may seem to be coming from ovaries or bladder. Men may complain of a hernia or ulcer. Some may believe they have cancer or another "horrible" condition because of the diagnostic confusion and uncertainty they have developed around the condition. Abdominal wall pain that is incorrectly attributed to an intra-abdominal process may lead to unnecessary consultation, testing, and surgery, further complicating the problem and delaying proper diagnosis and care. Abdominal cutaneous nerve entrapment syndrome (ACNES) that radiates to the scrotum or vulva suggests entrapment of the T12/L1 nerve, although trigger point pathology from the adductor musculature should be ruled out, along with inguinal or femoral hernia. Pain may follow the nerves' obliquity, but urolithiasis may also produce the same directionality of pain but with far more severity. Other intra-abdominal pathology that can resemble ACNES includes appendicitis, ovarian dysfunction, cholecystitis (at the T8-9 level) or peptic ulcer disease (also at the T8-9 level). More cranial nerve entrapment can suggest costochondritis, slipping rib syndrome, pleuritis, or involvement of the cutaneous nerves at the levels of T6-T8. On physical examination, patients may point to the neuromuscular foramen along the SP line of the abdomen or claim, "That's it" when the examiner palpates this site. Dorsal branches of the spinal nerves may become entrapped at the outer Bladder line and palpation over those exit sites is also warranted. Local treatment can involve needling, pressure, and heat applied to the entrapment sites in order to loosen tissue, deactivate trigger points, and relax the fascia.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.

Clinical Relevance: The various superficial venous channels that course over the abdomen provide alternative sources of vascular access if attempts at peripheral venipuncture fail for patients with portal hypertension due to liver cirrhosis or other causes. Accessing superficial vessels avoids the risks associated with pursuing central venous access.[7] Inferior vena caval obstruction (e.g., from thrombosis or tumor) or its congenital absence can cause the paraumbilical and abdominal subcutaneous veins to become patent.[8] The continued close relationship between the SP channel and underlying veins serves as a reminder of acupuncture's origins as a bloodletting procedure.

References

1. Sui MH, Ma HF, and Wang CY. Discussion on the location of acupoints on the Spleen meridian of foot-Taiyin in the abdominal region. *Zhen Ci Yan Jiu*. 2010; 35(5):391-393.
2. Choi Y and Lee D. A case of rectus sheath hematoma caused by yoga exercise. *Am J Emerg Med*. 2009;27(7):899.e1-2.
3. Senthilkumaran S, Balamurugan N, Menezes RG, et al. Rectus sheath hematoma: clinical examination is the key. *American Journal of Emergency Medicine*. 2012;30(9):2069-2070.
4. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics*. 2009;28:368-373.
5. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference*. November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
6. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.
7. Turc J, Gergele L, Attof R, et al. Case report. A new site for venous access: superficial veins of portal collateral circulation. *American Journal of Emergency Medicine*. 2012;30:258.e1-258.e2.
8. Schnedl WJ, Reittner P, Krause R, et al. Patent abdominal subcutaneous veins caused by congenital absence of the inferior vena cava: a case report. *Journal of Medical Case Reports*. 4:223. Accessed on 09-19-12 at http://jmedicalcasereports.com/content/pdf/1752-1947-4-223.pdf

SP 17

Shi Dou "Food Hole"

On the lateral side of the chest, in the 5th intercostal space, 6 cun lateral to the anterior midline, level with CV 16.

Caution needling! The lung lies below this point. Puncture obliquely and laterally along the intercostal space. Do not needle deeply.

Muscles

- **Serratus anterior muscle:** Holds the scapula against the thoracic wall. Protracts and rotates the scapula.

Clinical Relevance: Trigger points in the serratus anterior muscle in the vicinity of SP 17 produce pain in the muscle itself on the lateral mid-thorax. It may also radiate along the PC and HT channels to the palmar aspect of the 4th and 5th fingers.

Nerves

- **5th intercostal nerve:** Supplies the skin and muscles in this region.
- **Long thoracic nerve (C5-C7):** Supplies the serratus anterior muscle. A pure motor nerve that only innervates the serratus anterior. The nerve descends on the lateral aspect of the thoracic cage, branching to supply each digitation of the serratus anterior muscle. This anchors it at regular and short intervals along its course, thereby limiting its ability to lengthen or glide as a result of extreme excursions of the shoulder girdle.[1]

Clinical Relevance: Long thoracic nerve dysfunction can cause serratus anterior dysfunction and lead to notalgia paresthetica,

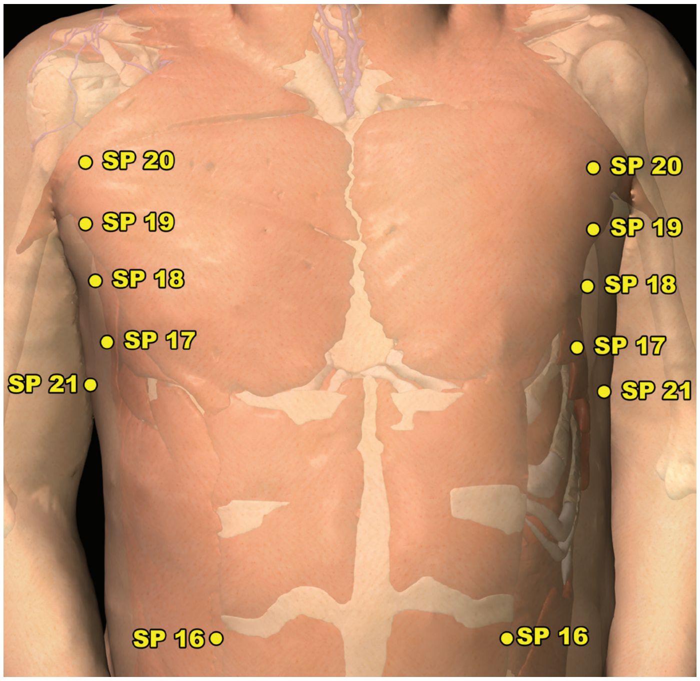


Figure 4-41. SP 17 through SP 21 occupy a seemingly unrelated region from the previous SP group on the abdomen. However, the drainage pathway that serves as a collateral route for abdominopelvic venous blood connects with this thoracoepigastric venous system, further characterized in yellow arrows in Figure 4-42.

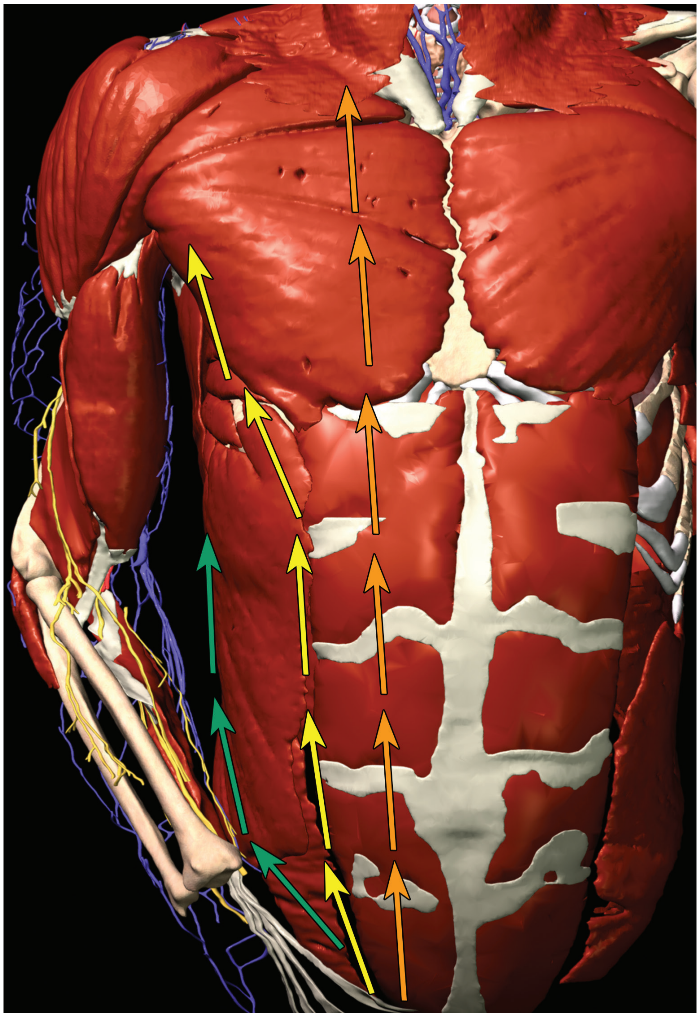


Figure 4-42. The vascular basis of the three channels traveling over the anterior abdominal wall relate closely to the collateral routes for drainage of abdominopelvic venous blood in the event that it cannot return to the heart as it normally would, through the inferior vena cava (IVC). As indicated here by the yellow arrows representing the SP line, backed up blood from the occluded IVC can reverse course through the valveless veins of the anterior abdominal wall and travel superficially through the superficial epigastric veins to the thoracoepigastric vein and ultimately the lateral thoracic vein, beneath SP 17 to SP 20. The orange arrows signify the ST channel and overlie the territory delineated by the anastomising inferior and superior epigastric veins. If these vascular pathways serve as collateral drainage routes, they empty into the internal thoracic veins of the superior vena caval system, sharing terrain with the KI channel. The blue-green arrows trace the lower abdominal trajectory of the LR line as it parallels the course of the superficial circumflex iliac veins which also anastomose in the subcutaneous tissues of the antero-lateral body wall with tributaries of the axillary vein. Finally, the thoracoepigastric veins in the vicinity of SP 21 become particularly prominent in cases of IVC obstruction. This helps explain why the early acupuncturists dubbed SP 21 as "The Great Connecting Point of All Connecting Point", viewing it as the major crossroad where several significant venous channels intersect.

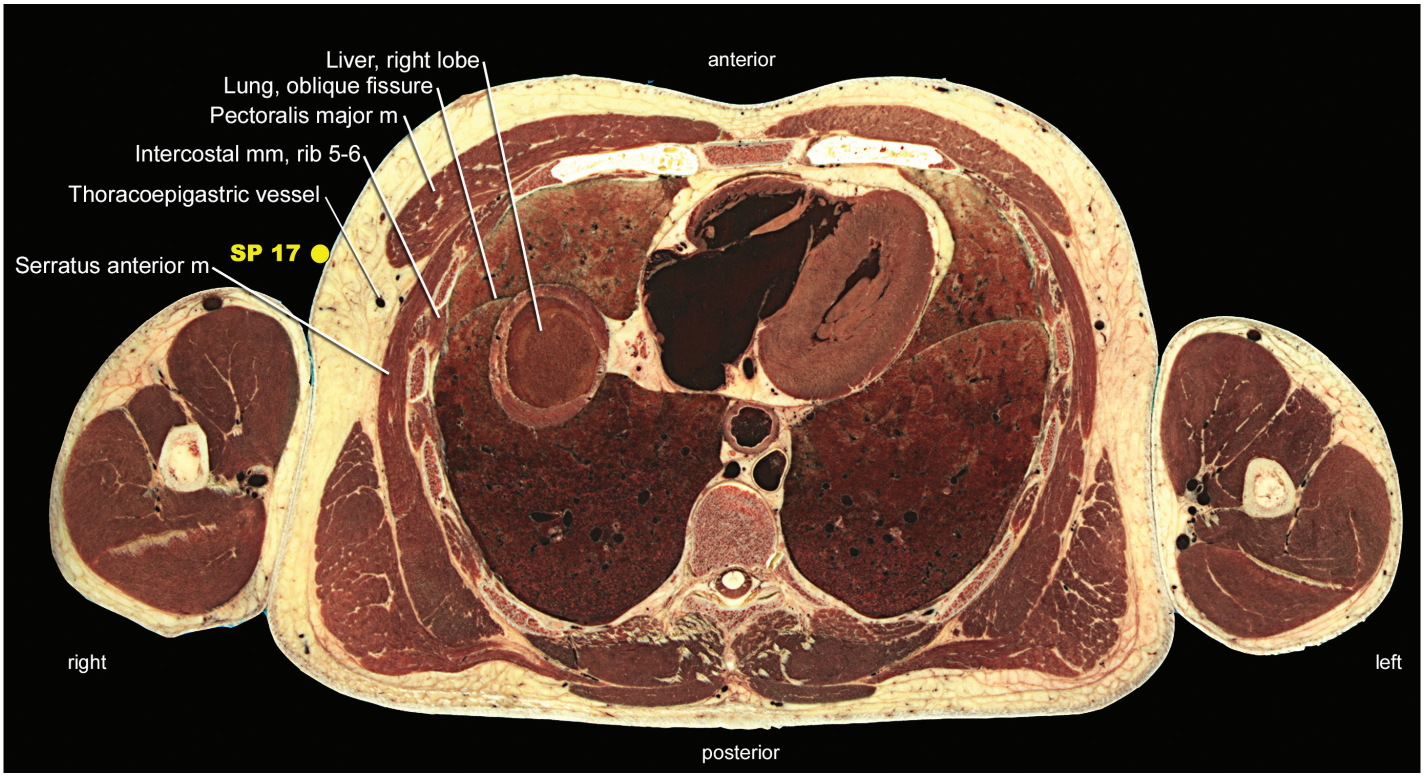


Figure 4-43. The descriptive name for SP 17, "Food Hole", may refer to the nearby nipple, associating the point with the feeding functions of the breast. The nipple in this image appears on the skin surface between the labels for the lung and liver.

a condition of pain with or without pruritus and paresthesia in the section between the spine and medial border of the scapula. Abnormal scapulothoracic stabilization may cause traction or compression of the cutaneous medial branches belonging to the dorsal primary rami of the thoracic spinal nerves.[2] Acupuncture, electroacupuncture, massage, laser therapy, or transcutaneous electrical nerve stimulation (TENS) may alleviate the discomfort rapidly and significantly. Causes of long thoracic nerve injury include sports injuries, heavy load bearing, traction injury, viral infection, vaccinations, and surgical procedures. More severe dysfunction causes scapulothoracic winging.[3]

Vessels

- **5th intercostal artery and vein:** Supplies and drains, respectively, the intercostal muscles, overlying skin, and parietal pleura.
- **Lateral thoracic artery:** Arises from the axillary artery. It descends along the axillary border of the pectoralis minor toward the thoracic wall.
- **Thoracoepigastric vein:** This vein arises from the region of the superficial epigastric vein and drains into the axillary vein or lateral thoracic vein. Provides a subcutaneous collateral pathway for the superficial circumflex iliac veins and the superficial epigastric veins to return abdominopelvic venous blood to the heart, as they anastomose with the lateral thoracic vein, a tributary of the axillary vein. Because these veins are valveless, blood can flow back into the axillary vein and bypass the inferior vena cava. The communication pathway between the lower veins and the lateral thoracic vein constitutes the thoracoepigastric vein.

Clinical Relevance: Mondor's disease, or phlebitis of the thoracoepigastric vein, was first described in 1939. This vascular rarity may be mistaken as a serious disease of the breast or body wall.[4] The painful and tender cordlike structures that follow from SP 17 to SP 20 are actually dilated segments of the thoracoepigastric vein. Although most cases are self-limiting, acupuncture, laser therapy, massage, or other forms of neuromodulation and physical medicine may facilitate recovery from this inflammatory and confusing condition. Although the condition is ordinarily benign, it may accompany or follow other conditions such as silicoadenitis of axillary nodes, breast cancer, and aesthetic mammaplasty.[5]

Indications and Potential Point Combinations

- **Back pain in the T5-T7 paraspinal region:** SP 17, GB 22, GB 23, BL 15.
- **Intercostal neuralgia in the 5th intercostal space region:** SP 17, BL 15, BL 14, GB 22, GB 23.
- **Hiccough:** SP 17, CV 22, CV 14.

References

1. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *Journal of Hand Therapy.* 2005;18(2):216-229.
2. Wang CK, Gowda A, Barad M, et al. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2009;4:17. doi:10.1186/1749-7221-4-17.
3. Sahin F, Yilmaz F, Esit N, et al. Compressive neuropathy of long thoracic nerve and accessory nerve secondary to heavy load bearing. A case report. *Europa Medicophysica.* 2007;43(1):71-74.
4. Thomford NR and Holaday WJ. Mondor's Disease (Phlebitis of the thoracoepigastric vein). *Ann Surg.* 1969;170(6):1035-1037.
5. Khan UD. Mondor disease: A case report and review of the literature. *Aesthet Surg J.* 2009;29(3):209-212.

SP 18

Tian Xi "Celestial Stream"

On the lateral side of the pectoral region, in the 4th intercostal space, 6 cun lateral to the anterior midline, level with CV 17.

Point placement appears in Figure 4-41.

Muscles

- **Serratus anterior muscle:** Holds the scapula against the thoracic wall. Protracts and rotates the scapula.

Clinical Relevance: Trigger points in the serratus anterior muscle in the vicinity of SP 18 produce pain in the muscle itself on the lateral mid-thorax. It may also radiate along the PC and HT channels to the palmar aspect of the 4th and 5th fingers.

Nerves

- **4th intercostal nerve:** Supplies the skin and muscles in this region.
- **Long thoracic nerve (C5-C7):** Supplies the serratus anterior muscle. A pure motor nerve that only innervates the serratus anterior. The nerve descends on the lateral aspect of the thoracic cage, branching to supply each digitation of the serratus anterior muscle. This anchors it at regular and short intervals along its course, thereby limiting its ability to lengthen or glide as a result of extreme excursions of the shoulder girdle.[1]

Clinical Relevance: Long thoracic nerve dysfunction can cause serratus anterior dysfunction and lead to notalgia paresthetica, a condition of pain with or without pruritus and paresthesia in the section between the spine and medial border of the scapula. Abnormal scapulothoracic stabilization may cause traction or compression of the cutaneous medial branches belonging to the dorsal primary rami of the thoracic spinal nerves.[2] Acupuncture, electroacupuncture, massage, laser therapy, or transcutaneous electrical nerve stimulation (TENS) may alleviate the discomfort rapidly and significantly. Causes of long thoracic nerve injury include sports injuries, heavy load bearing, traction injury, viral infection, vaccinations, and surgical procedures. More severe dysfunction causes scapulothoracic winging.[3]

Vessels

- **4th intercostal artery and vein:** Supplies and drains, respectively, the intercostal muscles, overlying skin, and parietal pleura.
- **Lateral thoracic artery:** Arises from the axillary artery. It descends along the axillary border of the pectoralis minor toward the thoracic wall.
- **Lateral thoracic vein:** A tributary of the axillary vein, the lateral thoracic vein communicates with the superficial epigastric and superficial circumflex iliac veins to provide collateral routes for abdominopelvic venous blood return.
- **Thoracoacromial artery:** A branch of the axillary artery, the thoracoacromial artery divides into four branches (acromial, deltoid, pectoral, and clavicular). The pectoral branch supplies this region.
- **Thoracoepigastric vein:** This vein arises from the region of the superficial epigastric vein and drains into the axillary vein or lateral thoracic vein. Provides a subcutaneous collateral

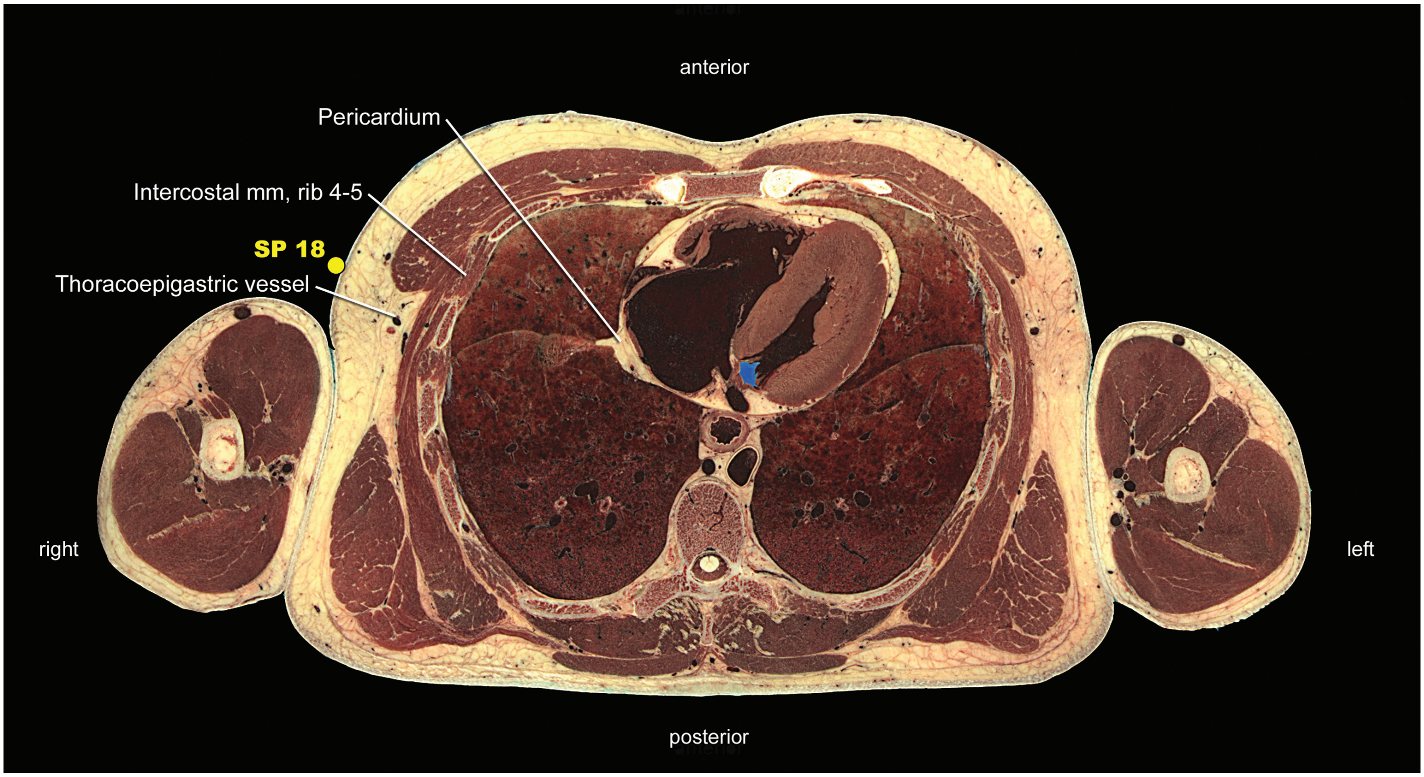


Figure 4-44. The "Celestial Stream", or "Celestial Ravine" affiliated with SP 18 refers to the thoracoepigastric vein lateral to the breast. The stream conveys blood through the channel (stream) over the chest (considered a "celestial" portion of the trunk as compared to the lower, more "earthy" regions below).

pathway for the superficial circumflex iliac veins and the superficial epigastric veins to return abdominopelvic venous blood to the heart, as they anastomose with the lateral thoracic vein, a tributary of the axillary vein. Because these veins are valveless, blood can flow back into the axillary vein and bypass the inferior vena cava. The communication pathway between the lower veins and the lateral thoracic vein constitutes the thoracoepigastric vein.

Clinical Relevance: Mondor's disease, or phlebitis of the thoracoepigastric vein, was first described in 1939. This vascular rarity may be mistaken as a serious disease of the breast or body wall.[4] The painful and tender cordlike structures that follow from SP 17 to SP 20 are actually dilated segments of the thoracoepigastric vein. Although most cases are self-limiting, acupuncture, laser therapy, massage, or other forms of neuromodulation and physical medicine may facilitate recovery from this inflammatory and confusing condition. Although the condition is ordinarily benign, it may accompany or follow other conditions such as silicoadenitis of axillary nodes, breast cancer, and aesthetic mammaplasty.[5]

Indications and Potential Point Combinations

- **Dyspnea, wheezing, fullness and pain in the chest:** SP 18, CV 17, LU 7, BL 13.
- **Mastitis, hypogalactia:** SP 18, ST 18, SI 1.
- **Local pain:** SP 18, trigger points in the pectoralis, intercostal, and serratus anterior muscles.

References

1. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *Journal of Hand Therapy*. 2005;18(2):216-229.

2. Wang CK, Gowda A, Barad M, et al. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17. doi:10.1186/1749-7221-4-17.

3. Sahin F, Yilmaz F, Esit N, et al. Compressive neuropathy of long thoracic nerve and accessory nerve secondary to heavy load bearing. A case report. *Europa Medicophysica*. 2007;43(1):71-74.

4. Thomford NR and Holaday WJ. Mondor's Disease (Phlebitis of the thoracoepigastric vein). *Ann Surg*. 1969;170(6):1035-1037.

5. Khan UD. Mondor disease: A case report and review of the literature. *Aesthet Surg J*. 2009;29(3):209-212.

SP 19

Xiong Xiang "Chest Village"

On the lateral side of the pectoral region, in the 3rd intercostal space, 6 cun lateral to the anterior midline, level with CV 18.

Point placement appears in Figure 4-41.

Muscles

- **Serratus anterior muscle:** Holds the scapula against the thoracic wall. Protracts and rotates the scapula.

Clinical Relevance: Trigger points in the serratus anterior muscle in the vicinity of SP 19 produce pain in the muscle itself on the lateral mid-thorax. It may also radiate along the PC and HT channels to the palmar aspect of the 4th and 5th fingers.

Nerves

- **3rd intercostal nerve:** Supplies the skin and muscles in this region.
- **Long thoracic nerve (C5-C7):** Supplies the serratus anterior muscle. A pure motor nerve that only innervates the serratus anterior. The nerve descends on the lateral aspect of the thoracic cage, branching to supply each digitation of the serratus anterior muscle. This anchors it at regular and short intervals along its course, thereby limiting its ability to lengthen or glide as a result of extreme excursions of the shoulder girdle.[1]

Clinical Relevance: Long thoracic nerve dysfunction can cause serratus anterior dysfunction and lead to notalgia paresthetica, a condition of pain with or without pruritus and paresthesia in the section between the spine and medial border of the scapula. Abnormal scapulothoracic stabilization may cause traction or compression of the cutaneous medial branches belonging to the dorsal primary rami of the thoracic spinal nerves.[2] Acupuncture, electroacupuncture, massage, laser therapy, or transcutaneous electrical nerve stimulation (TENS) may alleviate the discomfort rapidly and significantly. Causes of long thoracic nerve injury include sports injuries, heavy load bearing, traction injury, viral infection, vaccinations, and surgical procedures. More severe dysfunction causes scapulothoracic winging.[3]

Vessels

- **3rd intercostal artery and vein:** Supplies and drains, respectively, the intercostal muscles, overlying skin, and parietal pleura.
- **Lateral thoracic artery:** Arises from the axillary artery. It descends along the axillary border of the pectoralis minor toward the thoracic wall.
- **Lateral thoracic vein:** A tributary of the axillary vein, the lateral thoracic vein communicates with the superficial epigastric and

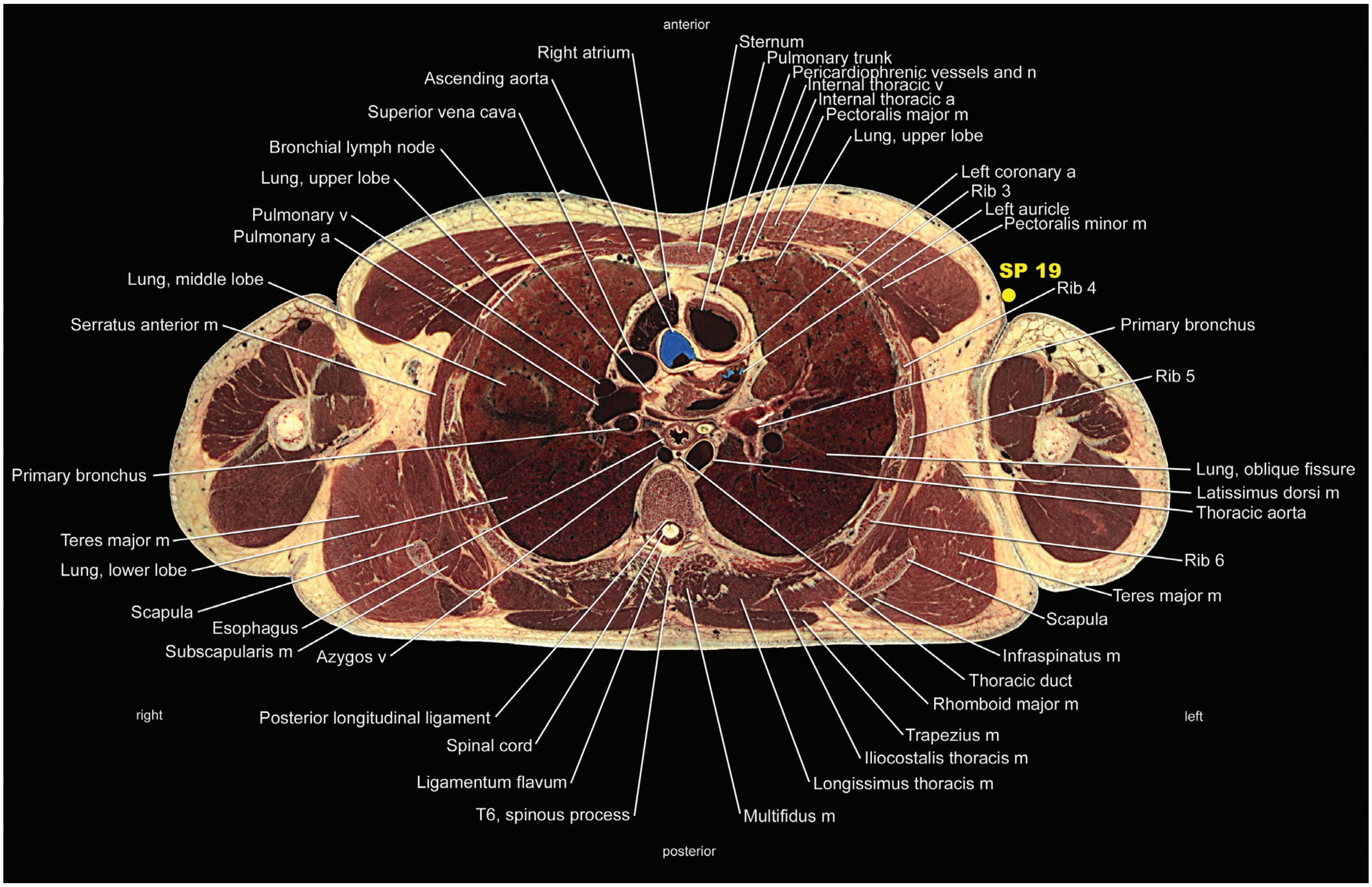

anterior
Right atrium
Ascending aorta
Superior vena cava
Bronchial lymph node
Lung, upper lobe
Pulmonary v
Pulmonary a
Lung, middle lobe
Serratus anterior m
Primary bronchus
Teres major m
Lung, lower lobe
Scapula
Esophagus
Subscapularis m
Azygos v
right
Posterior longitudinal ligament
Spinal cord
Ligamentum flavum
T6, spinous process
posterior
Sternum
Pulmonary trunk
Pericardiophrenic vessels and n
Internal thoracic v
Internal thoracic a
Pectoralis major m
Lung, upper lobe
Left coronary a
Rib 3
Left auricle
Pectoralis minor m
SP 19
Rib 4
Primary bronchus
Rib 5
Lung, oblique fissure
Latissimus dorsi m
Thoracic aorta
Rib 6
Teres major m
Scapula
Infraspinatus m
Thoracic duct
Rhomboid major m
Trapezius m
Iliocostalis thoracis m
Longissimus thoracis m
Multifidus m
left

Figure 4-45. SP 19, "Chest Village", sits nestled in the lateral region of the chest, tucked beside the pectoralis major muscle. As with the SP 17 and SP 18, the muscle accessible to a needle entering perpendicular to the body wall is the serratus anterior, although the pectoralis border resides close by. Seeing all the structures associated with this cross section affords the impression of a vital community within the chest, nothing the presence of heart, lungs, major vessels, and large muscle groups.

superficial circumflex iliac veins to provide collateral routes for abdominopelvic venous blood return.

- **Thoracoacromial artery:** A branch of the axillary artery, the thoracoacromial artery divides into four branches (acromial, deltoid, pectoral, and clavicular). The pectoral branch supplies this region.
- **Thoracoepigastric vein:** This vein arises from the region of the superficial epigastric vein and drains into the axillary vein or lateral thoracic vein. Provides a subcutaneous collateral pathway for the superficial circumflex iliac veins and the superficial epigastric veins to return abdominopelvic venous blood to the heart, as they anastomose with the lateral thoracic vein, a tributary of the axillary vein. Because these veins are valveless, blood can flow back into the axillary vein and bypass the inferior vena cava. The communication pathway between the lower veins and the lateral thoracic vein constitutes the thoracoepigastric vein.

Clinical Relevance: Mondor's disease, or phlebitis of the thoracoepigastric vein, was first described in 1939. This vascular rarity may be mistaken as a serious disease of the breast or body wall.[4] The painful and tender cordlike structures that follow from SP 17 to SP 20 are actually dilated segments of the thoracoepigastric vein. Although most cases are self-limiting, acupuncture, laser therapy, massage, or other forms of neuromodulation and physical medicine may facilitate recovery from this inflammatory and confusing condition. Although the condition is ordinarily benign, it may accompany or follow other conditions such as silicoadenitis of axillary nodes, breast cancer, and aesthetic mammaplasty.[5]

Indications and Potential Point Combinations

- **Fullness and pain in chest and lateral thorax:** SP 19, local trigger points, GB 22, GB 23, CV 17.
- **Rib pain, intercostal neuralgia:** SP 19, local trigger points.
- **Esophageal spasm or pain:** SP 19, CV 22, CV 14, PC 6.

References

1. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *Journal of Hand Therapy*. 2005;18(2):216-229.
2. Wang CK, Gowda A, Barad M, et al. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17. doi:10.1186/1749-7221-4-17.
3. Sahin F, Yilmaz F, Esit N, et al. Compressive neuropathy of long thoracic nerve and accessory nerve secondary to heavy load bearing. A case report. *Europa Medicophysica.* 2007;43(1):71-74.
4. Thomford NR and Holaday WJ. Mondor's Disease (Phlebitis of the thoracoepigastric vein). *Ann Surg.* 1969;170(6):1035-1037.
5. Khan UD. Mondor disease: A case report and review of the literature. *Aesthet Surg J.* 2009;29(3):209-212.

SP 20

Zhou Rong "Encircling Glory" or "All-Round Flourishing"

On the lateral side of the pectoral region, in the 2nd intercostal space, 6 cun lateral to the anterior midline, approximately one intercostal space below LU 1.

Point placement appears in relation to SP 17, SP 18, and SP 19 in Figure 4-41.

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Pectoralis minor muscle:** Stabilizes the scapula by holding it anteriorly against the thoracic wall and by drawing it inferiorly.
- **Coracobrachialis muscle:** Moves the humerus forward and in a medial direction, resulting in shoulder flexion and adduction.

Clinical Relevance: Trigger points in the pectoralis major muscle may refer to the shoulder, arm, or breast, depending on their location. In the clavicular section, referred pain extends to the shoulder and anterior deltoid region. Figure 4-46 depicts the intimate relationship between these two muscle groups. Trigger points on the lateral margin of the pectoralis major refer strongly to the breast and may travel to the axilla, causing the patient concern about breast pathology. The cross section of Figure 4-46 illustrates the anatomy relevant to SP 20 in a man; overlying subcutaneous and mammary tissue will likely increase the distance between SP 20 and the pectoralis major muscle. Trigger points in the pectoralis minor muscle overlap with that of its major counterpart. In addition, referred pain follows the PC line to the palmar middle and ring fingers.

Coracobrachialis trigger points at and around SP 20 refer strongly to the middle deltoid region and extend along the dorsal brachium, antebrachium, and hand, tipping off at the middle finger. The referred pain pattern closely resembles the TH line from TH 14 to TH 3.

Nerves

- **2nd intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve: (C7, C8, T1):** Supplies both the pectoralis minor and major muscles.

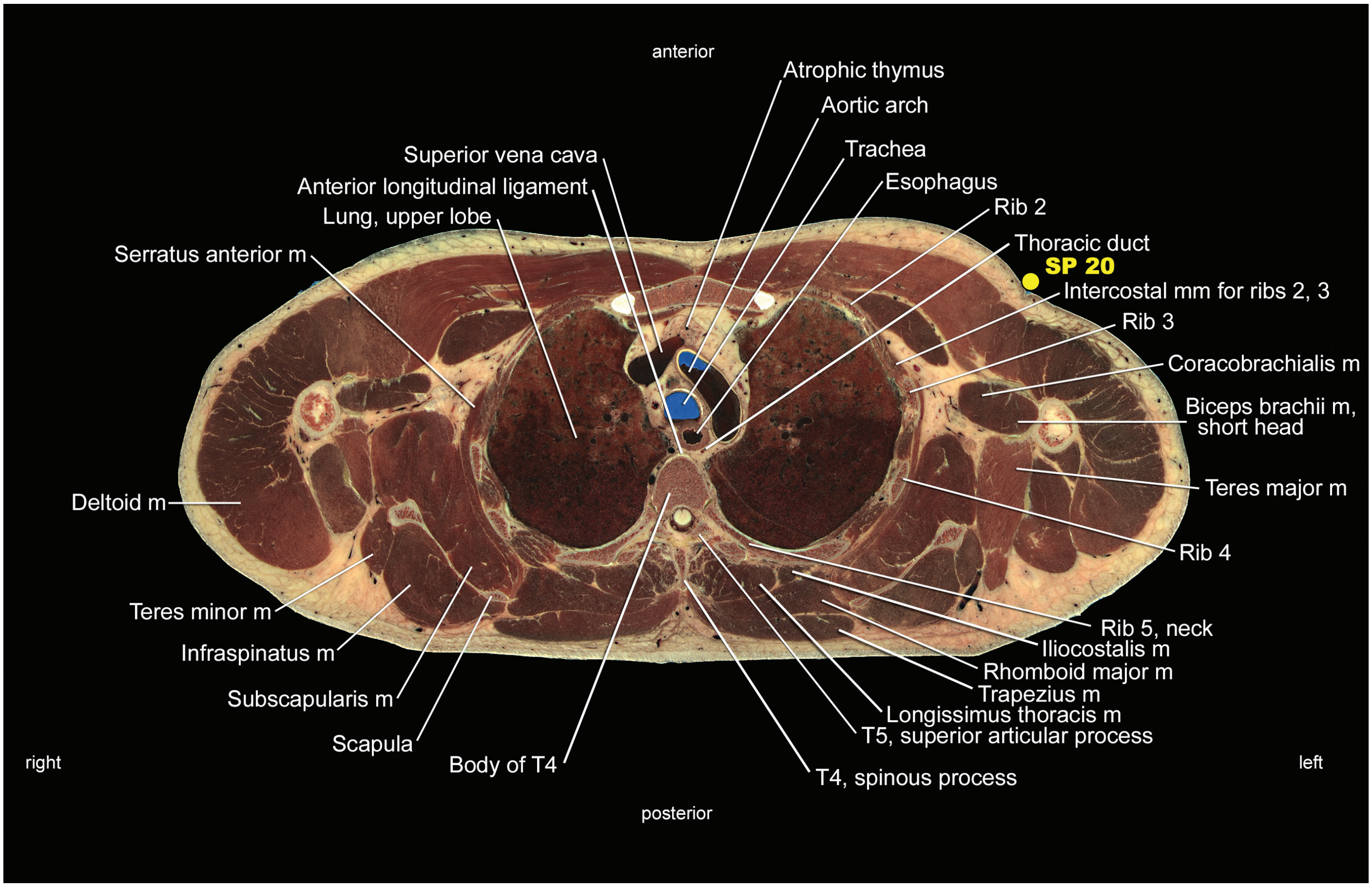

anterior
Atrophic thymus
Aortic arch
Trachea
Esophagus
Superior vena cava
Anterior longitudinal ligament
Lung, upper lobe
Rib 2
Thoracic duct
SP 20
Serratus anterior m
Intercostal mm for ribs 2, 3
Rib 3
Coracobrachialis m
Biceps brachii m, short head
Deltoid m
Teres major m
Rib 4
Teres minor m
Rib 5, neck
Iliocostalis m
Infraspinatus m
Rhomboid major m
Trapezius m
Subscapularis m
Longissimus thoracis m
T5, superior articular process
Scapula
Body of T4
right
left
T4, spinous process
posterior

Figure 4-46. SP 20, called "Encircling Glory" or "All-Round Flourishing" fits the multifaceted anatomy contained within this cross section. It also reveals the proximity of SP 20 to the pectoralis major, the anterior deltoid which it abuts, and the pectoralis minor muscle. The latter appears here as the darker, crescent-shaped structure deep to the massive pectoralis major that spans the entire chest.
The blood coursing through the major vessels at this level nourish the entire body to allow it flourish, suggesting an explanation for the name of "All-Round Flourishing". On another level, "Encircling Glory" as well as "All-Round Flourishing" applies to the influence of the nerves and vessels along this section of the SP channel for breast health, with the term "glory" connoting the apex of the SP channel at SP 20 before it changes course and descending toward SP 21.

- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle.
- **Musculocutaneous nerve (C5-C7)**: Supplies the coracobrachialis muscle.

Clinical Relevance: Nerve damage after surgery, irradiation, or other procedures near the breast and SP 20 may damage local nerves and their supporting structures. This has the potential to induce chronic breast pain.[1] Intercostal neuromas following breast surgery may affect one or more intercostal nerves along the lateral chest wall. Acupuncture, massage, and related techniques may aid in reducing nerve-based pain and myofascial restriction contributing to the problem.

Vessels

- **2nd intercostal artery and vein:** Supplies and drains, respectively, the intercostal muscles, overlying skin, and parietal pleura.
- **Lateral thoracic artery:** Arises from the axillary artery. It descends along the axillary border of the pectoralis minor toward the thoracic wall.
- **Lateral thoracic vein:** A tributary of the axillary vein, the lateral thoracic vein communicates with the superficial epigastric and superficial circumflex iliac veins to provide collateral routes for abdominopelvic venous blood return.
- **Thoracoacromial artery:** A branch of the axillary artery, the thoracoacromial artery divides into four branches (acromial, deltoid, pectoral, and clavicular). The pectoral branch supplies this region.
- **Thoracoepigastric vein:** This vein arises from the region of the superficial epigastric vein and drains into the axillary vein or lateral thoracic vein. Provides a subcutaneous collateral pathway for the superficial circumflex iliac veins and the superficial epigastric veins to return abdominopelvic venous blood to the heart, as they anastomose with the lateral thoracic vein, a tributary of the axillary vein. Because these veins are valveless, blood can flow back into the axillary vein and bypass the inferior vena cava. The communication pathway between the lower veins and the lateral thoracic vein constitutes the thoracoepigastric vein.

Clinical Relevance: Mondor's disease, or phlebitis of the thoracoepigastric vein, was first described in 1939. This vascular rarity may be mistaken as a serious disease of the breast or body wall.[2] The painful and tender cordlike structures that follow from SP 17 to SP 20 are actually dilated segments of the thoracoepigastric vein. Although most cases are self-limiting, acupuncture, laser therapy, massage, or other forms of neuromodulation and physical medicine may facilitate recovery from this inflammatory and confusing condition. Although the condition is ordinarily benign, it may accompany or follow other conditions such as silicoadenitis of axillary nodes, breast cancer, and aesthetic mammaplasty.

Indications and Potential Point Combinations

- **Fullness and pain in chest and lateral thorax:** SP 20, GB 22, GB 23, SP 21.
- **Rib pain, intercostal neuralgia:** SP 20, local trigger points, BL 12, BL 13.
- **Esophageal spasm or pain:** SP 20, PC 6, CV 22, CV 14
- **Hiccoughs:** SP 20, BL 17, CV 12.
- **Cough and chest congestion:** SP 20, LU 7, LI 4, LI 11, BL 12, BL 13, CV 22.

References

1. Ducic I, Seiboth LA, and Iorio ML. Chronic postoperative breast pain: danger zones for nerve injuries. *Plast Reconstr Surg.* 2011;127(1):41-46.
2. Thomford NR and Holaday WJ. Mondor's Disease (Phlebitis of the thoracoepigastric vein). *Ann Surg.* 1969;170(6):1035-1037.
3. Khan UD. Mondor disease: A case report and review of the literature. *Aesthet Surg J.* 2009;29(3):209-212.

SP 21

Da Bao "Great Wrapping"

On the lateral chest wall, on the midaxillary line, 6 cun below the end of the anterior axillary crease, approximately midway between the axilla and the end of the 11th rib. Palpate this area to identify the most tender location. This may fall at either the 6th or 7th intercostal space. Depending on point location based on tenderness to palpation, SP 21 may be found atop the external oblique muscle as in Figure 4-48 or closer to the serratus anterior or latissimus dorsi.

Muscles

- **Abdominal external oblique muscle:** Pulls the chest downward and raises intraabdominal pressure by compressing the abdominal cavity. Assists in flexing and rotating the spine. Can laterally flex the spine.

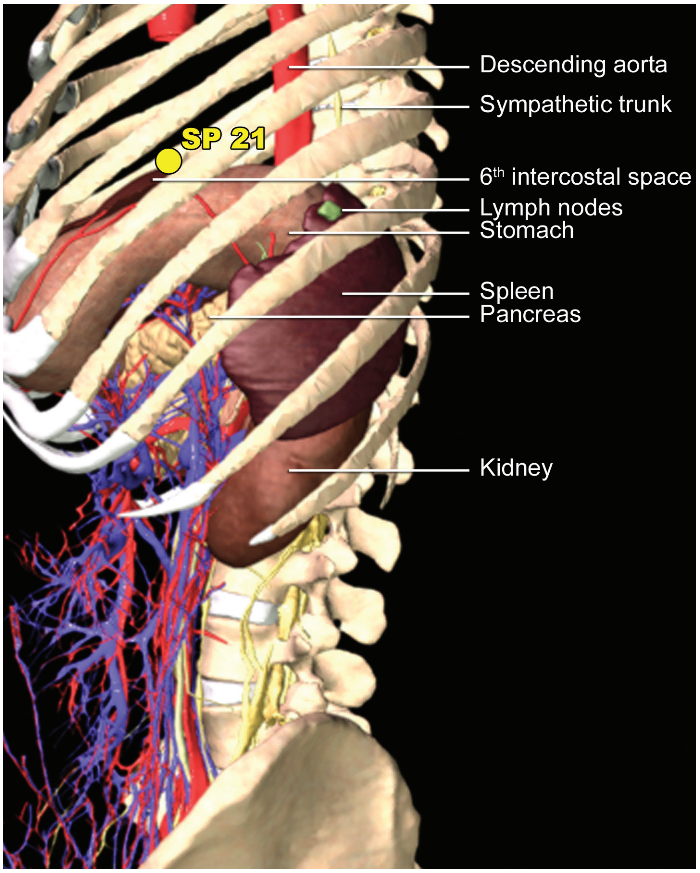


Figure 4-47. This depiction reveals the association of SP 21 to the spleen, pancreas, stomach, and kidney. In cases of portal vein hypertension, the vascular system develops a porto-caval collateral system of venous return.[2] Common causes of portal hypertension include posthepatic and alcoholic cirrhosis. Connecting the portal system with systemic circulation as a result of the vasculature responding to high portal pressure changes the conditions within existing vessel junctions as well as creates new vessels by means of angiogenesis. This collateral route for venous blood to return to the heart reduces portal pressure but also loads cardiac muscle and allows intestinal toxins to enter the general circulation. Splenorenal shunts may develop, perceived as a palpable, hard, non-pulsatile mass in the upper left quadrant of the abdomen, with or without splenomegaly. This left lateral view of SP 21 illustrates where such a connection between the splenic and renal veins may occur.

Clinical Relevance: External oblique trigger points may serve as a source of lateral truncal discomfort and, occasionally, digestive disturbances. Note how SP 21 sits between the serratus anterior and latissimus dorsi muscles as depicted in the cross section, Figure 4-48. Acupuncture needling, acupressure, or laser therapy may address myofascial dysfunction at the borders of these muscles as well as the body of the external oblique. This area is often tender to pressure.

Note: SP 17 to SP 20 also relate to the external intercostal muscles. However, they are not listed as needling targets due to concerns of inadvertent puncture of the lung with chest wall penetration.

Nerves

- **6th intercostal nerve:** Supplies the skin and intercostal muscles in this region.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves and L1):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerve entrapment in this region from trauma, sports injuries, or surgical procedures may cause abdominal wall pain or a perception of internal organ dysfunction due to crosstalk between the somatic and visceral nerves within overlapping levels of the spinal cord.

Vessels

- **Sixth intercostal artery and vein:** Supplies and drains, respectively, the intercostal muscles, overlying skin, and parietal pleura.
- **Thoracoepigastric vein:** This vein arises from the region of the superficial epigastric vein and drains into the axillary vein or lateral thoracic vein. Provides a subcutaneous collateral pathway for the superficial circumflex iliac veins and the superficial epigastric veins to return abdominopelvic venous blood to the heart, as they anastomose with the lateral thoracic vein, which is a tributary of the axillary vein. Because these veins are valveless, blood can flow back into the axillary vein and bypass the inferior vena cava. The communication pathway between the lower veins and the lateral thoracic vein constitutes the thoracoepigastric vein.

Clinical Relevance: As illustrated in Figure 4-48, the thoracoepigastric vessels relate to the SP line here at its endpoint as well as elsewhere along the channel's course. Surgical approaches to the thorax or breast may interfere with circulation pathways. Acupuncture and related techniques may improve circulation, alleviate pain, and aid in restoring tissue health.

Indications and Potential Point Combinations

- **Respiratory problems: cough, asthma, dyspnea:** SP 21, LU 7, LU 5, LU 1, BL 13, GB 21.

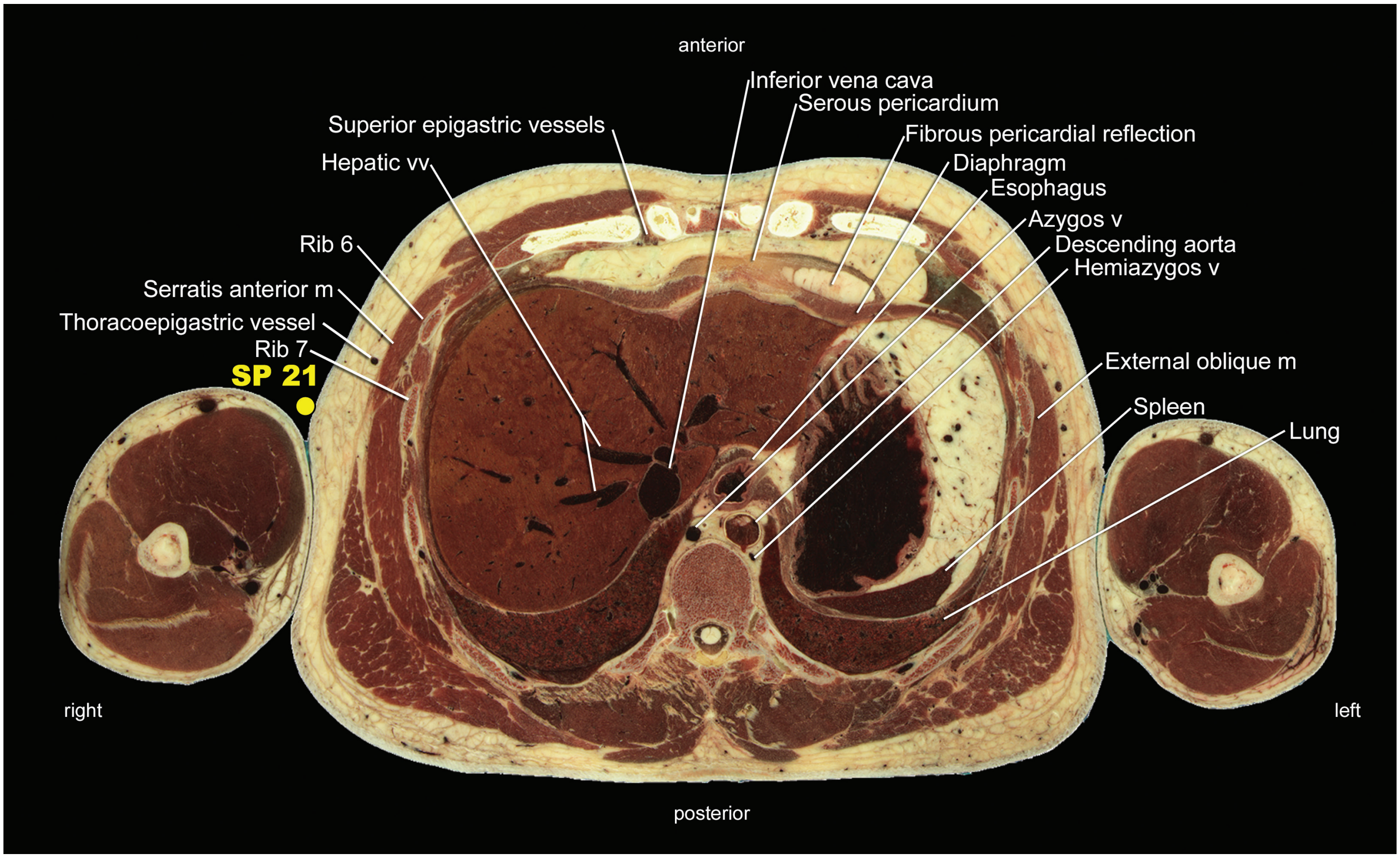

anterior
Inferior vena cava
Serous pericardium
Superior epigastric vessels
Fibrous pericardial reflection
Hepatic vv
Diaphragm
Esophagus
Azygos v
Rib 6
Descending aorta
Hemiazygos v
Serratis anterior m
Thoracoepigastric vessel
Rib 7
SP 21
External oblique m
Spleen
Lung
right
left
posterior

Figure 4-48. This final point on the SP line, SP 21, touches the same cross sectional level occupied by the spleen organ. Its name, "Great Embracement", may refer to the external oblique muscle wrapping around the abdomen at this level. Chinese medicine metaphors named SP 21 "the connecting point of all connecting points", the "regulator of all the network channels", and the "irrigator of the five viscera t hat presides over yin and yang". These references implicate the function of local collateral vessels' balancing capacity via the oscillatory venous web that embraces the anterolateral abdominal wall.

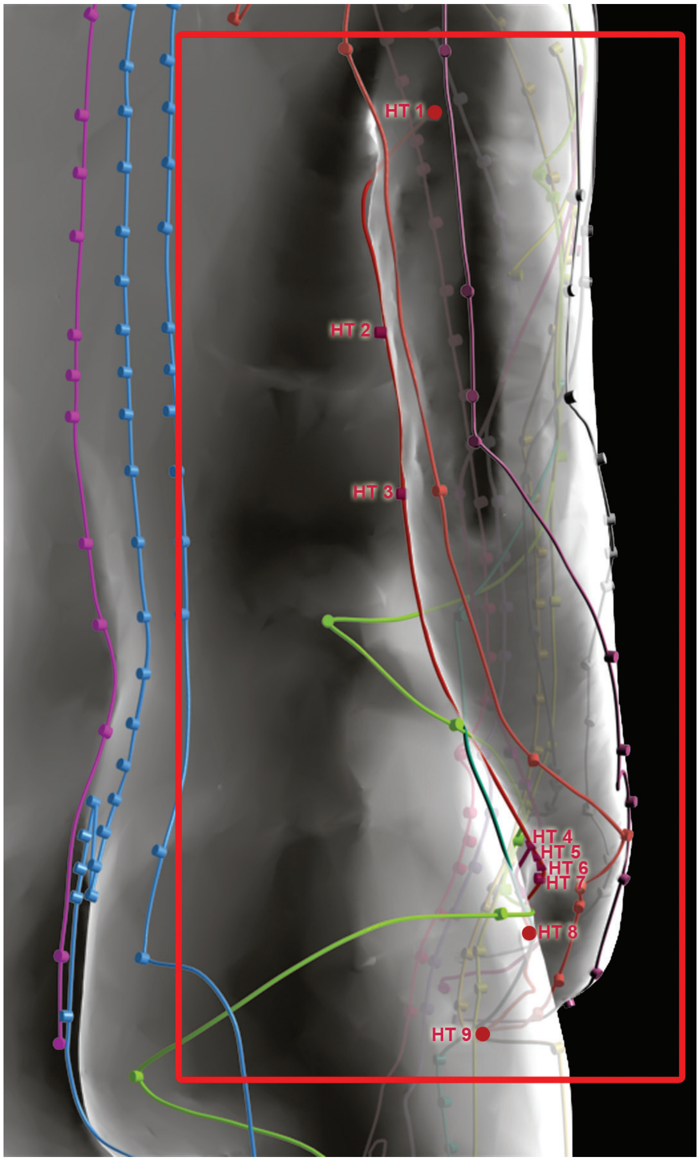
- **Thoracic or chest wall pain, especially lateral costal region:** SP 21, GB 22, GB 23, CV 17, CV 20, BL 15.
- **Mondor's disease (obliterative phlebitis typically affecting the lateral thoracic, thoracoepigastric, or superior epigastric veins and their tributaries):**[1] SP 21, LU 2, SP 16, SP 9, SP 6, CV 12.
- **Superficial thrombophlebitis of the lateral thorax, (non-infectious only):** SP 21.

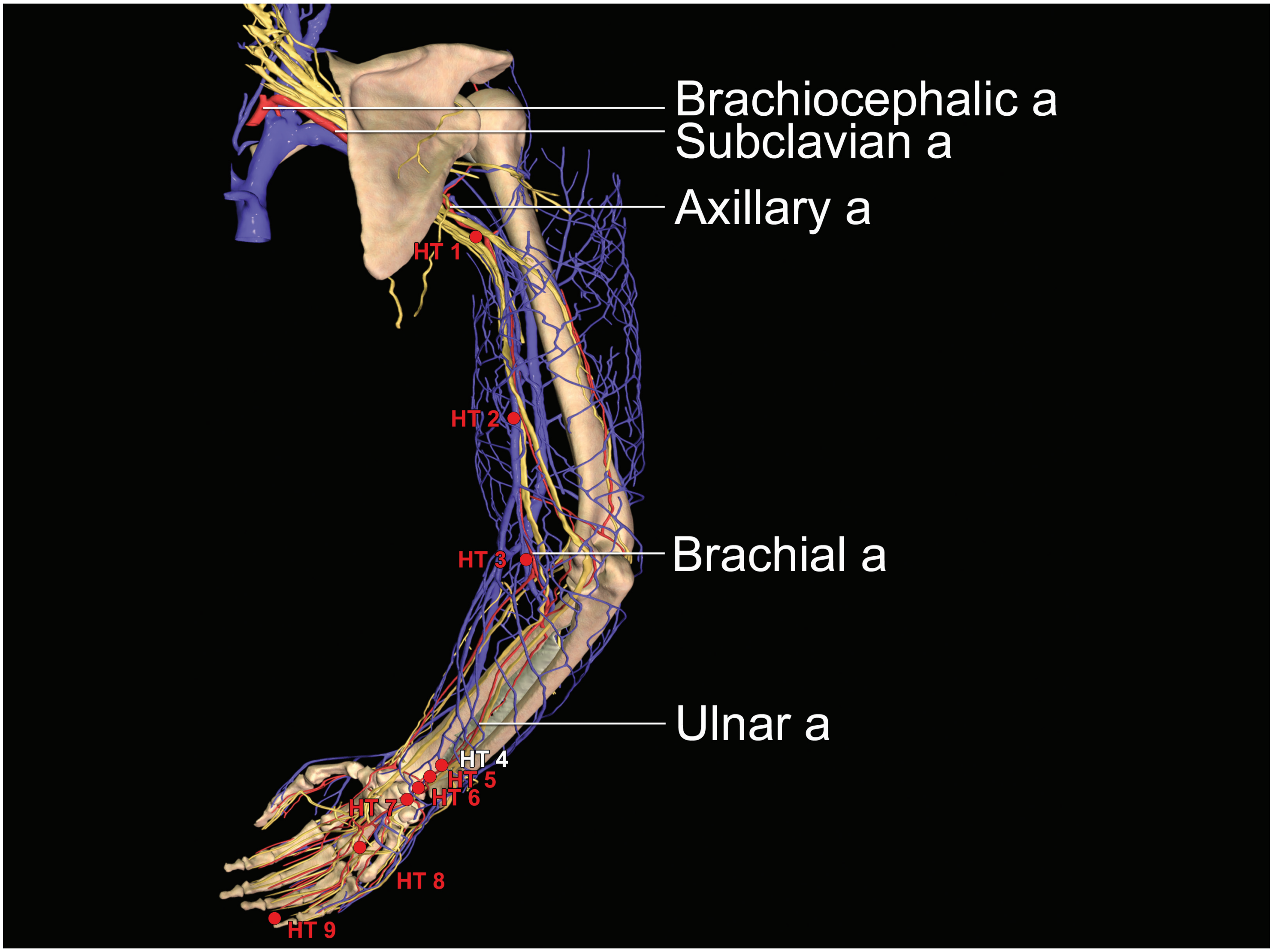
References

1. Losanoff JE, Basson MD, Salwen WA, et al. Mondor's disease mimicking a Spigelian hernia. *Hernia.* 2008;12:425-427.
2. Dolowy J, Stoinska A, Kusmierska M, et al. A case of spontaneous splenorenal shunt associated with nutcracker syndrome. *Pol J Radiol.* 2011;76(4):49-51.

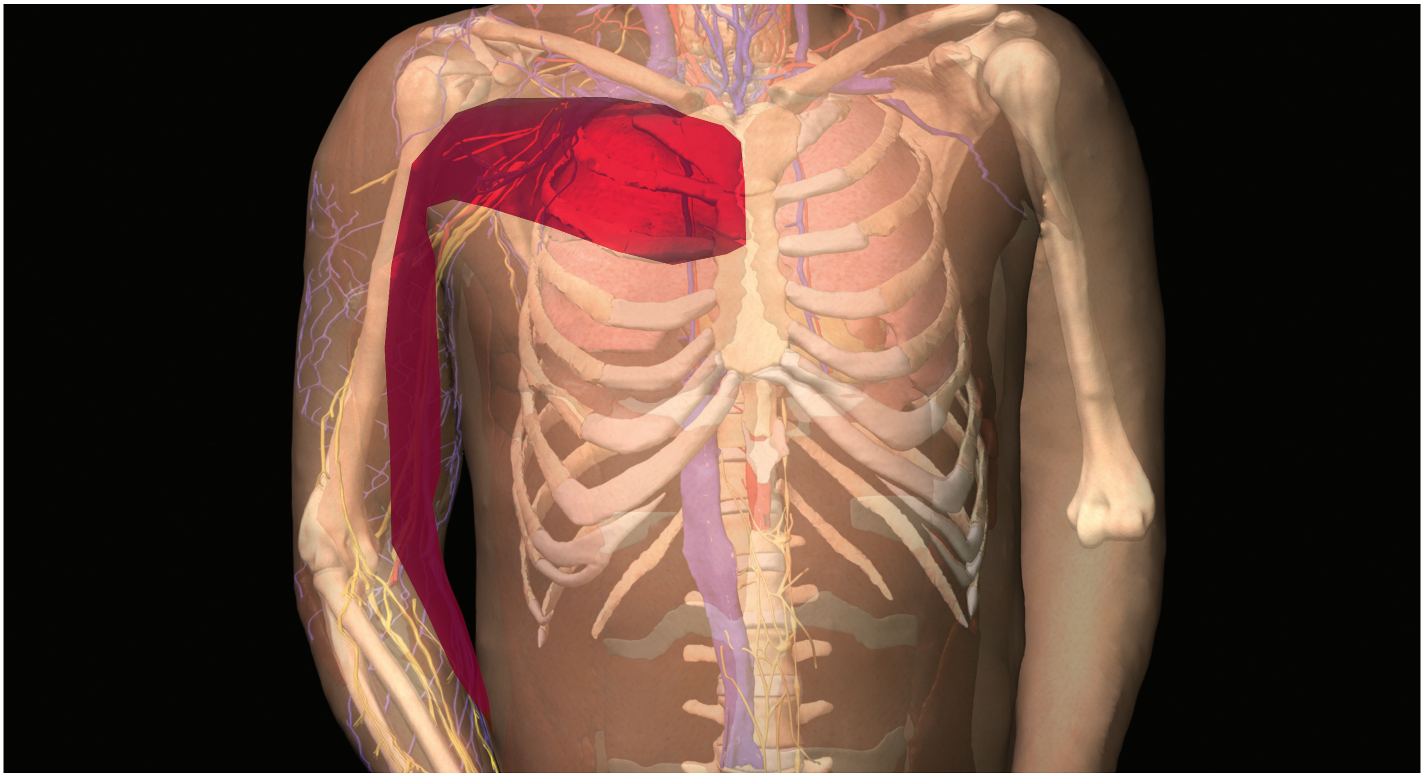
Channel 5:: The Heart (HT)

The Heart channel begins in the center of the axilla at HT 1. The channel descends along the medial brachium to the medial end of the cubital crease, at the elbow. From here, the Heart channel crosses the ventral aspect of the antebrachium to the ulnar side of the wrist over the ulnar artery. Crossing the palm between the 4th and 5th metacarpals, the Heart channel ends on the radial aspect of the dorsal tip of the little finger at HT 9.




Brachiocephalic a
Subclavian a
Axillary a
HT 1
HT 2
Brachial a
HT 3
Ulnar a
HT 4
HT 5
HT 6
HT 7
HT 8
HT 9

This image illustrates how the HT channel parallels the axillary, brachial, and ulnar arteries.



The red highlighted region depicts the course of the T1-T2 dermatome. Spinal cord stimulation of the T1-2 segments of the cord normalizes the function in the the heart's intrinsic nervous system. Benefits include analgesia, reduced medication requirements, and fewer, less severe anginal episodes. Pain radiating down the arm secondary to myocardial ischemia emulates the Heart channel trajectory; this occurs due to the sharing of information between visceral and somatic afferent fibers within overlapping spinal cord segments. This causes the confusion about the origin of pain due to the higher density of sensory nerves in the skin than the heart.[1] Acupuncture, as well, benefits patients with angina. Specifically, neuromodulation with acupuncture provides a significant reduction in the number of angina attacks during treatment, significantly increased maximal workload capacity until onset of chest pain, and reduction in ST segment depression at maximal workload. Quality of life likewise significantly improved, as did parameters assessing physical performance, peripheral chilliness, pessimism, vertigo, and relaxation.[2]

References

1. Wilson-Pauwels L, Stewart PA, and Akesson EJ. Autonomic Nerves. Hamilton, London: B.C. Decker, Inc., 1997. Pp. 42-43.
2. Richter A, Herlitz J, Hjalmarson A. Effect of acupuncture in patients with angina pectoris. Eur Heart J. 1991;12:175-178. Cited in Bueno EA, Mamtani R, and Frishman WH. Alternative approaches to the medical management of angina pectoris: acupuncture, electrical nerve stimulation, and spinal cord stimulation. Heart Disease. 2001;3:236-241.

HT 1

Ji Quan "Summit Spring" or "Highest Spring"

In the center of the axilla, medial or posterior to the pulsation of the axillary artery. Locate the point with the arm abducted. The point lies between the subscapularis muscle and the pectoralis minor, at the highest point of the axilla. (See Figure 5-4 to explore these relationships further.)

Caution: Avoid puncturing the axillary artery or vein. Avoid entering the thoracic cavity.

Muscles

- **Latissimus dorsi tendon:** Rotates the humerus medially. Extends and adducts the humerus. Raises the body toward the arm as when an individual climbs using the arms.
- **Teres major muscle:** Adducts the arm and rotates it medially.

Nerves

- **Brachial Plexus (C5-C8, T1):** A network of nerves, formed by the ventral rami of cervicothoracic spinal nerves, that supplies the neck, axilla, arm, and hand with motor, sensory, and autonomic nerve fibers. Exceptions include structures such as the trapezius muscle supplied by the accessory nerve and the floor of the axilla supplied by the intercostobrachia nerve (see below).
- **Medial brachial cutaneous nerve (C8, T1):** Supplies the skin on the medial brachium (arm).
- **Ulnar nerve (C8-T1):** Arises as a terminal branch of the medial cord of the brachial plexus, receiving fibers from C8, T1, and often C7.
- **Intercostobrachial nerve (T2):** The ventral ramus of the 2nd thoracic spinal nerve divides into branches, the 2nd intercostal nerve (which is the larger of the two) and a smaller branch, the intercostobrachial nerve. The intercostobrachial nerve is a lateral cutaneous branch of the 2nd intercostal nerve. It emerges from the 2nd intercostal space at the midaxillary line and penetrates the serratus anterior muscle to enter the brachial region (i.e., the axilla and arm). It innervates the floor of the axilla (i.e., the skin and its underlying subcutaneous tissue). The intercostobrachial nerve then communicates with the medial brachial cutaneous nerve to supply the dorsal and medial aspects of the brachium. It communicates with the posterior brachial cutaneous branch of the radial nerve.

Clinical Relevance: The biggest significance of HT 1 neurologically is its close proximity to the brachial plexus. As such, acupuncture, massage, and laser therapy to HT 1 often becomes the first step in the treatment of brachial plexopathy of non-neoplastic origin and acute brachial plexus neuritis. It also benefits patients with radiculopathy from cervical nerve root impingement due to spondylosis.[3]

Communications between the intercostal nerves (specifically, the second and third) and arms that supply the brachium are sources of referred cardiac pain.

Axillary node clearance for conditions such as breast cancer can damage the intercostobrachial nerve and thus impair sensation and/or cause neuropathic pain.[4] Acupuncture and related techniques aids the nerve in recovery and allot the patient to regain sensation. HT 1 would be implicated in an acupuncture needling protocol for this purpose.

Vessels

- **Circumflex scapular artery:** Arises from the subscapular artery and reaches the muscles on the dorsum of the scapula after curving around the axillary border of the scapula. The circumflex scapular artery takes part in the scapular anastomoses, along with several other vessels. The anastomoses occur on both the anterior and posterior surfaces. Participating vessels include the dorsal scapular, subscapular (via the circumflex scapular), and suprascapular arteries. These anastomoses create a potential collateral circulation pathway for the arm in the event of axillary

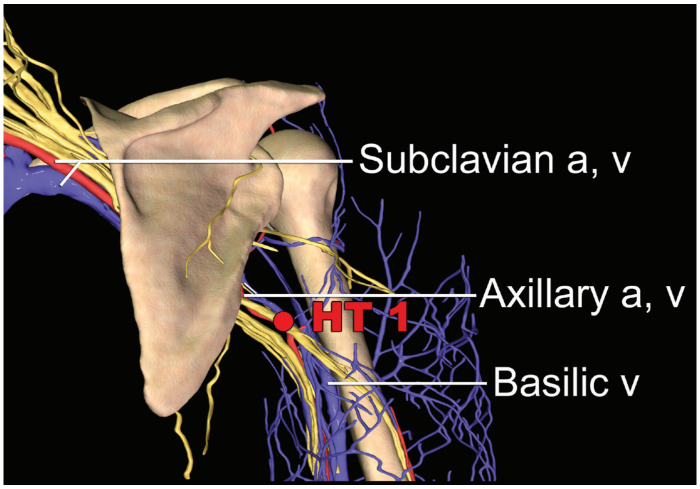


Figure 5-1. The name "Summit Spring" or "Highest Spring" for HT 1 connotes the axilla as the highest palpable location of the main artery (axillary artery) supplying the arm. Note that the axillary vein traveling through this region can become thrombosed and taught in cases of Mondor's Disease, causing them to bulge and grow taut, manifested as a "bowstring sign".

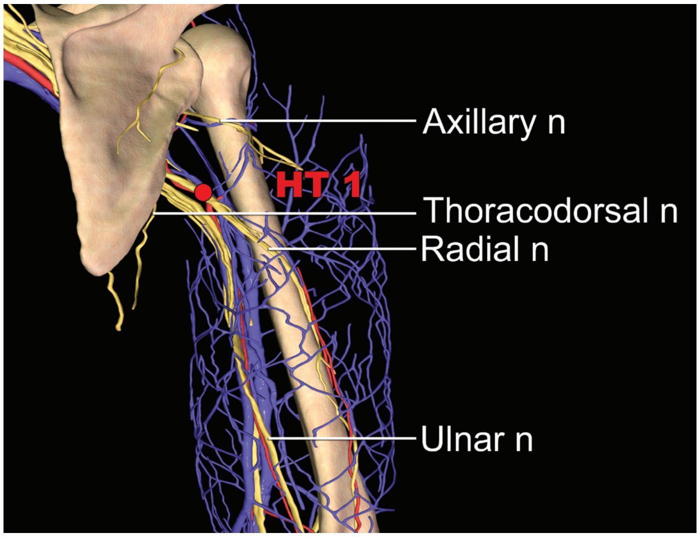


Figure 5-2. Neurologic indications for HT 1 brachial plexopathy; radial, ulnar, or median nerve injury; thoracic limb spasticity from stroke; and pain related to nerve compression or entrapment.

artery obstruction or ligation.

- **Axillary artery:** Provides blood flow to the arm. Arises from the subclavian artery. The third part of the axillary artery falls between the lateral border of the pectoralis minor muscle and the inferior border of the teres major muscle. Branches of the third portion of the axillary artery include the anterior and posterior circumflex humeral arteries and the subscapular artery.
- **Axillary vein:** The brachial veins that accompany the brachial artery unite with the basilic to form the axillary vein. The axillary vein ends lateral to the 1st rib and becomes the subclavian vein. The axillary vein connects, either directly or indirectly, with the inguinal region via the lateral thoracic vein and thoracoepigastric vein(s). The lateral thoracic vein is a tributary of the axillary vein and the thoracoepigastric veins arise from the anastomoses of superficial veins draining the groin. This connection between veins of the groin and the axillary vein creates a collateral channel through which venous blood returns to the heart in cases of inferior vena caval obstruction.
- **Basilic vein:** The basilic vein arises from the ulnar portion of the dorsal venous network of the hand and courses along the ulnar aspect of the forearm. It continues its ascent along the medial portion of the inferior arm (brachium), enters the axilla, and merges with the veins that accompany the brachial artery, thereby forming the axillary vein.

Clinical Relevance: Veins in the axillar outnumber arteries and commonly exhibit variations.[5] Arteritis in the head and arm could benefit from acupuncture and related techniques applied to highly vascularized regions such as HT 1, ST 9, and LU 9.[6]

Thrombophlebitis of the thoracoepigastric system of veins, also known as "Mondor's disease", affects women following breast cancer surgery with excision of the left axillary lymph nodes. It also occurs in women after breast augmentation of reactive hyperplasia of the axillary lymph nodes, misdiagnosed as silicoadenitis, leads to axillary node excision. Although Mondor's Disease most commonly appears below or on the lateral aspect of the breast (from SP 17 to SP 20), it also affects veins in the axilla.

When Mondor's disease affects the axillary vein, it causes them to exhibit a "bowstring sign" crossing the axilla from HT 1 toward HT 2. Superficial vein transection leads to blood stasis and phlebothrombosis when unidirectional valves disallow retrograde flow.[7] Mondor's disease is becoming more common as the number of breast augmentation mammoplasties and cancer surgeries increases. Acupuncture and related techniques aid in reducing pain and improving circulation in the region, though this should not replace specialist consultation as indicated.

Indications and Potential Point Combinations

- **Pains in ribs, arms, and pectoral area:** HT 1, plus palpate for trigger points in surrounding regions; e.g., subscapularis, pectoralis minor and major, teres minor and major, and intercostal muscles.
- **Thoracic limb paresthesias, paresis, or paralysis:** HT 1, plus points along neural pathways affected by the nerve injury; e.g., LI points for radial nerve dysfunction, HT and SI points for ulnar nerve dysfunction. Palpate for myofascial restrictions in the axillary and shoulder region that are perpetuating the neural impairment(s).

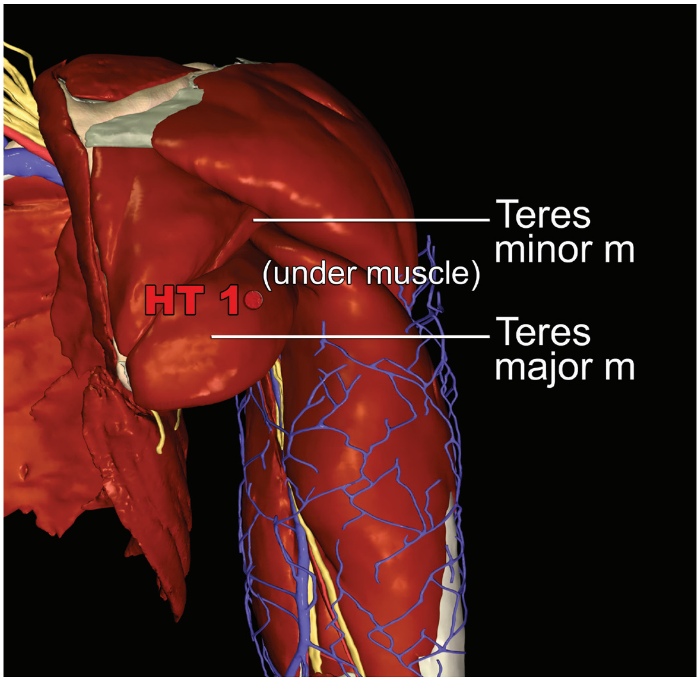


Figure 5-3. This image reveals the relationship of HT 1 deep to the teres muscles.

- **Brachial plexus injury:** HT 1; plus acupuncture points that impact the nerves affected by the injury. Target spinal nerve points on the lateral cervical region, GV 14, BL 11 as well as distal points related to the involved nerves.
- **Hot flushes, insomnia, night sweats, excessive thirst, dry mouth and throat:** HT 1, plus autonomic regulating points, such as LR 3, ST 36, LI 4.
- **Sadness, depression, anxiety:** HT 1, plus HT 3, LI 4, ST 36, LU 7.
- **Lactation disorders:** HT 1, SP 18, ST 18
- **Cardiac pain:** (After appropriate diagnostic and therapeutic measures have been taken for any cardiac irregularities) HT 1, or PC 6, CV 17, CV 14, CV 15, ST 36. Electrical stimulation applied to spinal cord segments C1-C2 (for vagal stimulation) and T1-T4 (to affect the intrathoracic intrinsic cardiac nervous system) utilizing points such as BL 10, BL 11, BL 12, BL 13, and BL 14 provides pain relief for patients suffering from severe angina pectoris.[1] The pain from cardiac disease usually refers to proximal somatic structures rather than distal ones; furthermore, nociceptive input from somatic and cardiac neurons converges onto the spinothalamic tract at T1-T5 but not C7 and C8. Thus, the neuroanatomic relationships would suggest selecting HT points along the T1 dermatome on the thoracic limb correspond to HT 1, HT 2, and HT 3, over more distal HT points. PC 6 falls within the T1 dermatome.[2]

References

1. Foreman RD. Neurological mechanisms of chest pain and cardiac disease. *Cleveland Clinic Journal of Medicine.* 2007;74 (Supp 1): S30-S33.
2. Moore KL and Dalley AF. *Clinically Oriented Anatomy, 4th Edition.* Philadelphia: Lippincott Williams & Wilkins, 1999. P. 682.
3. Huang YF, Wang TF, Liu Y, et al. Clinical observation on Jiquan (HT 1) for treatment of cervical spondylosis of nerve root type. *Zhongguo Zhen Jiu.* 2008;28(6):427-428.
4. Taira N, Shimozuma K, Ohsumi S, et al. Impact of preservation of the intercostobrachial nerve during axillary dissection on sensory change and health-related quality of life 2 years after breast cancer surgery. *Breast Cancer.* 2014;21(2):183-190.

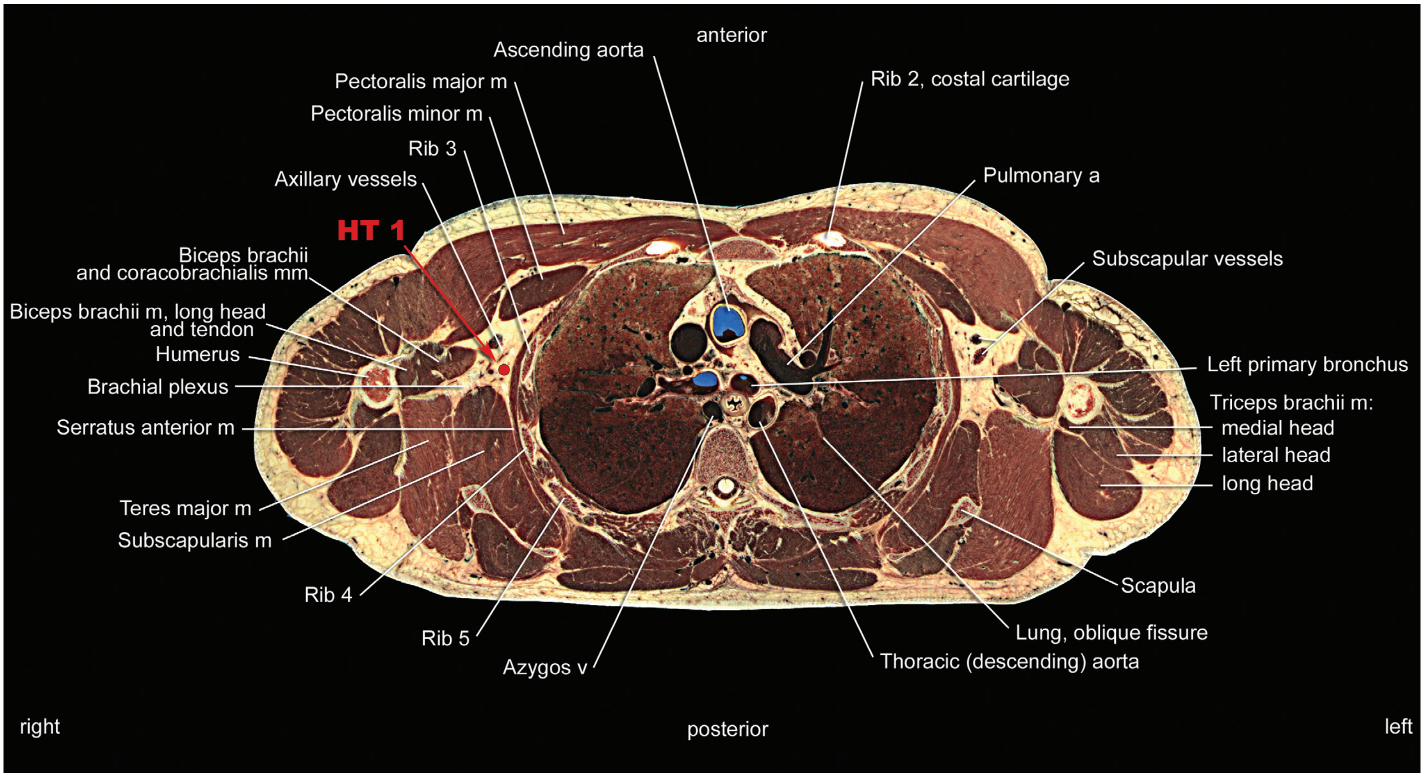

anterior
Ascending aorta
Pectoralis major m
Pectoralis minor m
Rib 3
Axillary vessels
HT 1
Biceps brachii and coracobrachialis mm
Biceps brachii m, long head and tendon
Humerus
Brachial plexus
Serratus anterior m
Teres major m
Subscapularis m
Rib 4
Rib 5
Azygos v
Rib 2, costal cartilage
Pulmonary a
Subscapular vessels
Left primary bronchus
Triceps brachii m:
medial head
lateral head
long head
Scapula
Lung, oblique fissure
Thoracic (descending) aorta
right
posterior
left

Figure 5-4. This cross section illustrates the structures surrounding HT 1, including the brachial plexus and axillary vessels.

5. Kyung DS, Lee JH, Kim DK, et al. The lateral thoracic artery passing through duplicated axillary vein: a case report. *Clin Anat.* 2013;26(8):1014-1016.
6. Gao QF, Shi XM, Li P, et al. Clinical observation on acupuncture and moxibustion for treatment of aorto-arteritis of arterial type in the head and arm. *Zhongguo Zhen Jiu.* 2005;25(8):523-525.
7. Khan UD. Mondor Disease: a case report and review of the literature. *Aesthetic Surgery Journal.* 2009;29:209. DOI: 10.1016/j.asj.2009.01.019.

HT 2

Qing Ling "Cyan Spirit" ("Blue Death")

On the medial side of the brachium, on the medial bicipital groove, 3 cun proximal to the cubital crease, on the line connecting HT 1 and HT 3.

Caution: The insertion site is directly over the brachial artery and companion veins. Avoid injuring the vessels; some suggest employing non-needling techniques to stimulate this site.

Fascia

- **Medial intermuscular septum:** Extends from the deep surface of the brachial fascia to the medial supracondylar ridge of the humerus. Divides the arm into anterior and posterior, or dorsal and ventral, compartments.
- **"Canal" or "Arcade" of Struthers (not always present):** A band or thickening of the deep, investing fascia in the distal third of the arm along the HT channel, at about the same location as HT 2. The "arcade" consists of a fibrous band or series of bands arching over the ulnar nerve.[2] In some cases, the ulnar nerve "sticks to" the fascial walls, keeping it from sliding freely and provoking entrapment pathology. The ulnar nerve changes course as it travels from the dorsal (posterior) to the ventral (anterior) compartments (see Figure 5-7), at the proximal opening of the canal, its tightest portion. The canal consists of the intermuscular septum, fascial fibers, and the epimysium of the triceps muscle. Other anatomists call this connective tissue element an internal brachial ligament.

Clinical Relevance: Myofascial restriction in the region of HT 2 increases traction on the ulnar nerve, predisposing it to damage and contributing to cubital tunnel syndrome.

Palpation of the medial brachium over the Canal of Struthers often elicits a report of tenderness to palpation.[3]

Muscles

- **Biceps brachii muscle:** Flexes the arm when the elbow is in extension. When the elbow flexes, the biceps brachii becomes the most powerful supinator of the forearm.
- **Triceps brachii muscle**: Serves as the main extensor of the forearm. The long head of the triceps steadies the head of the humerus of the abducted arm.

Clinical Relevance: Figure 5-7 illustrates how the edges of the biceps and triceps brachii lie within reach of an acupuncture needle entering HT 2 and thus pose opportunity for trigger point deactivation and proprioceptive influence. However, the main structures associating with the HT channel are neurovascular in nature; i.e., the axillary/brachial/ulnar arteries and the brachial plexus/medial brachial cutaneous/ulnar nerves. Figure 5-7 reveals the presence of the median nerve as well, exposing the neuroanatomical overlap of the HT and PC channels.

Nerves

- **Medial brachial cutaneous nerve (C8, T1):** Supplies the skin on the medial brachium (arm).
- **Ulnar nerve (C8-T1):** Arises as a terminal branch of the medial cord of the brachial plexus, receiving fibers from C8, T1, and often C7. It courses down the medial aspect of the arm and provides articular branches to the elbow joint. At the elbow, it continues posterior to the medial epicondyle and enters the antebrachium (forearm). The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.
- **Median nerve (C6-T1):** Accompanies the brachial artery along the arm but supplies no branches except for some small twigs to the brachial artery. The median nerve does supply articular branches to the elbow as it courses past the joint. Muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi

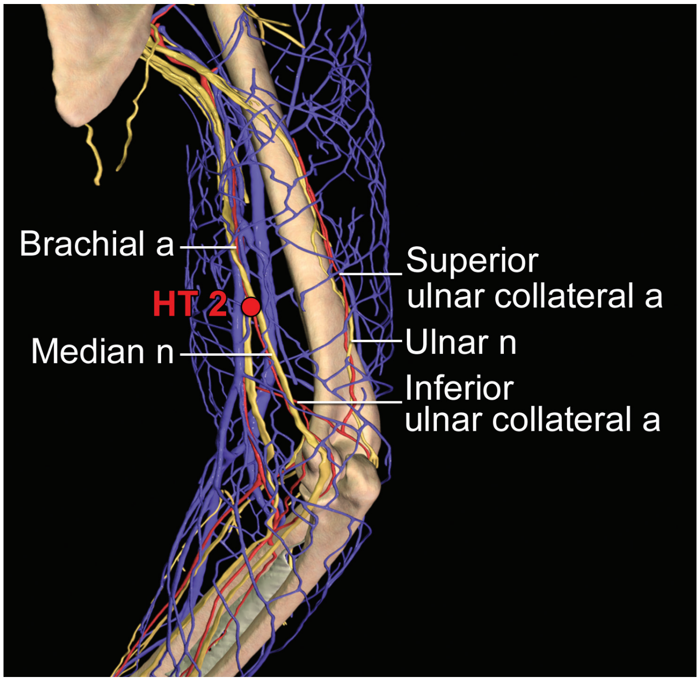


Figure 5-5. The abundance of venous structures at this site (HT 2) on a channel associated with the spirit (HT) explains the point's descriptive title of "Cyan Spirit" or "Blue Death". Note the position of the ulnar nerve as it winds around the humerus here, shifting from the brachium's dorsal to ventral compartment. In vivo, connective tissue tension limits its gliding and sliding capability, leading to nerve compression, stress, or other type of entrapment.

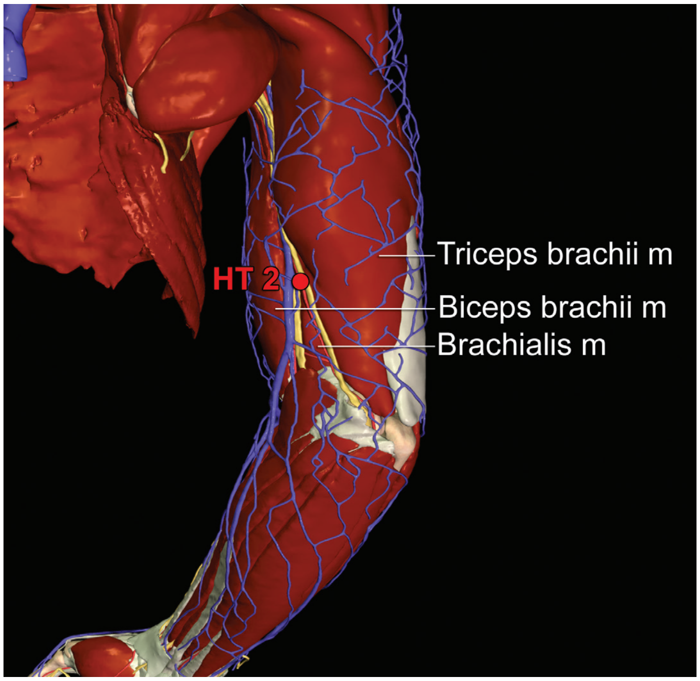


Figure 5-6. This image illustrates the placement of HT 2 along the medial bicipital groove, residing at the intersection of the biceps brachii, triceps brachii, and brachialis muscles.

radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except for the flexor carpi ulnaris and the medial half of the flexor digitorum profundus muscle. The median nerve innervates all thenar muscles except the adductor pollicis and deep head of the flexor pollicis brevis. It supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), the radial aspect of the ring finger, and adjacent palmar areas. Four branches of the median nerve supply the hand, named the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis muscle, the opponens pollicis muscle, and the superficial head of the flexor pollicis brevis muscle. The lateral branch supplies the 1st lumbrical muscle, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical muscle and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

Clinical Relevance: Cubital tunnel syndrome ranks as the second most common compressive neuropathy in the thoracic limb of humans, with carpal tunnel syndrome as the first.[4] Ulnar nerve compression can impair sensation, reduce the power of muscles supplied by the ulnar nerve, and radiate discomfort along the ulnar nerve's course. Causes include trauma, overuse, and myofascial dysfunction. The canal, or arcade, of Struthers constitutes the site (~HT 2) where the ulnar nerve traverses the intermuscular septum, leaving the anterior and entering the posterior compartments of the brachium; this is also a common source of nerve compression. Nerves need to glide and move longitudinally along their courses. When myofascia or other anatomical components stretch or tether them, this impacts their ability to function normally. The cross section in Figure 5-7 explores the multiplicity of neurovascular structures inhabiting HT 2. These include the ulnar, musculocutaneous, and median nerves; the brachial artery and its venae comitantes; and the basilic vein. Acupuncture, manual therapy, laser therapy, and a host of other physical medicine maneuvers contribute to alleviating compression and restriction of the ulnar nerve.[5]

Vessels

- **Brachial artery:** A continuation of the axillary artery, the brachial artery provides the main arterial supply to the arm. The brachial artery gives rise to the radial and ulnar arteries. Other main branches include the deep artery of the arm (profunda brachii artery) and the superior and inferior ulnar collateral arteries, which help form the elbow arterial anastomoses. The median nerve accompanies the brachial artery as it courses along the brachium.
- **Superior ulnar collateral artery:** This artery arises from the brachial artery near the middle of the arm and travels with the ulnar nerve toward the humerus. It anastomoses with the posterior branch of the ulnar recurrent artery and the inferior ulnar collateral artery which participate in the elbow anastomoses.
- **Brachial veins:** The brachial veins accompany the brachial artery and frequently encompass it, forming a common vascular sheath by means of their anastomotic interconnections. Blood draining from the brachial vein is further pushed along its pathway by the brachial artery's pulsations. The brachial veins form from the veins which travel with the radial and ulnar arteries. They drain into the axillary vein after joining with the basilic vein.
- **Inferior ulnar collateral artery:** This artery arises from the brachial artery about five centimeters proximal to the cubital crease. The inferior ulnar collateral artery joins the elbow anastomoses via by connecting with the anterior branch of the ulnar recurrent artery.
- **Basilic vein:** The basilic vein arises from the ulnar portion of the dorsal venous network of the hand and courses along the ulnar aspect of the forearm. It continues its ascent along the medial portion of the inferior arm (brachium), enters the axilla, and merges with the veins that accompany the brachial artery, thereby forming the axillary vein.

Clinical Relevance: The axillary vein and its tributaries exhibit variations that can complicate invasive procedures and impact neurologic function if they expand onto or otherwise compress neighboring nerves. Venous duplication increases the likelihood of thromboembolism when penetrated by a nerve and/or subjected to stretch.[6] Acupuncture and related techniques applied to this highly neurovascular region can lead to autonomic neuromodulation.

Indications and Potential Point Combinations

- **Rib pain:** HT 2, plus palpate for trigger points and tenderness at the paraspinal region and intercostals space at the level of the rib pain. Caution needling over the thorax.
- **Shoulder and arm pain:** HT 2, plus local trigger points in the brachium, shoulder, and upper back region.
- **Neuropathy and/or paresis in the thoracic limb:** HT 2, plus points along channels related to neuropathic nerves. Address related cervical spinal nerve points.

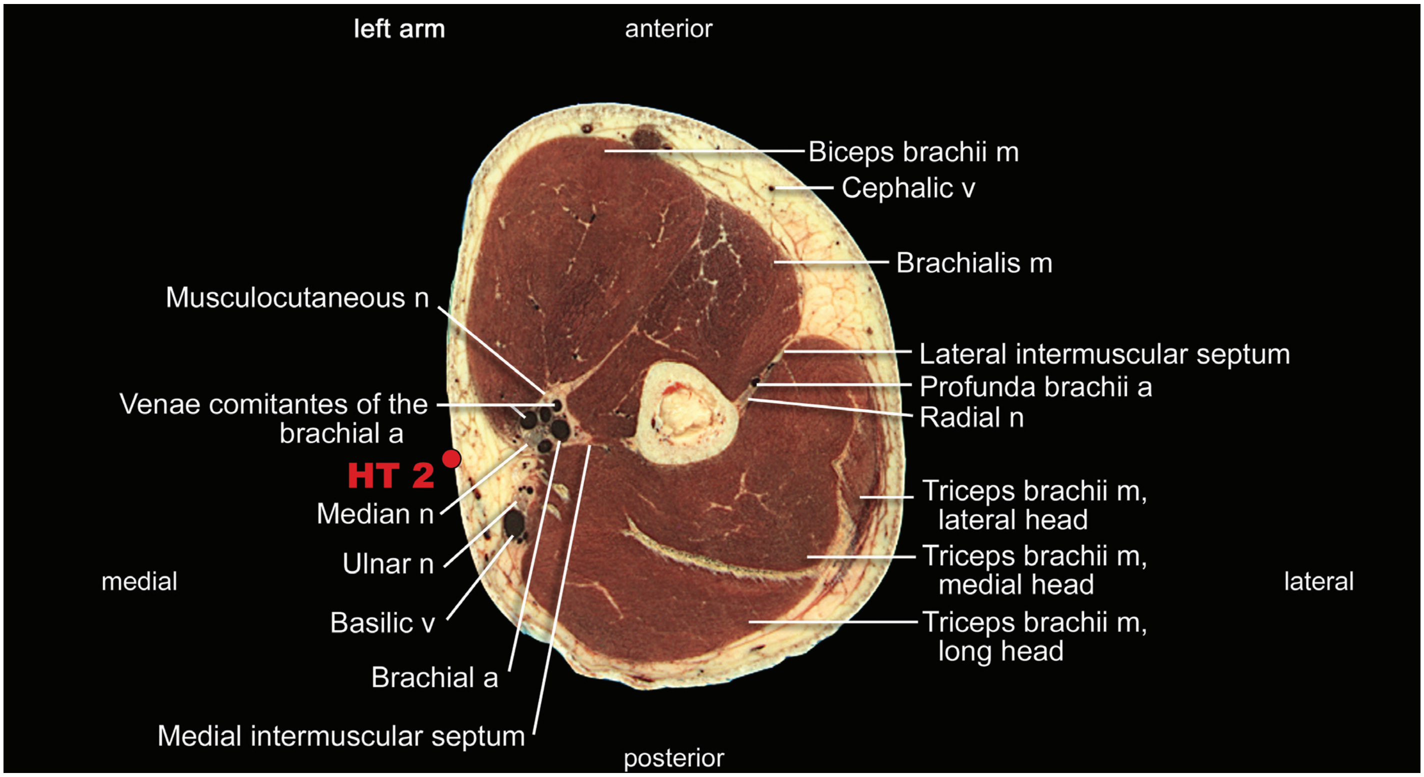

left arm
anterior
Biceps brachii m
Cephalic v
Brachialis m
Musculocutaneous n
Lateral intermuscular septum
Profunda brachii a
Radial n
Venae comitantes of the brachial a
HT 2
Median n
Triceps brachii m, lateral head
Triceps brachii m, medial head
Ulnar n
medial
lateral
Basilic v
Triceps brachii m, long head
Brachial a
Medial intermuscular septum
posterior

Figure 5-7. The intimate association of HT 2 with prominent vessels such as the brachial artery becomes evident in this cross section. Expanding the focus to include nearby nerves causes one to realize that nearly all of the peripheral nerves and vessels supplying the distal thoracic limb course through this bundle beneath the point.

- **Chest pain, both cardiac and thoracic wall pain:** After determining the course of action from a conventional medical perspective, for additional pain control, consider HT 2 along with paraspinal electroacupuncture stimulation of the upper thoracic spinal cord segments, such as BL 11-BL 14, as well as GV 14. Less direct and invasive than spinal cord stimulation via implanted electrodes, paraspinal electroacupuncture would share similar goals; i.e., delivery of electrical impulses to several of the most cranial thoracic spinal segments that 1) provide pain relief, 2) reduce frequency and severity of angina attacks, and lower the need for short-acting nitrate.[1]

References

1. Wu M, Linderoth B, and Foreman RD. Putative mechanisms behind effects of spinal cord stimulation on vascular diseases: a review of experimental studies. *Auton Neurosci.* 2008;138(1-2):9-23.
2. Von Schroeder HP and Scheker LR. Redefining the "Arcade of Struthers". *Journal of Hand Surgery.* 2003;28A:1018-1021.
3. Novak CB, Mehdian H, von Schroeder HP. Laxity of the ulnar nerve during elbow flexion and extension. *J Hand Surg.* 2012;37A:1163-1167.
4. Novak CB, Mehdian H, von Schroeder HP. Laxity of the ulnar nerve during elbow flexion and extension. *J Hand Surg.* 2012;37A:1163-1167.
5. Robertson C and Saratsiotis J. A review of compressive ulnar neuropathy at the elbow. *Journal of Manipulative and Physiological Therapeutics.* 2005;28:345.e1-345.e18.
6. Yang H-J, Gil Y-C, Jin J-D, et al. Novel findings of the anatomy and variations of the axillary vein and its tributaries. *Clinical Anatomy.* 2012;25:893-902.

HT 3

Shao Hai "Lesser Sea"

On the medial (ulnar) end of the cubital crease, in a depression anterior to the medial epicondyle of the humerus that appears when the elbow is flexed. Midway between PC 3 and the medial epicondyle of the humerus.

Muscles

- **Pronator teres muscle:** Pronates the forearm. Flexes the forearm at the elbow.

Clinical Relevance: Figure 5-10 shows the relationship of the more superficial and medial pronator teres to the brachialis muscle. The extensors of the antebrachium occupy the lateral compartment of the elbow. A needle entering HT 3 deeply enough reaches the pronator teres muscle and possibly the brachialis, depending on the nature of the insertion. HT 3 sits where myofascial trigger points in the pronator teres muscle reside. Referred pain issues from HT 3 strongly to the radial aspect of the distal volar antebrachium (from LU 7 to LU 10) with less pronounced pain between the elbow and wrist. "Pronator teres syndrome" leads to wrist pain of neurogenic origin. The median nerve courses between the humeral and ulnar heads of the pronator teres muscle and can become compressed with repetitive pronation/supination motions of the antebrachium.

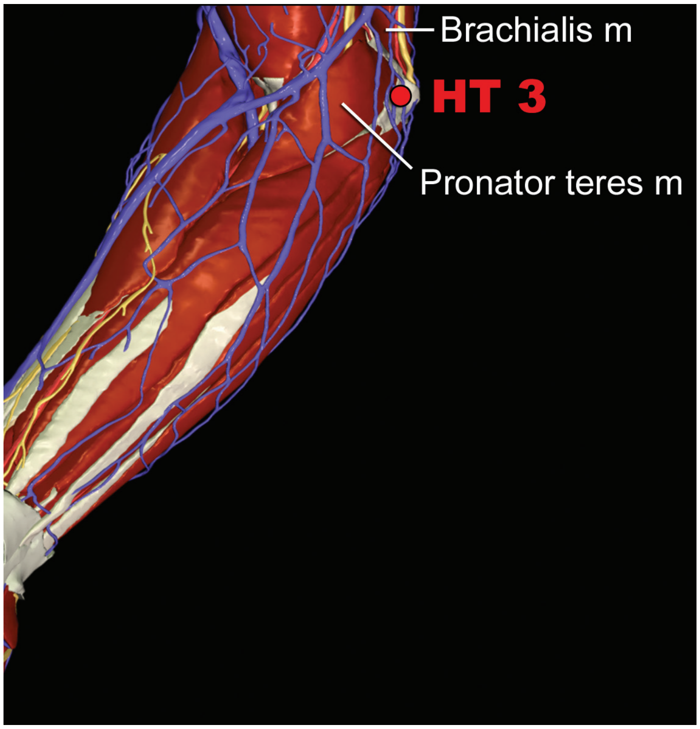


Figure 5-8. Muscles within reach of HT 3 include the pronator teres and brachialis muscles. The pronator teres muscles travels over the median nerve and brachial artery distal to this location (see also Figure 5-10). Myofascial restriction in the medial elbow, including restriction in the pronator teres muscle, furthers median nerve compression mimicking carpal tunnel syndrome. Depending on a patient's anatomy and location of tenderness to palpation, HT 3 might appear as shown here or more radial, within the belly of the pronator teres muscle.

Nerves

- **Medial brachial cutaneous nerve (C8, T1):** Supplies the skin on the medial brachium (arm).
- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Median nerve (C6-T1):** The median nerve forms distal to the axilla, arising from the medial and lateral cords of the brachial plexus. The bulk of the motor input of the median nerve arises from C8 and T1 fibers traveling in the medial cord, while most of the sensory axons of the median nerve derive from the lateral cord with C6 and C7 fibers.[1] After the terminal segments of the lateral and medial cords coalesce to form the median nerve, the nerve accompanies the brachial artery along the arm but supplies no branches except for some small twigs to the brachial artery. The median nerve supplies the elbow joint with articular branches. It passes beneath the bicipital aponeurosis (lacertus fibrosus) and the humeral head of the pronator teres muscle on its way to the forearm. It branches into the anterior interosseous nerve at about 4 cm distal to the medial epicondyle of the humerus where it passes under fascia from either the flexor digitorum superficialis or pronator teres muscle. Its course continues along the anterior interosseous membrane. Before it terminates in the distal forearm, it supplies the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except for the flexor carpi ulnaris and the medial half of the flexor digitorum profundus muscle. Along its way to the distal forearm, the median nerve can experience compression, well before it faces the flexor retinaculum at the wrist, such as between the superficial and deep heads of the pronator teres muscle.[2]
- **Ulnar nerve (C8-T1):** Arises as a terminal branch of the medial cord of the brachial plexus, receiving fibers from C8, T1, and often C7. It courses down the medial aspect of the arm and provides articular branches to the elbow joint. At the elbow, it continues posterior to the medial epicondyle and enters the antebrachium (forearm). The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: The anterior interosseous nerve suffers entrapment from anomalous muscles, trauma, vascular compression, and/or fibrous bands from either the flexor digitorum superficialis or pronator teres muscle. This nerve lies deep within the proximal antebrachium between the flexor digitorum superficialis and profundus muscles. Tension in the pronator teres accentuates anterior interosseous entrapment syndrome.

Abundant restriction in the vicinity of HT 3 places additional pressure or traction on the ulnar nerve, located closer to SI 8 than HT 3, as illustrated in Figure 5-10.

Vessels

- **Inferior ulnar collateral artery:** This artery arises from the brachial artery about 5 cm proximal to the cubital crease. It joins the elbow anastomoses via its connection with the anterior branch of the ulnar recurrent artery.

- **Anterior (branch of the) ulnar recurrent artery:** Arises from the ulnar artery just past the elbow joint. It joins with the ulnar collateral and interosseous recurrent arteries to form the elbow anastomoses. It supplies the brachialis and pronator teres muscles.

- **Basilic vein:** The basilic vein courses along the medial aspect of the arm and ultimately empties into the axillary vein after merging with the brachial veins. The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm. At the elbow, it joins the median cubital vein. The basilic vein accompanies the medial antebrachial cutaneous nerve in the vicinity of HT 3.

Clinical Relevance: According to some, the inferior ulnar collateral artery provides the only direct vascular supply to the ulnar nerve in the section proximal to the cubital tunnel,[4] although connections with the superior ulnar collateral artery lend support. (See Figure 5-10.) If trauma, surgery, scar tissue, and/or inflammation interrupt or diminish extrinsic blood supply to the ulnar nerve, acupuncture and related techniques aidsn in restoring blood supply.

Indications and Potential Point Combinations

- **Psychological disturbance:** depression, mental fatigue brought on by intense emotion, anxiety, insomnia, seizures precipitated by anxiety: HT 3 combined with HT 7, ST 36, LR 3, GV 20.

- **Heart pain with nausea and vomiting:** After instituting appropriate conventional medical care, consider HT 3 plus PC 6, ST 36.

- **Intercostal neuralgia:** HT 3, SI 9 and/or SI 10 as well as tender myofascial trigger points and taut bands in the spinal segmental region associated with the dysfunctional intercostals nerve(s). Palpate for trigger points in the related intercostals muscles.

- **Pain or numbness of the thoracic limb, especially the elbow, from arthritis, nerve entrapment, or myofascial pain; also, cubital tunnel syndrome (a compression/traction neuropathy occurring at the elbow),[3] anterior interosseous nerve syndrome with hand weakness (patient expresses difficulty executing the "pinch" motion); differentiate from brachial neuritis with different locus of injury; pronator syndrome with pain and paresthesias that can mimic carpal tunnel syndrome but differentiable with resisted forearm pronation and other maneuvers:** HT 3, and tender myofascial trigger points in the region that may be precipitating or perpetuating the pain and neural dysfunction. For anterior interosseous nerve syndrome, consider adding PC points (e.g., PC 4-PC 6) associated with the anterior interosseous nerve as well as trigger points in the muscles it supplies, such as the lateral part of the flexor digitorum profundus muscle affecting digits 2 and 3, and the pronator quadrates. The anterior interosseous nerve also sends articular branches to the wrist, suggesting local wrist points such as PC 7.

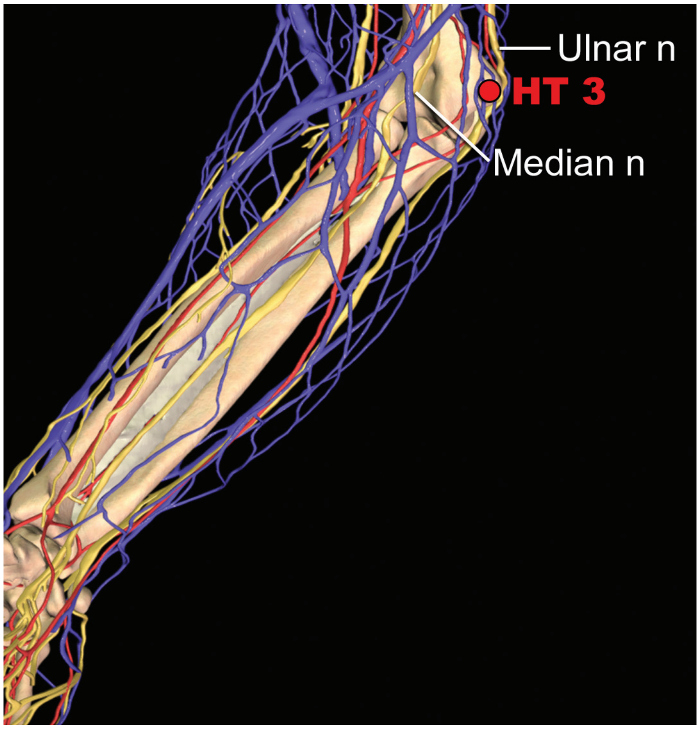


Figure 5-9. The ulnar nerve runs near HT 3, though it directly underlies SI 8, at the ulnar groove. The median nerve comes into the picture when considering HT 3, given its potential for compression by the pronator teres. A more radial location for HT 3, as discussed for the previous figure, would provide relatively more stimulation to the median than the ulnar nerve.

References

1. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect.* 2008;57:177-185.
2. Beaton LB and Anson BJ. The relation of the median nerve to the pronator teres muscle. Anat Rec. 1939;75:23-26. Cited in Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect.* 2008;57:177-185.
3. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect.* 2008;57:177-185
4. Yamaguchi K, Sweet FA, Bindra R, et al. The extraneural and intraneural arterial anatomy of the ulnar nerve at the elbow. *J Shoulder Elbow Surg.* 1999;8:17-21.

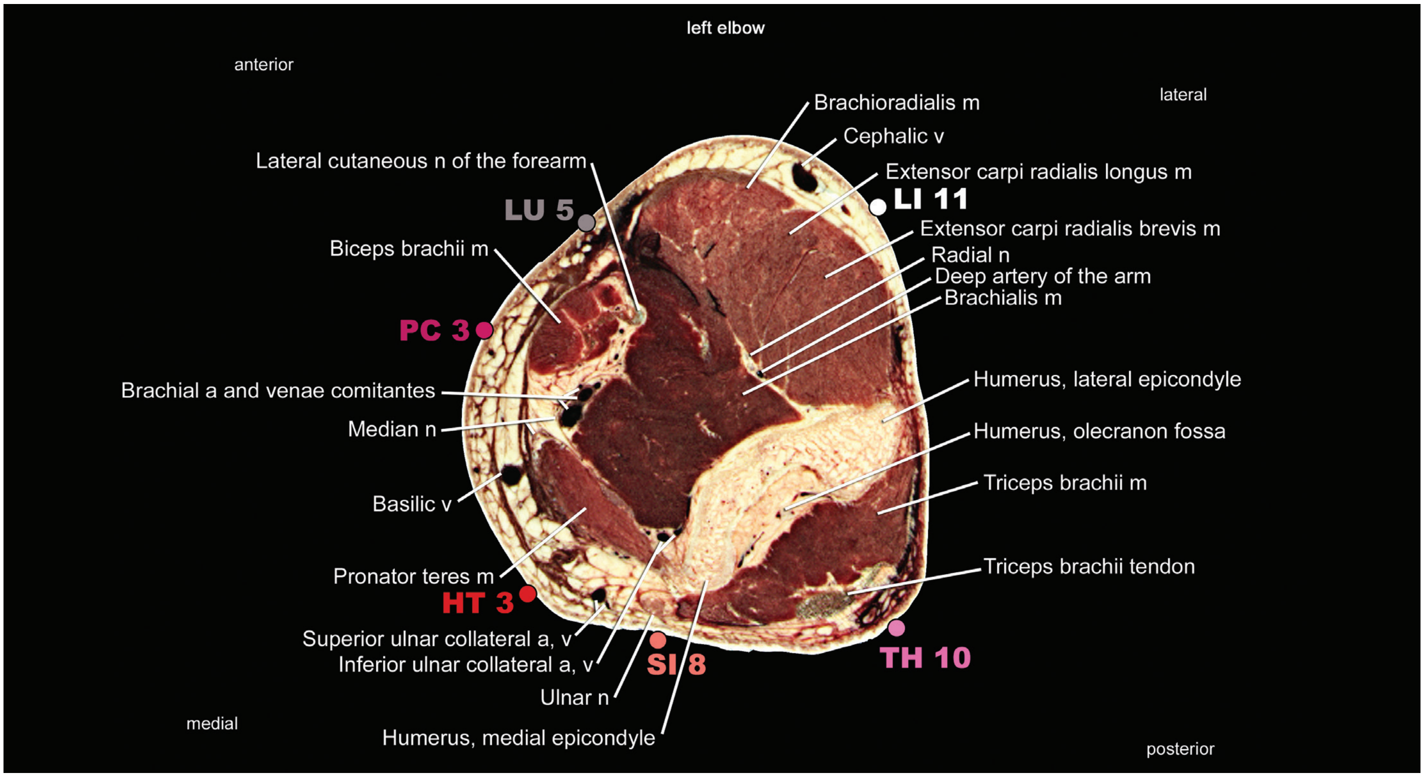

left elbow
anterior
lateral
Brachioradialis m
Cephalic v
Lateral cutaneous n of the forearm
Extensor carpi radialis longus m
LU 5
LI 11
Extensor carpi radialis brevis m
Biceps brachii m
Radial n
Deep artery of the arm
Brachialis m
PC 3
Brachial a and venae comitantes
Humerus, lateral epicondyle
Median n
Humerus, olecranon fossa
Triceps brachii m
Basilic v
Pronator teres m
Triceps brachii tendon
HT 3
Superior ulnar collateral a, v
Inferior ulnar collateral a, v
SI 8
TH 10
Ulnar n
medial
Humerus, medial epicondyle
posterior

Figure 5-10. Several neurovascular structures sit near HT 3, including the brachial artery and its venae comitantes, the basilica vein, ulnar nerve, and the median nerve. HT 3, as the "Lesser Sea" marks the diminution in size of the brachial artery after it has given off several branches at or near the elbow, including the radial and ulnar arteries as well as the superior and inferior ulnar collateral arteries that produce an anastomosis around the elbow. HT 3 is the "Shao Hai" (Lesser Sea) point on the Shao Yin of the Hand channel. Points at the elbows and knees are also known as "Sea" points where the smaller vessels (streams and rivers) of the forearm are metaphorically connecting to larger distributing or collecting vessels (i.e., the arteries and veins, respectively).

HT 4

Ling Dao "Spirit Pathway"

Proximal to the wrist on its volar aspect, 1.5 cun proximal to the wrist crease and HT 7, on the radial aspect of flexor carpi ulnaris tendon.

Muscles

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius and ulna.
- **Flexor carpi ulnaris muscle:** Adducts and flexes the hand at the wrist.

Clinical Relevance: Prolonged contraction of the forearm and hand flexors can lead to fatigue and myofascial dysfunction. Activities include motorcycle racing and other high-force, repetitive activities.[1] The cross-sectional anatomy visible in Figure 5-12 illustrates the relationships of the local musculature to the entry site at HT 4, suggesting the angle and depth required for local trigger point deactivation.

Tension in the flexor carpi ulnaris muscle contributes to ulnar nerve lesions at the elbow more commonly than does tension in the flexor digitorum profundus.[2] Ulnar neuropathy at the wrist is more rare and difficult to localize with routine electrophysiologic studies than ulnar neuropathy at the elbow.[3] Myofascial palpation of the tissues along the course of the ulnar nerve often reveals the locus of dysfunction and prompts attention to the site through medical acupuncture and related techniques.

Swelling of the pronator quadratus muscle as well as soft tissue edema outside of the muscle can become visible on radiograph and indicate inflammatory, infectious, or hemorrhagic conditions.[4] Fascia covering the muscle keeps fluid accumulation centralized in this region. Note the thin fat layer in Figure 5-12 between the pronator quadratus and flexor digitorum profundus muscles. This fat plane can become visible on radiographs when this section expands with fluid. The fat layer sits directly below HT 4.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the volar and ulnar aspects of the forearm from the vicinity of HT 2 to HT 7.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles.
- **Anterior interosseous nerve:** A branch of the median nerve, the anterior interosseous nerve supplies the flexor digitorum profundus (lateral, or radial aspect), flexor pollicis longus, and the pronator quadratus muscles. (The ulnar nerve also innervates the flexor digitorum profundus, medial, or radial side.) The anterior interosseous nerve provides articular branches to the wrist joint. Although anatomy texts often show the nerve terminating within the belly of the pronator quadratus muscle, others contend that the anterior interosseous nerve continues on to terminate at the palmar aspect of the radiocarpal and intercarpal joints.

Clinical Relevance: Venipuncture can injure the medial antebrachial cutaneous nerve. The nerve becomes subcutaneous just proximal to the medial epicondyle. It follows the HT channel region to provide cutaneous sensation to the ulnar aspect of the antebrachium.[5] Steroid injection for medial epicondylitis, cubital tumor surgery, arthroscopy of the elbow, and

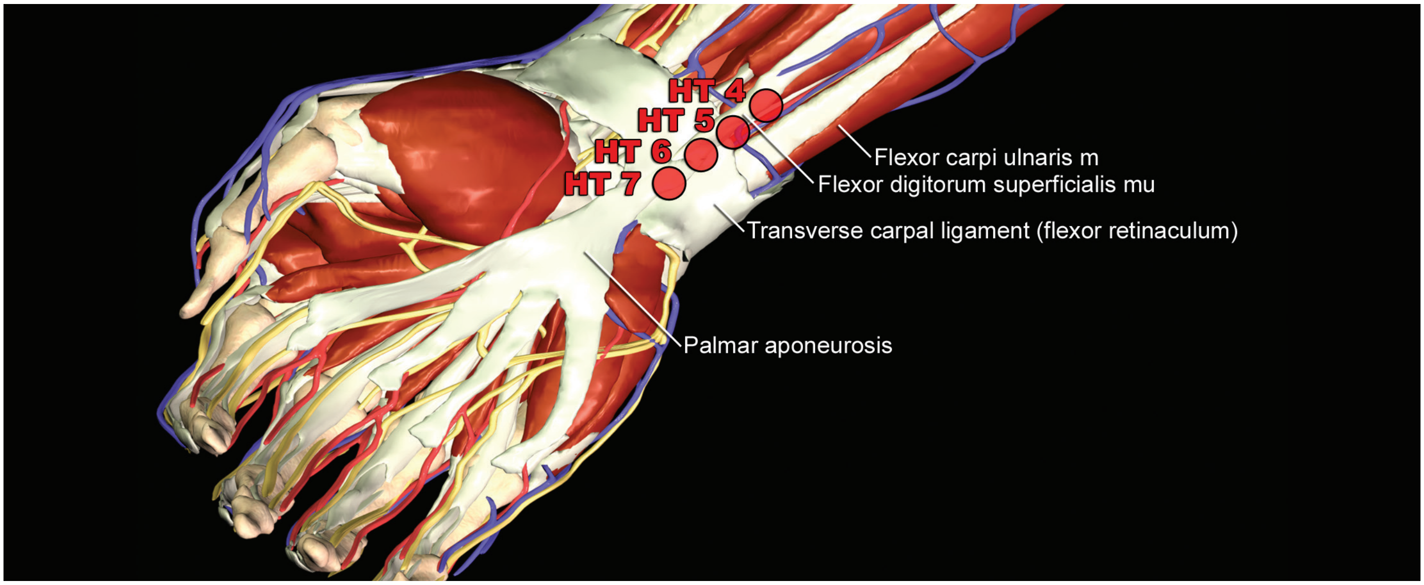

HT 4
HT 5
HT 6
HT 7
Flexor carpi ulnaris m
Flexor digitorum superficialis mu
Transverse carpal ligament (flexor retinaculum)
Palmar aponeurosis

Figure 5-11. The points inhabiting this section of the distal antebrachium share indications because their neuroanatomic and musculoskeletal relationships overlap. Palpate the entire thoracic limb to identify pain's etiology by finding the primary trigger point(s) and not just referred pain. Then add stimulation to the appropriate tendon to modulate Golgi tendon organ input as needed.

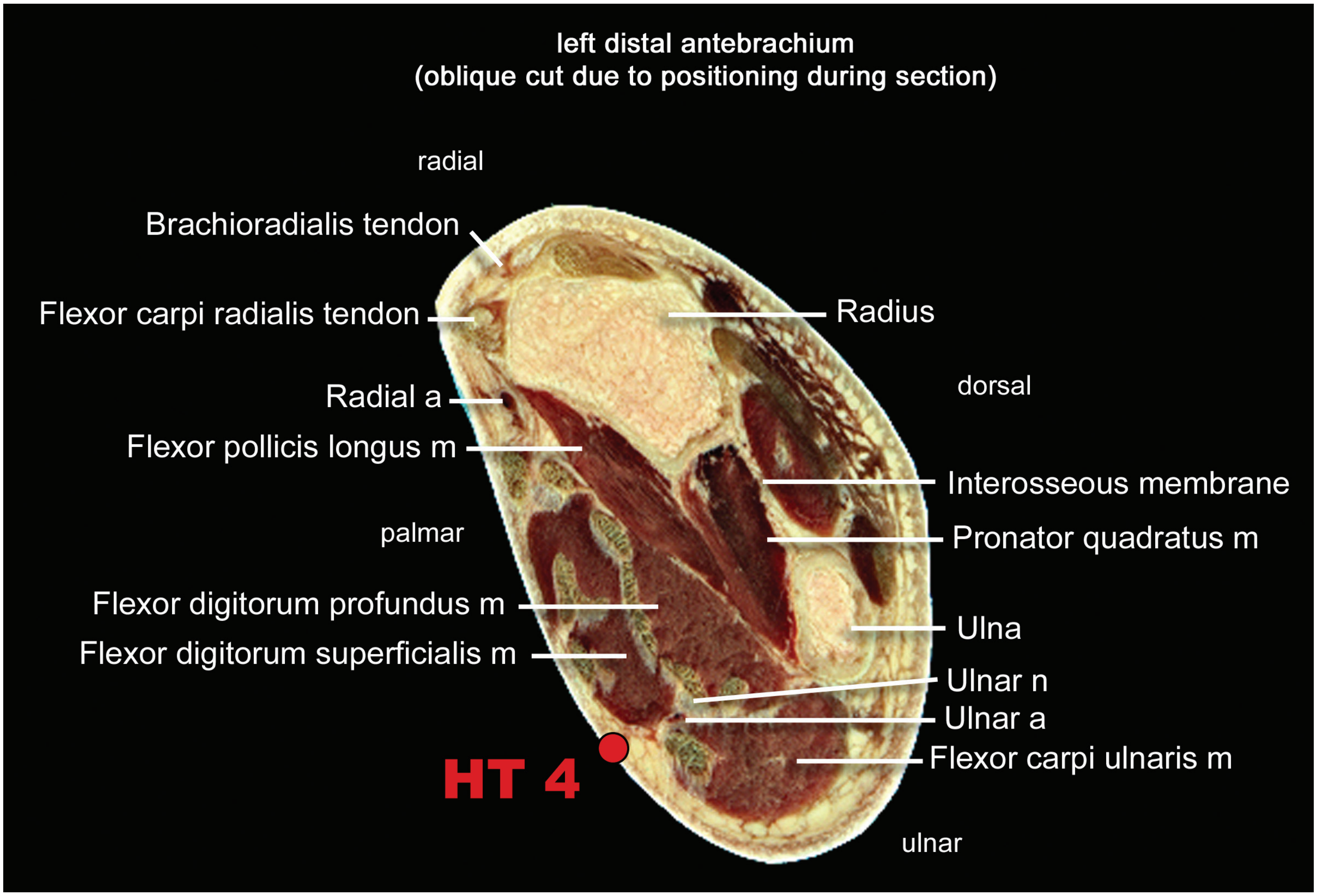

left distal antebrachium
(oblique cut due to positioning during section)
radial
Brachioradialis tendon
Flexor carpi radialis tendon
Radius
dorsal
Radial a
Flexor pollicis longus m
Interosseous membrane
palmar
Pronator quadratus m
Flexor digitorum profundus m
Ulna
Flexor digitorum superficialis m
Ulnar n
Ulnar a
HT 4
Flexor carpi ulnaris m
ulnar

Figure 5-12. As the most proximal point of the group at the wrist, HT 4 goes by the name "Spirit Pathway" implying its pathway to the Heart, where the spirit resides in Chinese medicine. The vascular conduit, i.e., the ulnar artery, connecting HT 4 to the master pump appears on this cross section just deep to the point.

routine venipuncture can injure the nerve, along with repetitive motion trauma, soft tissue injury, and subcutaneous lipomas. This causes a purely sensory neuropathy. Medical acupuncture and related techniques could be implemented in order to aid in the recovery of medial antebrachial cutaneous nerve injury function.

The ulnar nerve is vulnerable to suffer compression at the wrist from soft tissue expansions such ganglion cysts.[6] Ulnar neuropathy at the wrist takes the form of a mixed motor and sensory neuropathy, purely motor, or purely sensory.[7]

Following repair of the ulnar and median nerves, sympathetic unmyelinated fibers regrow more quickly than sensory myelinated fibers. The relative amount of autonomic versus somatic nerve endings in an acupuncture point locale colors the kind of response the tissue exhibits.

Pressure on the anterior interosseous nerve could cause diagnostic confusion.[8] Patients characteristically describe the discomfort as dull, non-radiating, and achy. Wrist hyperextension worsens the problem in some patients. Myofascial restriction in the flexor muscles of the distal forearm would likely worsen the compression, prompting practitioners to palpate the region and deactivate trigger points that are contributing to the problem. The course of the anterior interosseous nerve belongs more to the PC channel (PC 6, PC 7) than the HT, but myofascial dysfunction can spill over from one channel to another.

Vessels

- **Ulnar artery:** In this region, the dorsal and palmar carpal branches of the ulnar artery anastomose with the radial artery.
- **Ulnar veins:** These paired veins drain the forearm and accompany the ulnar artery. The receive tributaries from muscles lying nearby.

Clinical Relevance: Corticosteroid injection for carpal tunnel syndrome runs the risk of injuring local nerves or vessels. Injection on either side of the palmaris longus tendon can injure the median nerve, while an ulnar approach risks damaging the ulnar artery and nerve.[9]

Indications and Potential Point Combinations

- **Ulnar neuralgia:** Select HT 4 for pain in this region, but also palpate for myofascial restriction and target trigger points. Consider adding proximal ulnar nerve points such as SI 8 or HT 3. Palpate for caudal cervical somatic dysfunction, paying particular attention to the C7-T1 region. Select GV 14 and local points for caudal cervical somatic dysfunction.
- **Wrist or elbow pain:** HT 4 if tender, plus local trigger points. Palpate the musculotendinous junctions of the involved dysfunc-

tional muscles for additional trigger points, to determine the cause of the pain, if it is indeed myofascial, as opposed to articular, or neuropathic.

References

1. Marina M, Porta J, Vallejo L, et al. Monitoring hand flexor fatigue in a 24-h motorcycle endurance race. *Journal of Electromyography and Kinesiology*. 2011;21:255-261.
2. Eliaspour D, Seighipour L, Hedayati-Moghaddam MR, et al. The pattern of muscle involvement in ulnar neuropathy at the elbow. *Neurol India.* 2012;60(1):36-39.
3. Cowdery SR, Preston DC, Herrmann DN, et al. Electrodiagnosis of ulnar neuropathy at the wrist. Conduction block versus traditional tests. *Neurology*. 2002;59(3):420-427.
4. Moosikasuwan JB. The pronator quadratus sign. *Radiology*. 2007;244:927-928.
5. Asheghan M, Khatibi A, and Holisaz MT. Paresthesia and forearm pain after phlebotomy due to medial antebrachial cutaneous nerve injury. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2011;6:5.
6. Karam C, Quin CC, Paganoni S, et al. Teaching NeuroImages: Ganglion cyst causing pure sensory ulnar neuropathy at the wrist. *Neurology*. 2012;79(8):e76-e76.
7. Wu JS, Morris JD< and Hogan GR. Ulnar neuropathy at the wrist: case report and review of literature. *Arch Phys Med Rehabil*. 1985;66(11):785-788.
8. Dellon AL, MacKinnon SE, and Daneshvar A. Terminal branch of anterior interosseous nerve as source of wrist pain. *Journal of Hand Surgery*. 1984;9-B(3):316-322.
9. Hussain SS, Taylor C, and Van Rooyen R. Ulnar artery ischaemia following corticosteroid injection for carpal tunnel syndrome. *Journal of the New Zealand Medical Association*. 2011;124(1335):80-83.

HT 5

Tong Li "Connecting Li"

Proximal to the wrist on its volar aspect, 1 cun proximal to the wrist crease and HT 7, on the radial aspect of the tendon of the flexor carpi ulnaris muscle.

Note the proximity of the points HT 4, HT 5, HT 6, and HT 7 in Figure 5-11. As such, the cross-sectional anatomy of HT 5 will be similar to HT 4.

Muscles

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius and ulna.
- **Flexor carpi ulnaris muscle:** Adducts and flexes the hand at the wrist.

Clinical Relevance: Prolonged contraction of the forearm and hand flexors can lead to fatigue and myofascial dysfunction. Activities include motorcycle racing and other high-force, repetitive activities.[2] The cross-sectional anatomy visible in Figure 5-12 illustrates the relationships of the local musculature to the entry site at HT 4, suggesting the angle and depth required for local trigger point deactivation. Structures deep to HT 5 will have a similar layout to HT 4.

Tension in the flexor carpi ulnaris muscle contributes to ulnar nerve lesions at the elbow more commonly than does tension in the flexor digitorum profundus.[2] Ulnar neuropathy at the wrist is more rare and difficult to localize with routine electrophysiologic studies than ulnar neuropathy at the elbow.[4] Myofascial palpation of the tissues along the course of the ulnar nerve often reveals the locus of dysfunction and prompts attention to the site through medical acupuncture and related techniques.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the volar and ulnar aspects of the forearm from the vicinity of HT 2 to HT 7.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles.
- **Anterior interosseous nerve:** A branch of the median nerve, the anterior interosseous nerve supplies the flexor digitorum profundus (lateral, or radial aspect), flexor pollicis longus, and the pronator quadratus muscles. (The ulnar nerve also innervates the flexor digitorum profundus, medial, or radial side.) The anterior interosseous nerve provides articular branches to the wrist joint. Although anatomy texts often show the nerve terminating within the belly of the pronator quadratus muscle, others contend that the anterior interosseous nerve continues on to terminate at the palmar aspect of the radiocarpal and intercarpal joints.

Clinical Relevance: Venipuncture sometimes injures the medial antebrachial cutaneous nerve. The nerve becomes subcutaneous just proximal to the medial epicondyle. It follows the HT channel region to provide cutaneous sensation to the ulnar aspect of the antebrachium.[5] Steroid injection for medial epicondylitis, cubital tumor surgery, arthroscopy of the elbow, and routine venipuncture can injure the nerve, along with repetitive motion trauma, soft tissue injury, and subcutaneous lipomas. This can cause a sensory neuropathy. Medical acupuncture and related techniques aid in the recovery of medial antebrachial cutaneous nerve injury function.

The ulnar nerve suffers compression at the wrist from soft tissue expansions such ganglion cysts.[6] Ulnar neuropathy at the wrist can express itself as a mixed motor and sensory neuropathy, purely motor, or purely sensory.[7]

Following repair of the ulnar and median nerves, sympathetic unmyelinated fibers regrow more quickly than sensory myelinated fibers. The relative amount of autonomic versus somatic nerve endings in an acupuncture point locale colors the kind of response the tissue exhibits.

Pressure on the anterior interosseous nerve could cause diagnostic confusion.[8] Patients characteristically describe the discomfort as dull, non-radiating, and achy. Wrist hyperextension worsens the problem in some patients. Myofascial restriction in the flexor muscles of the distal forearm would likely worsen the compression, prompting practitioners to palpate the region and deactivate trigger points that are contributing to the problem. The course of the anterior interosseous nerve belongs more to the PC channel (PC 6, PC 7) than the HT, but myofascial dysfunction can spill over from one channel to another.

Vessels

- **Ulnar artery:** In this region, the dorsal and palmar carpal branches of the ulnar artery anastomose with the radial artery.
- **Ulnar veins:** These paired veins drain the forearm and accompany the ulnar artery. The receive tributaries from muscles lying nearby.

Clinical Relevance: Corticosteroid injection for carpal tunnel syndrome runs the risk of injuring local nerves or vessels. Injection on either side of the palmaris longus tendon can injure the median nerve, while an ulnar approach risks damaging the ulnar artery and nerve.[9]

The nervi vasorum associated with the ulnar artery figure prominently into the cardiovascular and hemodynamic indications of this point. Note the close association between vessels and HT 5 in Figure 5-13…a theme that characterizes one of the key features of the HT line.

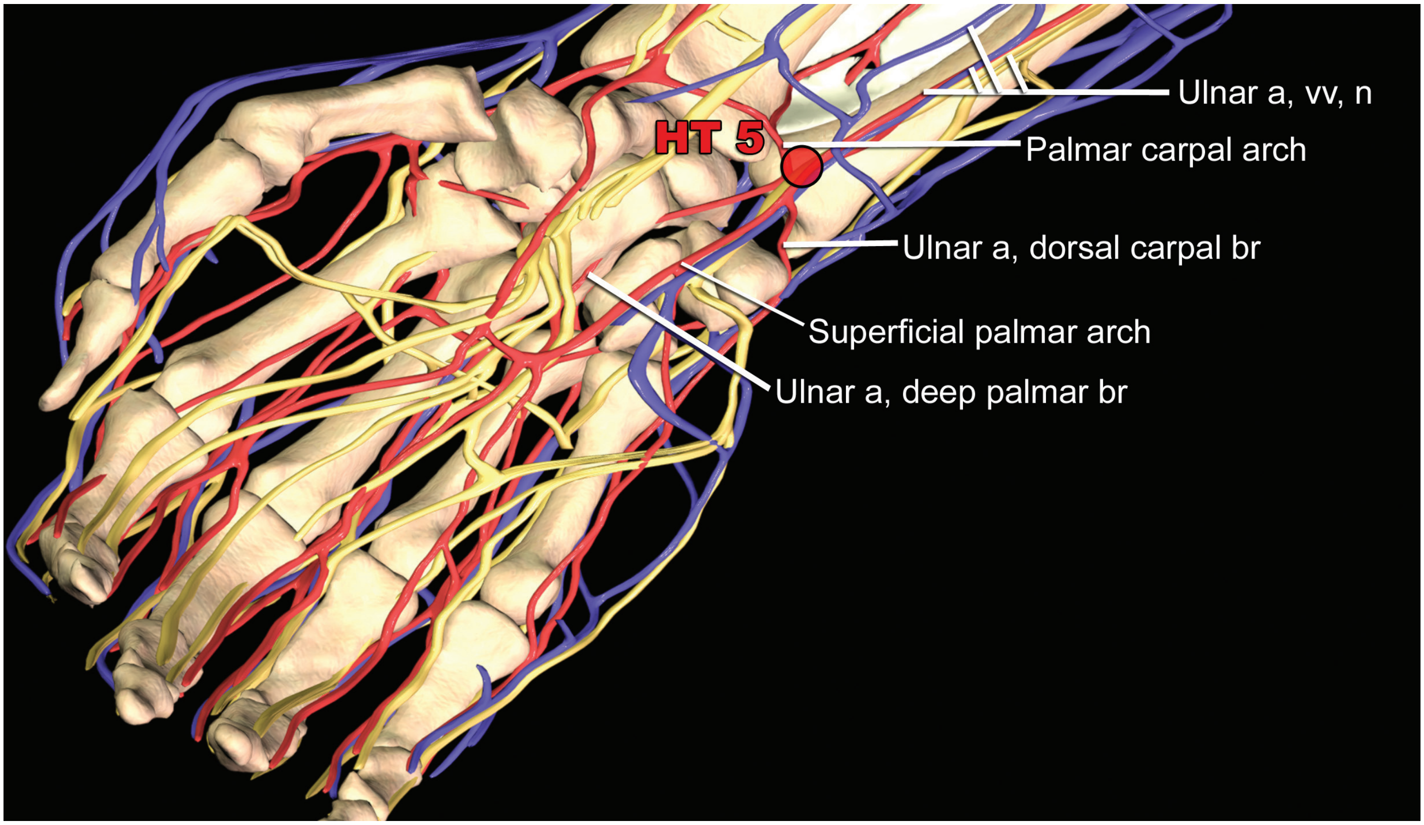


Figure 5-13. HT 5, as “Connecting Li” indicates a connecting place or village at a crossroad. Anatomically, HT 5 lies near two offshoot branches of the ulnar artery. One continues into the palm as the superficial palmar carpal arch. The other links the HT channel to the SI channel via the dorsal carpal branch of the ulnar artery, shown in this figure just distal and ulnar to HT 5. The latter branch constitutes a connecting (transverse) vessel between the HT and SI lines, harkening back to the original conceptualization of acupuncture channels as vascular conduits.

Indications and Potential Point Combinations

- **Emotional issues:** Performance or test anxiety, heart symptoms of emotional origin: HT 5, HT 7, ST 36, GV 20.
- **Angina pectoris:** ST 36, BL 15, BL 20, HT 5, and PC 6 (see below for evidence-based application).
- **Sudden loss of voice, aphasia, hoarseness:** HT 5, CV 23, CV 22, ST 9.
- **Wrist pain:** Palpate for tender areas to determine source of pain (myofascial, arthrodial, neuropathic) and additional points (whether proximal, distal, volar, dorsal, or lateral).

Evidence-Based Applications

- Acupuncture at ST 36, BL 15, BL 20, HT 5, and PC 6 reduced the number of attacks per week in **angina pectoris** patients and reduced ST-segment depression during exercise, possibly indicating protection of the myocardium from ischemia.[1]

References

1. Richter A, Herlitz J, and Hialmarson A. Effect of acupuncture in patients with angina pectoris. European Heart Journal. 1991;12:175-178.
2. Marina M, Porta J, Vallejo L, et al. Monitoring hand flexor fatigue in a 24-h motorcycle endurance race. *Journal of Electromyography and Kinesiology*. 2011;21:255-261.
3. Eliaspour D, Seighipour L, Hedayati-Moghaddam MR, et al. The pattern of muscle involvement in ulnar neuropathy at the elbow. *Neurol India*. 2012;60(1):36-39.
4. Cowdery SR, Preston DC, Herrmann DN, et al. Electrodiagnosis of ulnar neuropathy at the wrist. Conduction block versus traditional tests. *Neurology*. 2002;59(3):420-427.
5. Asheghan M, Khatibi A, and Holisaz MT. Paresthesia and forearm pain after phlebotomy due to medial antebrachial cutaneous nerve injury. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2011;6:5.
6. Karam C, Quin CC, Paganoni S, et al. Teaching NeuroImages: Ganglion cyst causing pure sensory ulnar neuropathy at the wrist. *Neurology*. 2012;79(8):e76-e76.
7. Wu JS, Morris JD< and Hogan GR. Ulnar neuropathy at the wrist: case report and review of literature. *Arch Phys Med Rehabil*. 1985;66(11):785-788.
8. Dellon AL, MacKinnon SE, and Daneshvar A. Terminal branch of anterior interosseous nerve as source of wrist pain. *Journal of Hand Surgery*. 1984;9-B(3):316-322.
9. Hussain SS, Taylor C, and Van Rooyen R. Ulnar artery ischaemia following corticosteroid injection for carpal tunnel syndrome. *Journal of the New Zealand Medical Association*. 2011;124(1335):80-83.

HT 6

Yin Xi "Yin Cleft"

Proximal to the wrist on its volar aspect, 0.5 cun proximal to the wrist crease at HT 7, on the radial aspect of the tendon of the flexor carpi ulnaris muscle.

Muscles

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.

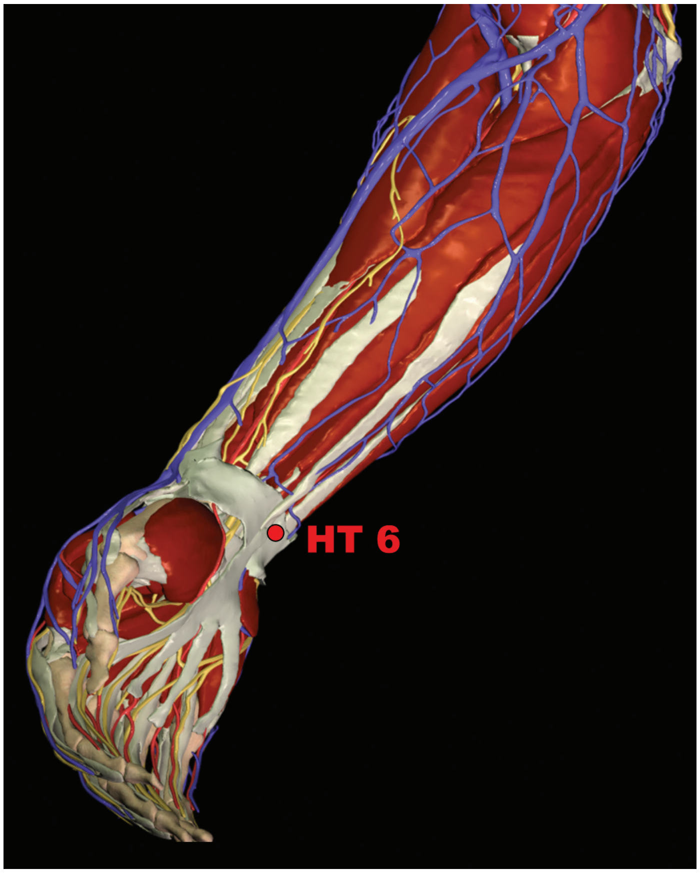


Figure 5-14. Points located at or near myotendinous junctions were historically called "Xi" or "Cleft" points, signifying a division between the muscle and tendon. HT 6, "Yin Cleft" is such a point along the HT channel, considered a Yin channel because it courses along the inner and palmar surface of the thoracic limb. Tender myotendinous junctions signal active trigger points resulting from irritable nociceptors and poor oxygenation relative to normal myotendinous junctions. Myotendinous junctions in the wrist and hand contain a high density of Golgi tendon organs (GTO), particularly in the muscular portion of thejunction (Jozsa L, Balint J, Kannus P, et al. Mechanoreceptors in human myotendinous junction. *Muscle & Nerve.* 1993;16:453-457). GTO's work with muscle spindles to signal position and respond to active contraction in the muscle as well as passive stretch. Free nerve endings in these zones serve as pain receptors. In addition to GTO's and free nerve endings, the myotendinous junction also contains Ruffini and Pacinian corpuscles, i.e., mechanoreceptors that aid the GTO and free nerve endings in orchestrating coordinated and protective control over complex bodily movements. Thus, myotendinous junctions house four types of sensory nerve endings: Type I (Ruffini corpuscles, pressure sensors), Type II (Pacinian corpuscles, also pressure sensors), Type III (GTO's) and Type IV (free nerve endings).

- **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius and ulna.
- **Flexor carpi ulnaris muscle:** Adducts and flexes the hand at the wrist.

Clinical Relevance: Prolonged contraction of the forearm and hand flexors can lead to fatigue and myofascial dysfunction. Activities include motorcycle racing and other high-force, repetitive activities.[1] The cross-sectional anatomy visible in Figure 5-15 illustrates the relationships of the local musculature to the entry site at HT 6, suggesting the angle and depth required for local trigger point deactivation.

Tension in the flexor carpi ulnaris muscle contributes to ulnar nerve lesions at the elbow more commonly than does tension in the flexor digitorum profundus.[2] Ulnar neuropathy at the wrist is more rare and difficult to localize with routine electrophysiologic studies than ulnar neuropathy at the elbow.[3] Myofascial palpation of the tissues along the course of the ulnar nerve often reveals the locus of dysfunction and prompts attention to the site through medical acupuncture and related techniques.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Note: Communicating branches pass between the median and ulnar nerves.**
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Venipuncture can injure the medial antebrachial cutaneous nerve. The nerve becomes subcutaneous just proximal to the medial epicondyle. It follows the HT channel region to provide cutaneous sensation to the ulnar aspect of the antebrachium.[4] Steroid injection for medial epicondylitis, cubital tumor surgery, arthroscopy of the elbow, and routine venipuncture can injure the nerve, along with repetitive motion trauma, soft tissue injury, and subcutaneous lipomas.

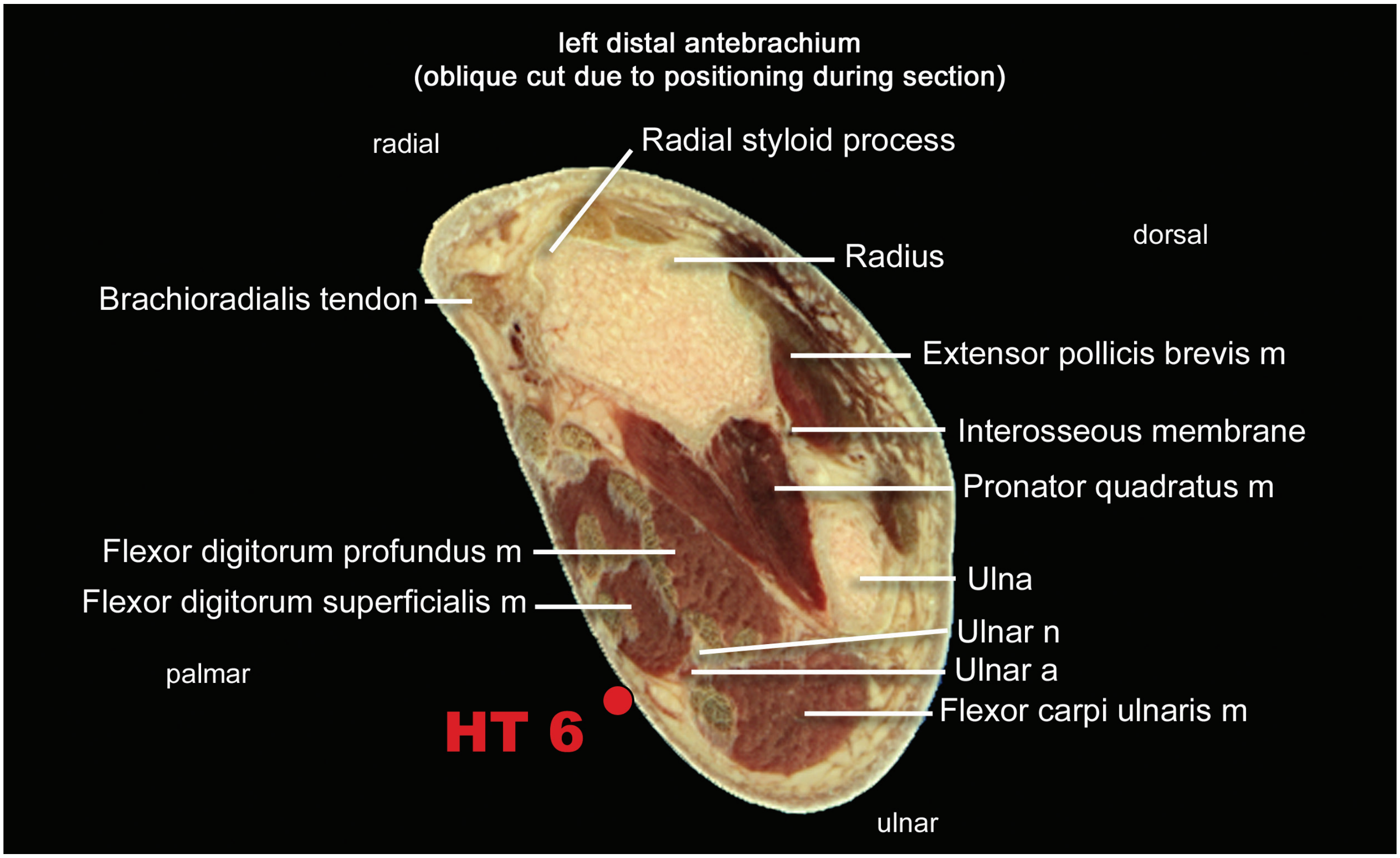

left distal antebrachium
(oblique cut due to positioning during section)
radial
Radial styloid process
Radius
dorsal
Brachioradialis tendon
Extensor pollicis brevis m
Interosseous membrane
Pronator quadratus m
Flexor digitorum profundus m
Flexor digitorum superficialis m
Ulna
Ulnar n
Ulnar a
palmar
HT 6
Flexor carpi ulnaris m
ulnar

Figure 5-15. As with the other HT points near the wrist, the ulnar nerve and artery stand in close approximation.

A sensory neuropathy can result. Medical acupuncture and related techniques will support neural recovery.

The ulnar nerve suffers compression at the wrist from soft tissue expansions such ganglion cysts.[5] Ulnar neuropathy at the wrist can express itself as a mixed motor and sensory neuropathy, purely motor, or purely sensory.[6]

Following repair of the ulnar and median nerves, sympathetic unmyelinated fibers regrow more quickly than sensory myelinated fibers. The relative amount of autonomic versus somatic nerve endings in an acupuncture point locale colors the kind of response the tissue exhibits.

Vessels

- **Ulnar artery:** Arises near the neck of the radius in the cubital fossa. It provides several branches, including the anterior and posterior (branches of the) ulnar recurrent arteries, the common interosseous artery, the anterior and posterior interosseous arteries, and the dorsal and palmar carpal branches, which anastomose with the radial artery.
- **Ulnar veins:** These paired veins drain the forearm and accompany the ulnar artery. The receive tributaries from muscles lying nearby.

Clinical Relevance: Note the proximity of the ulnar nerve and artery to HT 6 in Figure 5-15. Needling directly into the ulnar artery and nerve at this site could cause hemorrhage and pain. Instead, palpate for the pulse prior to inserting a needle. Angle the insertion toward the muscles instead. That said, nervi vasorum associated with the ulnar artery figure prominently into the cardiovascular and hemodynamic indications of this point.

Indications and Potential Point Combinations

- **Chest pain, angina pectoris, palpitations, chest pressure:** HT 6, with HT 2 or HT 3, PC 6, GV 14, BL 10-BL 15
- **Anxiety, insomnia, night sweats:** HT 6 with PC 4, PC 5, or PC 6, GV 20, LR 3
- **Local pain:** HT 6 if tender, along with other trigger points in the flexor muscles.

References

1. Marina M, Porta J, Vallejo L, et al. Monitoring hand flexor fatigue in a 24-h motorcycle endurance race. *Journal of Electromyography and Kinesiology.* 2011;21:255-261.
2. Eliaspour D, Seighipour L, Hedayati-Moghaddam MR, et al. The pattern of muscle involvement in ulnar neuropathy at the elbow. *Neurol India.* 2012;60(1):36-39.
3. Cowdery SR, Preston DC, Herrmann DN, et al. Electrodiagnosis of ulnar neuropathy at the wrist. Conduction block versus traditional tests. *Neurology.* 2002;59(3):420-427.
4. Asheghan M, Khatibi A, and Holisaz MT. Paresthesia and forearm pain after phlebotomy due to medial antebrachial cutaneous nerve injury. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2011;6:5.
5. Karam C, Quin CC, Paganoni S, et al. Teaching NeuroImages: Ganglion cyst causing pure sensory ulnar neuropathy at the wrist. *Neurology.* 2012;79(8):e76-e76.
6. Wu JS, Morris JD< and Hogan GR. Ulnar neuropathy at the wrist: case report and review of literature. *Arch Phys Med Rehabil.* 1985;66(11):785-788.

HT 7

Shen Men "Spirit Gate"

On the wrist crease, in the articular region between the pisiform bone and the ulna, in a depression on the radial aspect of the flexor carpi ulnaris tendon. When needling a patient who is in the prone position, HT 7 can be needled on the ulnar side of the flexor carpi ulnaris tendon, close to its insertion and directed toward the radial side of the tendon.

Note how Figure 5-17 reveals proximity of the HT channel to the median of the volar antebrachium where the PC line lies. This intimate association anatomically explains why the HT and PC point exhibit commonality in their indications.

Tendons

- **Flexor digitorum superficialis tendon:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints. Also flexes the proximal phalanges at the wrist and metacarpophalangeal joints.
- **Flexor digitorum profundus tendon:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.
- **Flexor carpi ulnaris tendon:** Adducts and flexes the hand at the wrist.

Clinical Relevance: Figure 5-18 reveals the close assortment of tendons coursing beneath HT 7. Falling and bracing oneself with the outstretched hand occasionally injure flexor and extensor tendons.[12] Of the flexor tendons involved in Colles' fractures, the flexor digitorum profundus to the index finger and the flexor pollicis longus are most likely to be affected. Some flexor tendon ruptures in patients with rheumatoid arthritis occur as a result of wear by bone spurs or direct invasion of hypertrophic tenosynovium.[13]

Medical acupuncture and related techniques such as laser therapy would improve tendon health and healing capacity through direct tissue effects on injured segment and relaxation of the tissue in the muscle belly to reduce traction on the tendon.

Those who participate in grip sports sometimes develop entrapment syndromes.[14] See next section on nerves regarding their entrapments by tendons and other entities. Use acupuncture and related techniques to relax myotendinous regions and foster flexibility in wrist and antebrachial structures.

Nerves

- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal

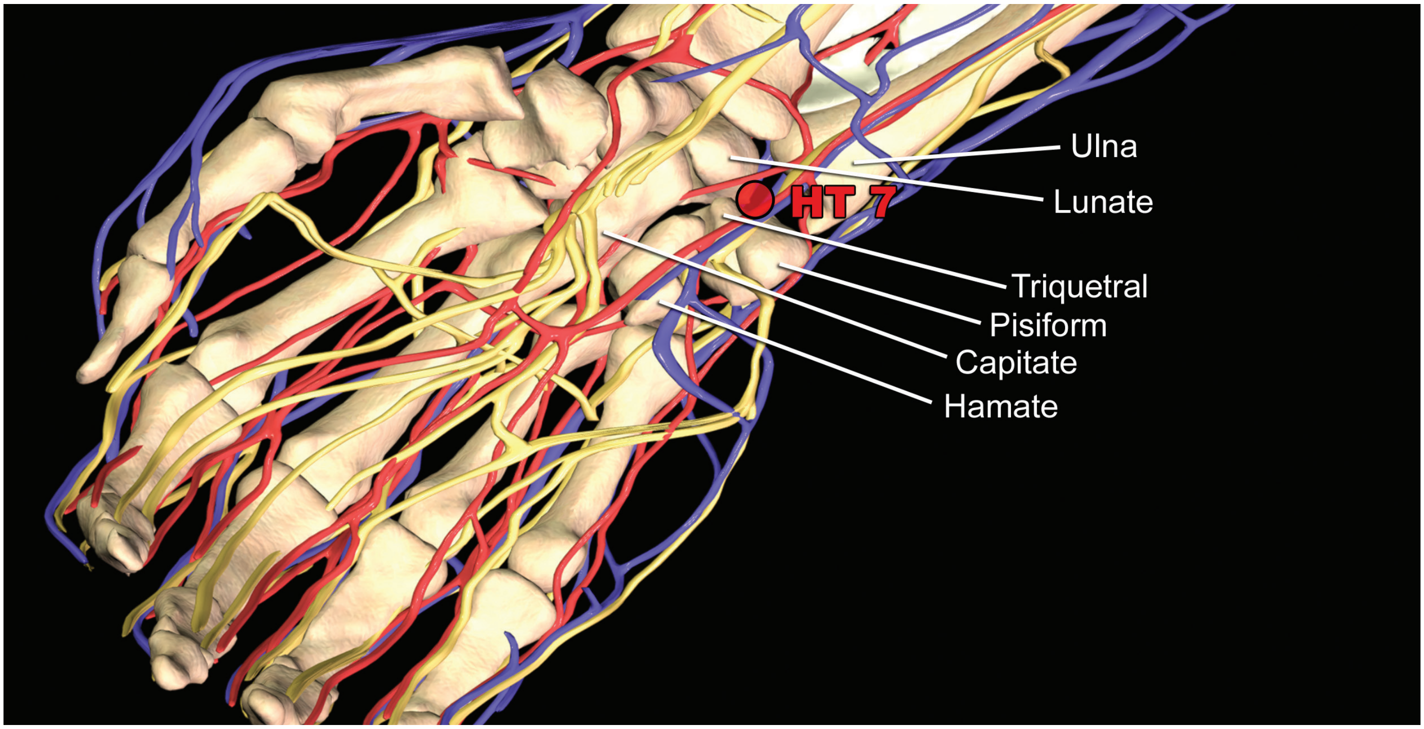


Figure 5-16. HT 7, "Spirit Gate" or "Spirit Door", is considered a passageway to the spirit that allows acupuncture to induce calm. Auricular Shen Men has been dubbed the "Valium® point" for its similarly calming effects. Whereas auricular Shen Men invokes trigeminovagal influences to calm the nervous system, body Shen Men (i.e., HT 7), modulates autonomic function by influencing sympathetic fibers in the nervi vasorum and ulnar nerve.

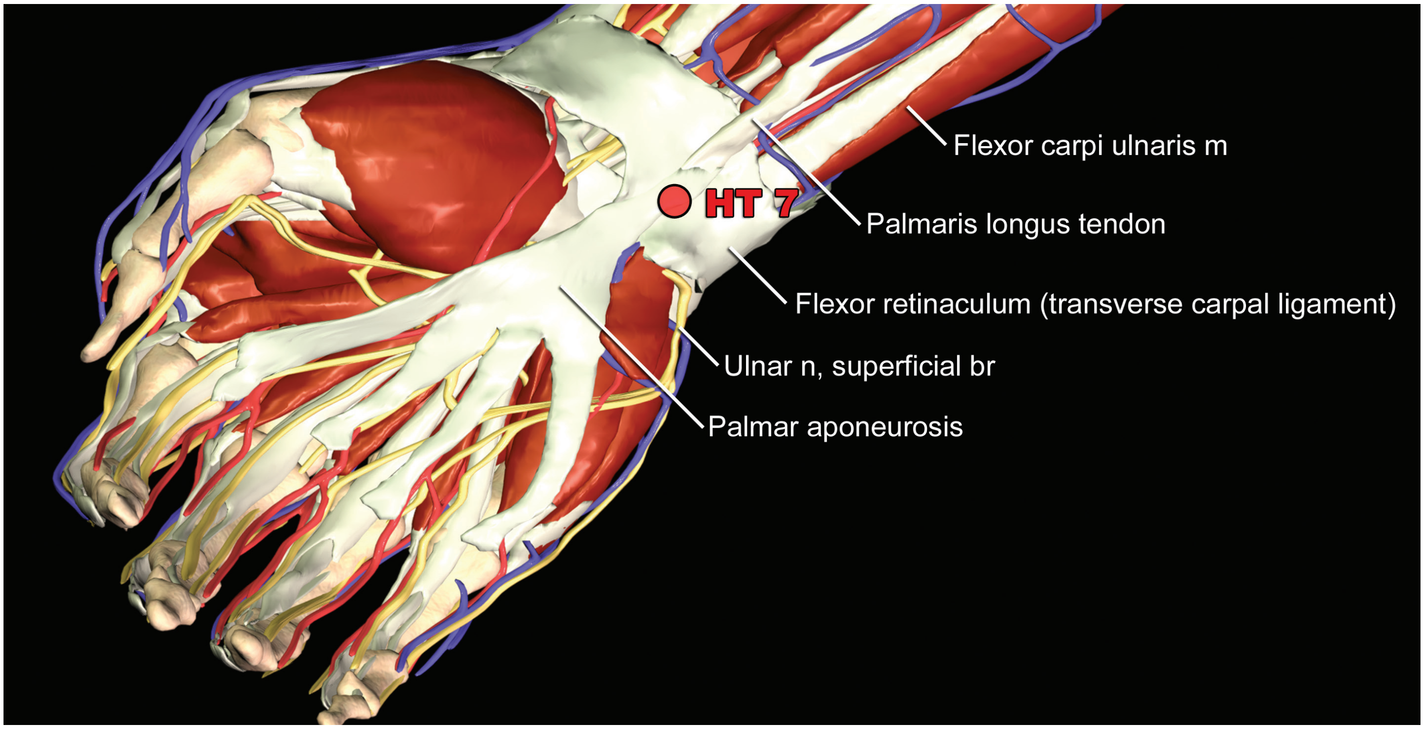


Figure 5-17. Connective tissue and myofascial restriction in the flexor compartment of the wrist produces pain and limits movement in the wrist. Acupuncture, massage, and laser therapy in the vicinity of HT 7 reduces tension in the structures appearing in this image as well as underlying tissue, depending on the depth that the stimulation reaches. See Figure 5-18 to study the cross-sectional anatomy at the level of HT 7.

palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Some anatomists contend that three different tunnels exist in the wrist and that Guyon's canal is frequently misrepresented or confusingly outlined. They define the tunnels as 1) a carpal tunnel deep to the flexor retinaculum; 2) the canalis ulnaris (Guyon's canal) between two layers of the flexor retinaculum; and 3) the canalis pisohamatum that issues the deep branch of the ulnar nerve into the hypothenar eminence.[15]

Ulnar nerve entrapment in the wrist, called Guyon's canal syndrome, refers to a compression neuropathy at the wrist or hand that can cause loss of motor, sensory, or both motor and sensory function within the ulnar nerve distribution.[16] Various growths, degenerative conditions, inflammation, and trauma in the vicinity of the ulnar nerve injure it. Specific processes include ganglion cysts, anomalous musculotendinous arches, lipomas, ulnar neuropathy, hamate fractures, ulnar hand trauma, and occupational requirements for wrist hyperextension over long periods of time.

Ozdemir et al describe Guyon's canal as a 4.0 – 4.5 cm long tunnel starting proximal to the hypothenar eminence and extending to the fibromuscular arch at the hypothenar eminence.[17] The palmar carpal ligament, palmaris brevis, and fibrous tissue build the roof of the canal. The flexor digitorum profundus, transverse carpal ligament, the pisohamate and pisometacarpal ligaments form the floor. The flexor carpi ulnaris, pisiform bone, and abductor digiti minimi create the ulnar aspect of the canal. Its radial side comprises the hook of the hamate, transverse carpal ligament, and digital flexor tendons.

Guyon's canal courses along the groove between HT 7 (see Figure 5-16) and HT 8 (Figure 5-19). Note the relationship between HT 7 in Figure 5-16 and the ulnar nerve, artery, and vein it overlies. Acupuncture and related techniques such as massage and laser therapy applied to HT 7 and its myofascial vicinity invites the tissue to relax and relieve pressure on the nerve. Carpal tunnel syndrome, a median nerve entrapment syndrome, at times produces ulnar neuropathy as tension in the wrist extends to involve additional nerves. In addition, postoperative fibrosis after carpal tunnel surgical release can contribute to ulnar nerve entrapment in Guyon's canal.

Vessels

- **Ulnar artery:** Arises near the neck of the radius in the cubital fossa. It provides several branches, including the anterior and posterior (branches of the) ulnar recurrent arteries, the common interosseous artery, the anterior and posterior interosseous arteries, and the dorsal and palmar carpal branches, which anastomose with the radial artery.
- **Ulnar veins:** These paired veins drain the forearm and accompany the ulnar artery. The receive tributaries from muscles lying nearby.

Clinical Relevance: Aneurysm of the ulnar artery appears after traumatic injury to the hand in sports activities such as a basketball dunk.[18] Take care to not penetrate the ulnar artery aneurysm with an acupuncture needle.

One complication of steroid injection for carpal tunnel syndrome involves ulnar artery ischemia.[19] Acupuncture and related techniques improve tissue circulation and can serve as helpful adjuncts in such situations.

The main indications for HT 7 include anxiety and insomnia. The ability of HT 7 to impact the psyche likely relates to the abundant autonomic fibers adjacent to the point, including the

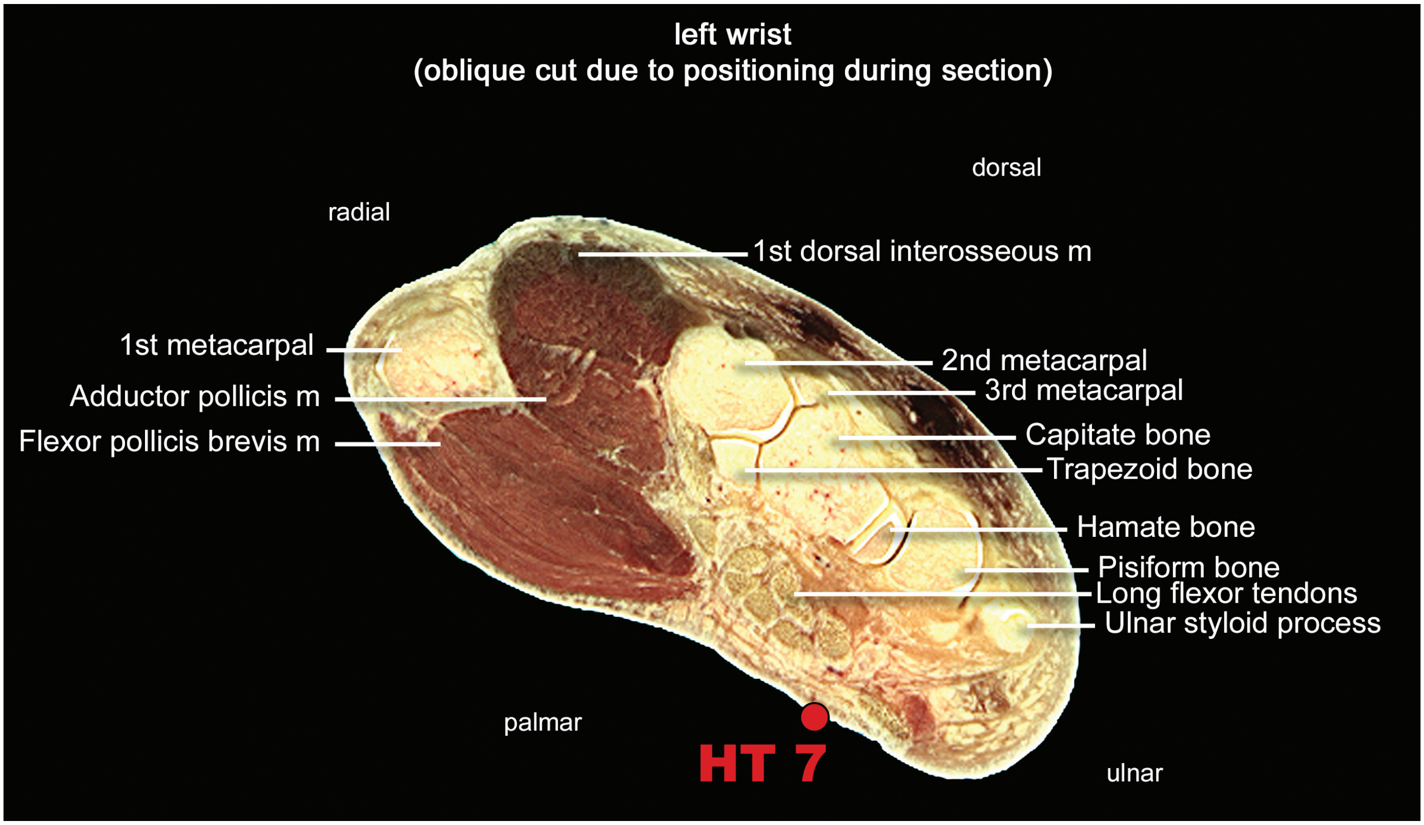


Figure 5-18. The ulnar vessels and nerve appear directly below HT 7 in this cross section, on the ulnar aspect of the long flexor tendon groups.

nervi vasorum of the ulnar artery and sympathetic fibers in the ulnar nerve.

Indications and Potential Point Combinations

- **Mental-emotional agitation; depression; stress-related palpitations, angina pectoris, hypertension, seizures, memory loss, or insomnia:** HT 7, plus PC 7, HT 3, LR 3, ST 36
- **A feeling of heat in the palms, thirst for cold drinks:** HT 7, LI 4, ST 36, ST 44, LR 3
- **Emergence agitation in pediatric patients:** HT 7, LI 4

Evidence-Based Applications

- **Stress**[1]
- **Insomnia**[2]
- **Post-stroke anxiety:** HT 7, GV 20, GV 24, Yintang (GV 24.5), GV 26, LI 4, LR 3, and PC 6.[20]
- Capsicum (hot pepper) plasters applied to HT 7 reduced **emergence agitation in pediatric patients undergoing tonsillectomy and/or adenoidectomy.**[21]
- Acupuncture at LI 4 and HT 7 immediately after induction of anesthesia significantly lowered pain and agitation scores in children after **bilateral myringotomy and tympanostomy.**[22]
- Acupressure at HT 7 improves sleep quality and reduces anxiety in **insomniacs.**[23,24]
- Acupuncture at HT 7 and BL 40, along with CV 3, BL 23, CV 6, LU 9, LR 3, and LR 2 reduced **nocturnal enuresis in children** in a Chinese case series.[25]
- Acupuncture at HT 7, PC 6, GV 26, SP 6, and GV 20 improved **mental depression after stroke** in a Chinese case series.[26]
- Acupuncture at HT 7 in rats sensitized to morphine significantly decreased dopamine release in the nucleus accumbens and the behavioral activity induced by a systemic morphine challenge. This suggests that the beneficial effect of acupuncture for morphine addiction may work by inhibiting the neurochemical and behavioral **sensitization to morphine.**[3]
- Acupuncture at HT 7, but not at PC 6 or a tail point, significantly prevented a decrease in extracellular dopamine levels in the nucleus accumbens during **withdrawal from ethanol.** It also significantly prevented an increase in accumbal dopamine levels subsequent to an ethanol challenge, in chronic ethanol-treated rats. These results indicate that HT 7 helps normalize dopamine release in the mesolimbic system in chronic ethanol-treated rats.[4]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[5]
- Neural tracer investigation found central neural pathways from the heart and acupuncture points PC 6 and HT 7 in the middle cervical, stellate, and T4 sympathetic ganglia and the T2 to T6 spinal ganglia. Sites of overlap were also found in the brain and spinal cord, illustrating the interrelationship of PC 6, HT 7, and **autonomic regulation of heart function.**[6]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with **Sjögren's syndrome.**[7]
- Laser acupuncture significantly outperformed sham laser for

the treatment of **mild to moderate depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[8]

- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes.**[9]
- Electroacupuncture at CV 4, GV 20, SP 6, KI 3, and HT 7 may have afforded a modulating positive effect on **psychogenic and non-psychogenic erectile dysfunction.** It improved the quality of erection and restored sexual activity in 39% of patients.[10]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[11]

References

1. Chan J, Briscomb D, Waterhouse E, and Cannaby A-M. An uncontrolled pilot study of HT7 for "stress". *Acupuncture in Medicine*. 2002;20(2-3):74-77.
2. Lin Y. Acupuncture treatment for insomnia and acupuncture analgesia. *Psychiatry and Clinical Neurosciences*. 1995;49:119-120.
3. Kim MR, Kim SJ, Lyu YS, Kim SH, Lee YK, Kim TH, Shim I, Zho R, Golden GT, and Yang CH. Effect of acupuncture on behavioral hyperactivity and dopamine release in the nucleus accumbens in rats sensitized to morphine. *Neuroscience Letters*. 2005;387:17-21.
4. Zhao RJ, Yoon SS, Lee BH, Kwon YK, Kim KJ, Shim I, Choi K-H, Kim MR, Golden GT, and Yang CH. Acupuncture normalizes the release of accumbal dopamine during the withdrawal period and after the ethanol challenge in chronic ethanol-treated rats. *Neuroscience Letters*. 2005. In press.
5. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research*. 2003;31:552-556.
6. Jang I, Cho K, Moon S, Ko C, Lee B, Ko B, and Lee C. A study on the central neural pathway of the heart, Nei-Kuan (EH-6) and Shen-Men (He-7) with neural tracer in rats. *American Journal of Chinese Medicine*. 2003;31(4):591-609.
7. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation*. 1993;20:541-548.
8. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine*. 2005;23(3):103-111.
9. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society*. 1995;2(1):3-12.
10. Kho HG, Sweep CGJ, Chen X, Rabsztyn PRI, and Meuleman EJH. The use of acupuncture in the treatment of erectile dysfunction. *International Journal of Impotence Research*. 1999;11:41-46.
11. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.
12. Iyer S, Basu I, Kaba R, et al. Rupture of all digital flexors following Colles' fracture. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2012;65:e290-e292.
13. Ertel AN. Flexor tendon ruptures in rheumatoid arthritis. *Hand Clin*. 1989;5(2):177-190.
14. Provyn S, Atanesyan H, Shahabpour M. The hazards of the neurovascular passage in the wrist. *Science & Sports*. 2008;23:61-65.
15. Provyn S, Atanesyan H, Shahabpour M. The hazards of the neurovascular passage in the wrist. *Science & Sports*. 2008;23:61-65.
16. Ozdemir O, Calisaneller T, Gulsen S, et al. Ulnar nerve entrapment in Guyon's canal due to recurrent carpal tunnel syndrome: case report. *Turkish Neurosurgery*. 2011;21(3):435-437.
17. Ozdemir O, Calisaneller T, Gulsen S, et al. Ulnar nerve entrapment in Guyon's canal due to recurrent carpal tunnel syndrome: case report. *Turkish Neurosurgery*. 2011;21(3):435-437.
18. Cohen-Kashi KJ, Leeman J, Rothkopf I, et al. Traumatic artery aneurysm secondary to basketball dunk: a case report and review. *Vascular*. 2012;20(2):96-99.
19. Hussain SS, Taylor C, and Van Rooyen R. Ulnar artery ischaemia following corticosteroid injection for carpal tunnel syndrome. *N Z Med J*. 2011;124(1335):80-83.
20. Wu P and Liu S. Clinical observation on post-stroke anxiety neurosis treated by acupuncture. *J Trad Chin Med*. 2008;28(3):186-188.
21. Acar HV, Yilmaz A, Demir G, et al. Capsicum plasters on acupoints decrease the incidence of emergence agitation in pediatric patients. *Paediatr Anaesth*. 2012;22(11):1105-1109.
22. Lin Y-C, Tassone RF, Jahng S, et al. *Pediatric Anesthesia*. 2009;19:1096-1101.
23. Nordio M and Romanelli F. Efficacy of wrists overnight compression (HT 7 point) on insomniacs: possible role of melatonin? *Minerva Med*. 2008;99(6):539-547.
24. Cerrone R, Giani L, Galbiati B, et al. Efficacy of HT 7 point acupressure stimulation in the treatment of insomnia in cancer patients and in patients suffering from disorders other than cancer. *Minerva Med*. 2008;99(6):535-537.
25. Yuping W, Runfang L, and Hua K. Acupuncture treatment of children nocturnal enuresis – a report of 56 cases. *J Tradit Chin Med*. 2006;26(2):106-107.
26. Zhang C. The brain-resuscitation acupuncture method for treatment of post wind-stroke mental depression – a report of 45 cases. *J Tradit Chin Med*. 2005;25(4):243-246.

HT 8

Shao Fu "Lesser Palace"

On the palm of the hand, between the 4th and 5th metacarpal bones, in the area where the tip of the 5th digit touches the palm when a tight fist is made. Usually occurs between the two transverse palmar creases.

Fascia

- Palmar aponeurosis: the deep fascia over the palm that covers the underlying soft tissues and flexor tendons. The tendon of the palmaris longus fuses with the palmar aponeurosis and the underlying flexor retinaculum (transverse carpal ligament) at the wrist. The palmar aponeurosis appears in Figure 5-17.

Clinical Relevance: Dupuytren contracture develops when collagen nodules and cords manifest and shorten the palmar fascia, causing digital flexion deformity.[2] This fibroproliferative disorder more commonly afflicts the ring and little fingers along the HT channel. Recurrence after surgical correction is common. Prevention and treatment with nonsurgical methods such as physical therapy, soft tissue manual therapy, stretch, laser therapy, and acupuncture at HT 8 and surrounding region should be tried before fasiotomy or fasciectomy.

Muscles and Tendons

- **Flexor digitorum superficialis tendons to the 4th and 5th digits:** Flex the middle phalanges of the fingers at the proximal interphalangeal joints. Also flex the proximal phalanges at the wrist and metacarpophalangeal joints.
- **Flexor digitorum profundus tendons to 4th and 5th digits:** Flex the distal phalanges at the distal interphalangeal joints of the fingers. Aid flexion of the hand.
- **4th lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extend the interphalangeal joint.
- **3rd palmar interosseous muscle:** Adducts the digits toward the axial line. Assists the lumbrical muscles in extending the interphalangeal joints and flexing the metacarpophalangeal joints.
- **4th interosseous dorsalis muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.

Clinical Relevance: HT 8 lands at a particularly muscular section of the hand, explaining its applications for hand pain and nerve entrapment. Because needling a sensitive region such as the palm causes discomfort, myofascial release and laser therapy will likely be more readily accepted for trigger point deactivation and fascia work.

Nerves

- **Palmar cutaneous branch of the ulnar nerve:** Supplies the skin on the medial (ulnar) aspect of the palm and wrist.
- **Common palmar digital nerves:** Arise from the median nerve and the superficial branch of the ulnar nerve. They branch to become the proper palmar digital nerves. They provide sympathetic motor supply to the skin of the palmar surfaces of the

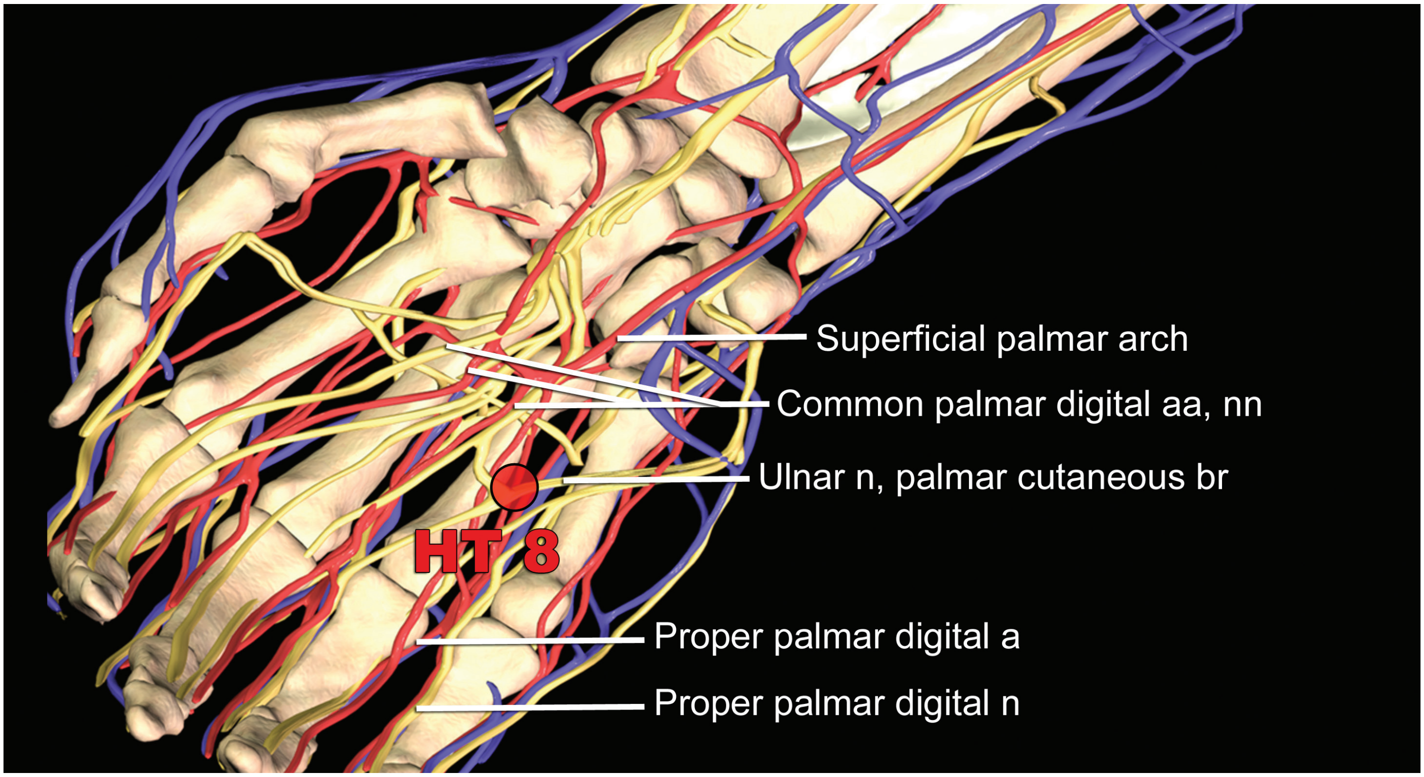


Figure 5-19. The Chinese name for HT 8, "Shao Fu" employs the term "Shao" or "Lesser" for a point along the HT like Shao Hai did for HT 3. "Shao" suggests the channel's anatomic term "Shao Yin of the Arm". Too, HT 8 resides near PC 8, "Palace of Toil"; refer to Figures 9-23 to 9-26 for anatomical comparisons. In contrast to PC 8, the neurovasculature structures near HT 8 are indeed somewhat "lesser" considering they supply the ring and little fingers rather than the index and middle digits. As such, the palace where HT 8 resides is anatomically less well endowed. Note, as well, the size difference in the gap between metacarpals IV and V (at HT 8) as opposed to that between II and III (PC 8).

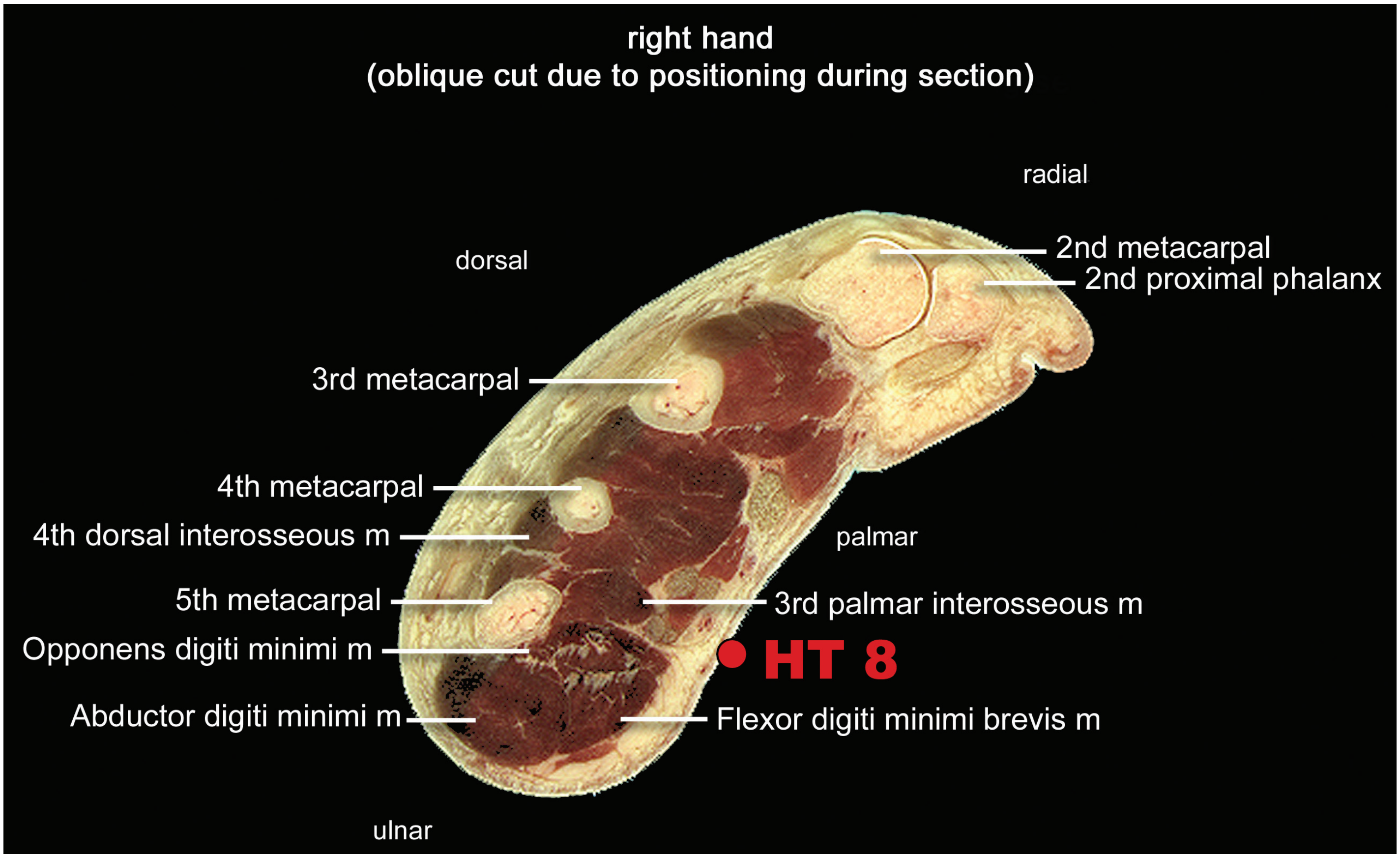


Figure 5-20. At first, the muscularity of HT 8 appears to overshadow the vasculature in this cross section, visible as small, oblong red structures superficial to the muscular structures. These arteries are part of the superficial palmar arterial arch or its branches. Remember that the arteries of the hand house a rich supply of nervi vasorum, i.e., autonomic nerves that control blood vessel diameter in response to changes in temperature and psychological states.

adjacent sides of two digits. The proper palmar digital nerve branches supply the dorsum of the fingertip, in the nail bed region. The proper palmar digital nerve branches from the ulnar nerve supply the palmar and dorsal skin on the medial side of the 4th digit and the entire 5th digit and the respective nail beds. The proper palmar digital nerves originating from the median nerve supply the palmar skin and nail bed of the thumb, index, and middle finger, as well as the radial side of the ring finger (4th digit).

- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: The highly muscular region around HT 8 (shown in Figure 5-20) emphasizes the possibility of ulnar nerve entrapment secondary to hand strain and repetitive motion injury. Anomalous muscle trajectories commonly occur in this region, increasing the potential for nerve compression at Guyon's canal. For example, the flexor digiti minimi brevis has been shown to traverse Guyon's canal where ulnar tunnel syndrome arises.[3] Anatomical variations also affect the abductor digiti minimi muscle[4] and the palmaris brevis.

Vessels

- **Superficial palmar arch:** This constitutes the main termination of the ulnar artery. The superficial palmar arch gives rise to three common palmar digital arteries. These arteries anastomose with the palmar metacarpal arteries, which arise from the deep palmar arterial arch. In contrast to the superficial palmar arch which arises mainly from the ulnar artery, the radial artery provides the main arterial basis for the deep palmar arch. The superficial and deep palmar arterial arches serve as the main sources of blood supply to all structures in the human hand. Preservation of fetal arteries in dominant hands may account for the preservation of complete superficial arterial arches into adulthood.[5]
- **Common palmar digital artery for 4th and 5th digits:** Each common palmar digital artery divides into proper palmar digital arteries, which give rise to a dorsal branch innervating the finger

tips with vessels known as the dorsal branches of the proper palmar digital arteries. The proper palmar digital arteries course along the adjacent sides of digits II through IV.

- **Common palmar digital veins for 4th and 5th digits:** The superficial and deep palmar venous arches accompany the superficial and deep palmar arterial arches.

Clinical Relevance: Acute digital pain, discoloration, reduced skin temperature, and cyanosis without Raynaud syndrome should prompt one to consider the diagnosis of acute digital ischemia.[6] Consider referral for microsurgical exploration and embolus localization. An aneurysm of the ulnar artery, atrial fibrillation, or thoracic outlet syndrome can contribute to the development of digital embolism. Ulnar pseudoaneurysm is another possible etiology. Vascular wall damage can occur secondary to needling trauma, emphasizing the need for caution when introducing acupuncture needles into highly vascular territory. Delaying recognition and aggressive microsurgical treatment raises the possibility of the need for finger amputation. While laser therapy, massage, and acupuncture can facilitate recovery from ischemic events, these therapies should be pursued as appropriate and not delay invasive care when warranted.

Raynaud's phenomenon affects the body's extremities by causing an exaggerated vasospastic response to temperature change and/or psychological stress.[7] Patients with systemic sclerosis (also known as scleroderma) and other connective tissue diseases develop Raynaud's as a secondary problem. Primary Raynaud's phenomenon is related to functional alterations in the endothelium of blood vessels. Acupuncture provides relief of Raynaud's phenomenon through neurologic and, possibly, anti-inflammatory effects on cytokine levels.[8]

Indications and Potential Point Combinations

- **Autonomic arousal, including fever, sweating, especially in the palms; feelings of heat in the palms or burning sensations in the hands; palpitations, chest pain:** HT 8, if such a strong intervention seems required, plus consideration of HT 5, PC 6, and PC 7, as well as ST 36 and GV 20.
- **Neural compromise, including paresthesias, paresis, or paralysis in the thoracic limb:** Outline the defective neurologicpathways including the affected spinal cord segments and address accordingly.
- **Raynaud's syndrome:** HT 8 if required; although LI 4, PC 6, ST 36, and LR 3 would be more readily accepted by most patients. Include laser therapy and massage when possible to HT 8 and PC 8.

Evidence-Based Applications

- Acupuncture stimulation of HT 8, BL 66, and LR 2 effectively reduced elevated body temperature induced by **bacterial inflammation,** in part by suppressing hypothalamic production of pro-inflammatory cytokines.[1]

References

1. Son Y-S, Park H-J, Kwon O-B, Jung S-C, Shin H-C, and Lim S. Antipyretic effects of acupuncture on the lipopolysaccharide-induced fever and expression of interleukin-6 and interleukin-1β mRNAs in the hypothalamus of rats. *Neuroscience Letters.* 2002;319:45-48.
2. Werker PMN, Pess GM, van Rijssen AL, et al. Correction of contracture and recurrence rates of Dupuytren contracture following invasive treatment: the importance of clear definitions. *J Hand Surg.* 2012;37A:2095-2105.
3. Madhavi C and Holla SJ. Anomalous flexor digiti minimi brevis in Guyon's canal. *Clin Anat.* 2003;16(4):340-343.
4. Netscher D and Cohen V. Ulnar nerve compression at the wrist secondary to anomalous muscles: a patient with a variant of abductor digiti minimi. *Ann Plast Surg.* 1997;39(6):647-651.
5. Sarkar A, Dutta S, Bal K, et al. Handedness may be related to variations in palmar arterial arches in humans. *Singapore Med J.* 2012;53(6):409-412.
6. Leclere FMP, Mordon S, and Schoofs M. Acute digital ischemia: a neglected microsurgical emergency. Report of 17 patients and literature review. *Microsurgery.* 2010;30:207-213.
7. Brown S. Diagnosis and management of patients with Raynaud's phenomenon. *Nursing Standard.* 2012;26(46):41-46.
8. Omole FS, Lin JS, Chu T, et al. Raynaud's phenomenon, cytokines and acupuncture: a case report. *Acupunct Med.* 2012;30(2):139-141.

HT 9

Shao Chong "Lesser Rushing"

On the radial side of the base of the nail of the 5th digit, the width of a Chinese leek leaf from the corner of the nail.

Nerves

- **Dorsal branches of proper palmar digital nerve:** Arise from the ulnar nerve (C8-T1).

Clinical Relevance: The dorsal sensory nerve reaches the nail bed at the ting points, or end points of each channel.[3] These sites, whether or not they are classical acupuncture points, can improve sensation in digits with compromised nerve supply.

Vessels

- **Dorsal branches of proper palmar digital artery of the radial side of the 5th digit:** Arise from the proper palmar digital arteries, which in turn arise from the superficial palmar arterial arch, which comes from the ulnar artery.

Clinical Relevance: The dorsal branches of the proper palmar digital artery contain a rich supply of nervi vasorum that, when stimulated with an acupuncture needle, can lead to profound hemodynamic shifts. This makes HT 9 one of the prime points for recovery from vasovagal episodes.

Indications and Potential Point Combinations

- **Sympathetic hyperarousal: Mania, palpitations:** HT 9 with PC 7, PC 6
- **Coma, stroke, shock other loss of consciousness states; resuscitation:** HT 9 plus PC 9 and GV 26 (strongly stimulated with a pecking motion)
- **Hyperthermia:** HT 9, bled for extreme conditions, GV 20, LR 2, LR 3.
- **Raynaud phenomenon,** which may be due either to a primary disease such as Fabry disease, systemic sclerosis, or other microangiopathies, or secondary Raynaud's due to a local defect in normal vascular responses in the face of cold temperature or emotional stress causing digital blanching); secondary causes would likely respond more quickly and favorably:[1] HT 9, LI 4, PC 6, ST 36, LR 3, Baxie (in the web spaces between the fingers)
- **Vascular dementia:** Jing-well, or ting points, improve memory in rats with experimental vascular dementia.[4]

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[2]

References

1. Wasik JS, Simon RW, Meier T, et al. Nailfold capillaroscopy: specific features in Fabry disease. *Clinical Hemorheaology and Microcirculation.* 2009;42:99-106.
2. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
3. Bas H and Kleinert JM. Anatomic variations in sensory innervation of the hand and digits. *J Hand Surg.* 1999;24A:1171-1184.
4. He F. Influences of electro-acupuncture at related jing-well points in rats with vascular dementia. *J Tradit Chin Med.* 2012;32(2):238-242.

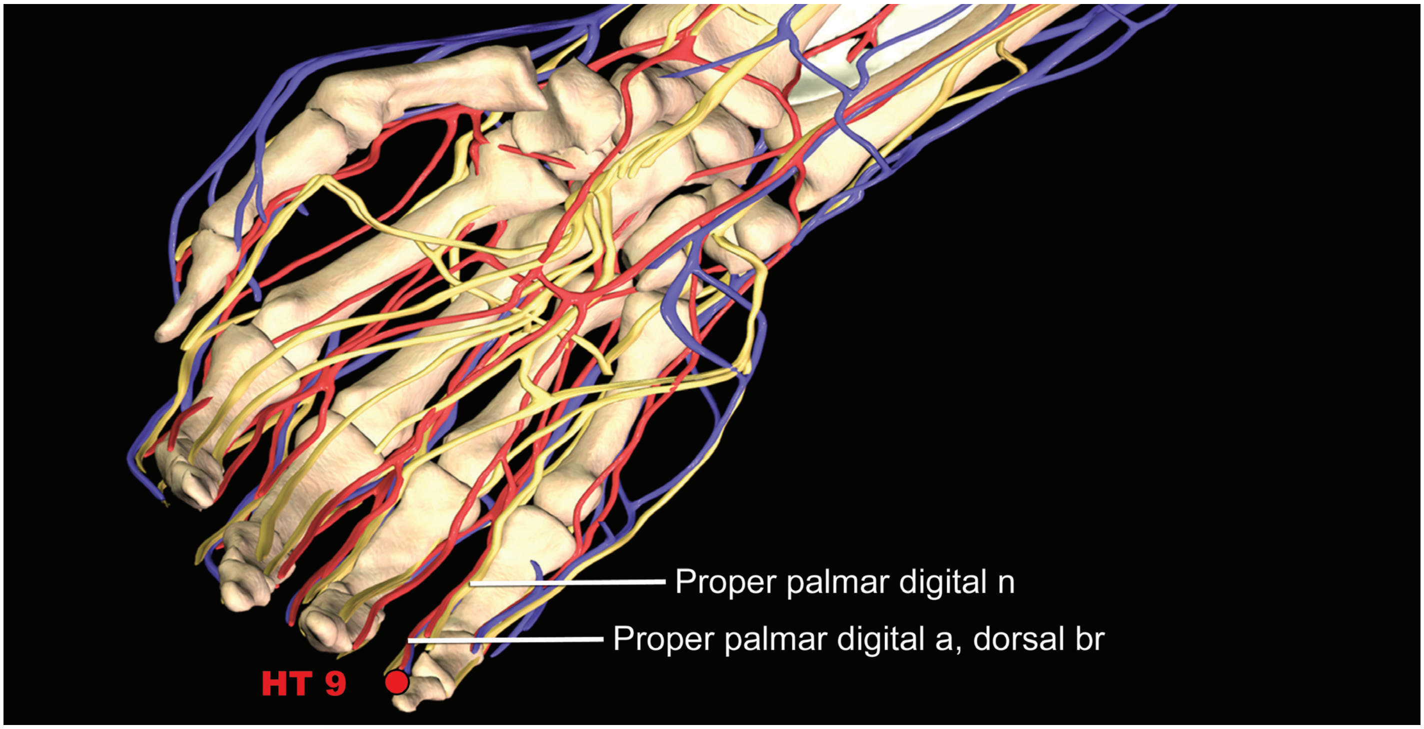
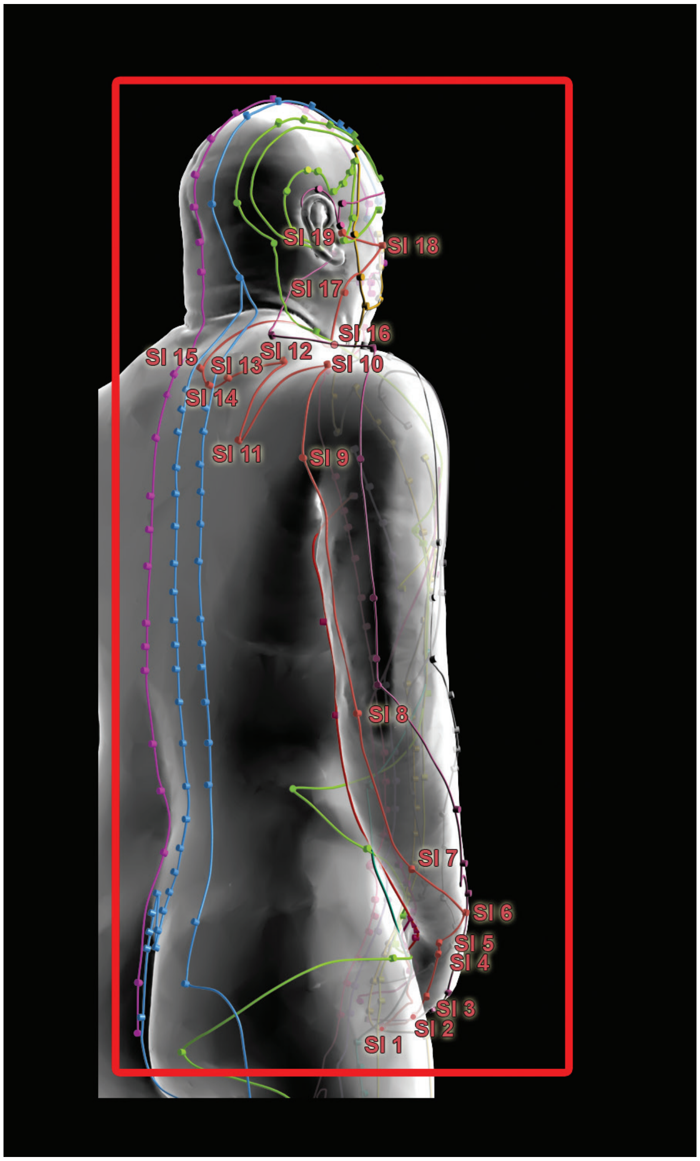
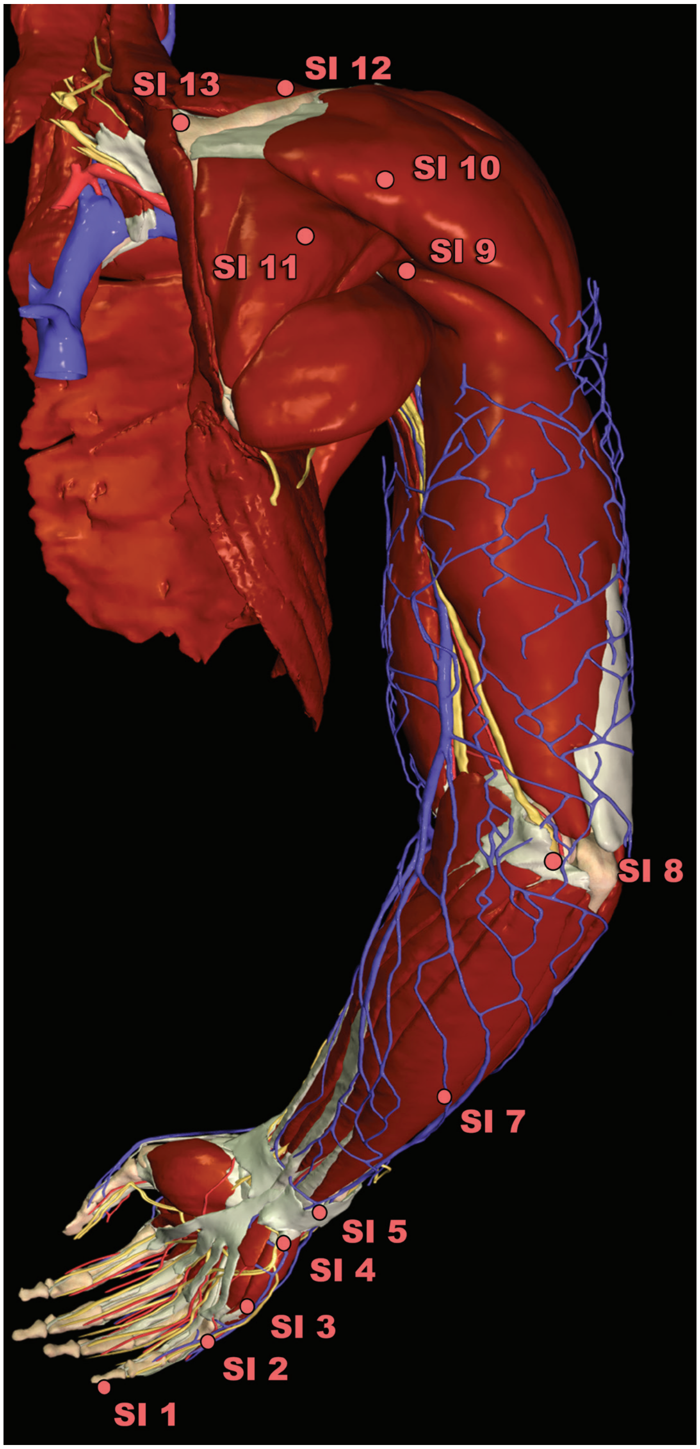


Figure 5-21. The substantial sympathetic supply of nerves affecting the microvasculature near the nails helps explain why certain points such as HT 9 or "Lesser Surge" find their way into treatments for shock and collapse.

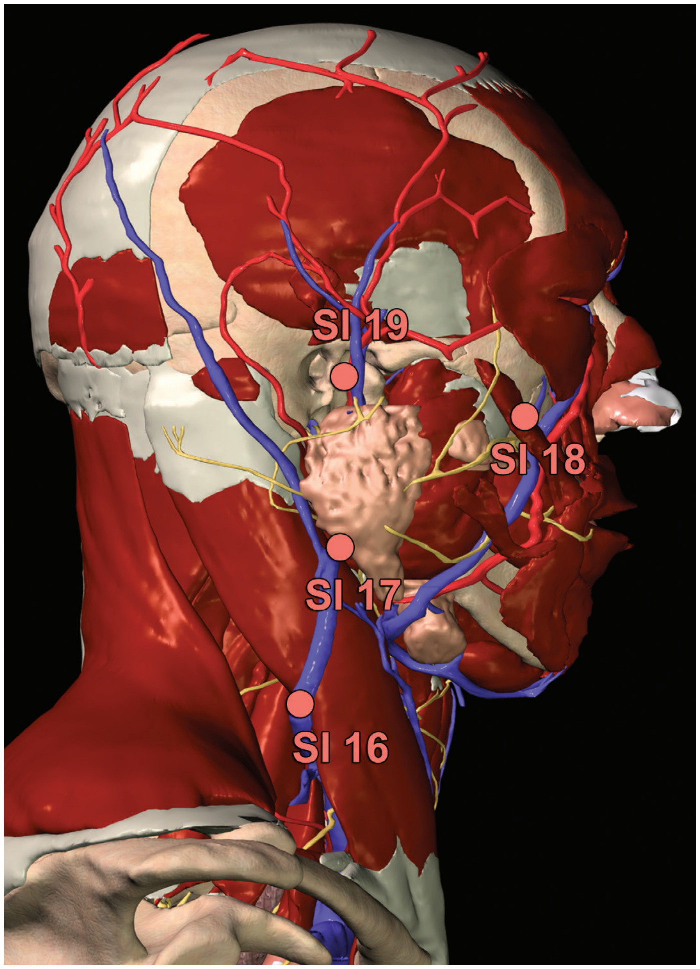
Channel 6:: The Small Intestine (SI)

The Small Intestine channel begins on the little finger near the ulnar side of the fingernail. It migrates toward the wrist along the ulnar aspect of the hand, and takes a short detour to the dorsal distal antebrachium before resuming its ulnar aspect journey to the ulnar groove at the elbow. From there it ascends to the shoulder and ultimately makes it to the ear, but only after zigzagging somewhat erratically over the scapula and lateral face.


SI 19
SI 18
SI 17
SI 16
SI 15
SI 12
SI 13
SI 10
SI 14
SI 11
SI 9
SI 8
SI 7
SI 6
SI 5
SI 4
SI 3
SI 2
SI 1



The anatomical structures beneath the surface trajectory of the Small Intestine channel frequently correspond to the clinical indications given for points along the channel. Points SI 1 to SI 8 relate intimately with the ulnar nerve and its branches. As such, indications for these points include problems related to structures supplied by the ulnar nerve: elbow pain, sensory deficits, ulnar neuralgia, or motor deficits of the flexor carpi ulnaris or the ulnar portion of the flexor digitorum profundus. The SI points scattered over the posterior shoulder address myofascial pain in the shoulder and upper back.



Indications of SI points on the head and neck pertain mostly to problems along the SI channel including pain in the temporomandibular joint, neck, and ear, as well as torticollis.

SI 1

Shao Ze "Lesser Marsh"

Ulnar to the nail base of the 5th digit, the width of a Chinese leek leaf from the corner of the nail.

Nerves

- **Dorsal branches of proper palmar digital nerve:** Arise from the ulnar nerve (C8-T1). The dorsal branches of the proper palmar digital nerves supply branches to the dorsum of the tip of the little finger and nail bed, and the ulnar aspect of the ring finger.

Clinical Relevance: SI 1 is called the "milk let-down point". Lactation requires appropriate responses from the master autonomic control switch, i.e., the hypothalamus. Stimulation of SI 1 activates the C8/T1 spinal cord segments, just cranial to the level at which the sympathetic portion of the spinal cord begins. As the most distal point on the SI channel, SI 1 receives the richest autonomic innervation per unit area of any SI point on the thoracic limb. The ulnar nerve arises from the most caudal spinal segments (i.e., those closest to the mammary glands) forming the brachial plexus. The concatenation of these concepts explains how SI 1 became popular to stimulation lactation.

Vessels

- **Dorsal branches of proper palmar digital artery of the ulnar side of the 5th digit:** Arise from the proper palmar digital arteries, which in turn arise from the superficial palmar arterial arch, which comes from the ulnar artery.

Clinical Relevance: Autonomic offshoots of the ulnar nerve become the nervi vasorum of arterioles at SI 1. These afferents impel neuromodulatory influences from the fingertip to the spinal cord and brain and serve to regulate autonomic tone in the upper body.

Indications and Potential Point Combinations

- **Pain problems along SI and BL channels: torticollis, neck and throat pain, eye pain, occipital headache, severe shoulder pain or ulnar neuropathy:** SI 1 plus tender points local to the pain problem, with BL points located at the relevant spinal cord segments, BL 60, GV 20.
- **Fever and chills:** SI 1 plus ST 36, GV 20.
- **Stroke, coma, loss of consciousness, epilepsy:** SI 1, GV 20
- **Mastitis, hypogalactia, other lactation disorders:** SI 1, ST 18, CV 17, LI 4

Evidence-Based Applications

- Electroacupuncture (EA) at SI 1 **improved lactation quantity and maintained prolactin levels** significantly better than EA at LI 1 according to a Chinese study.[1]

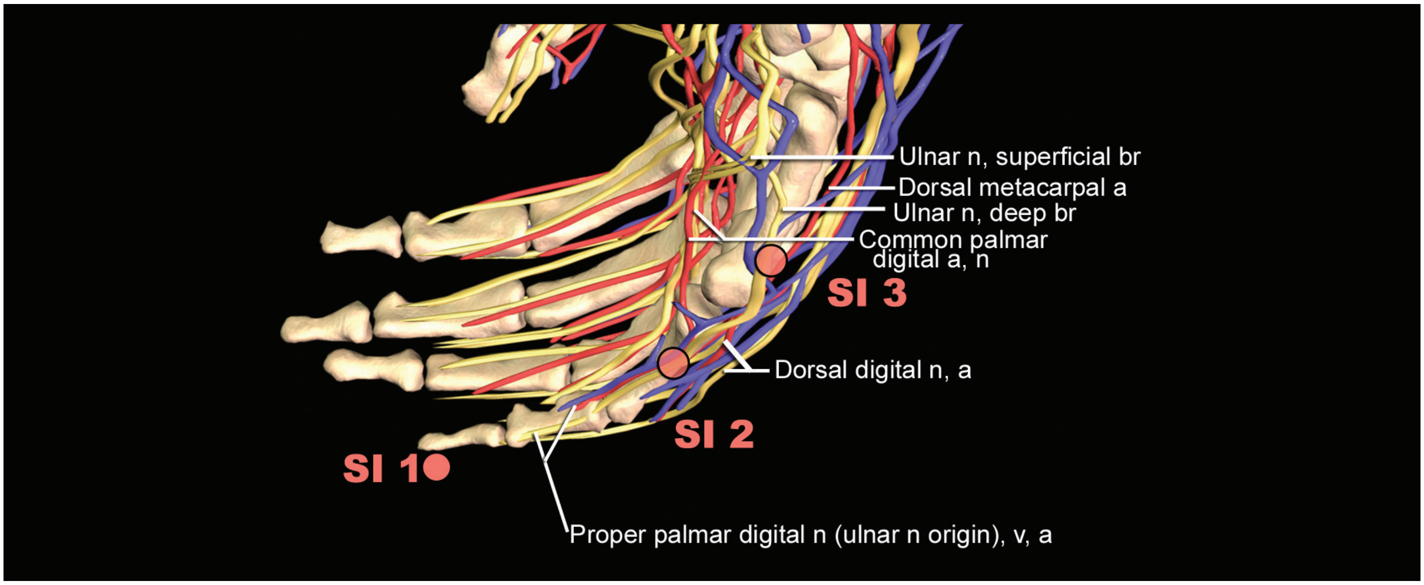


Figure 6-1. According to Nigel Wiseman[2] the original meaning of the character for "Shao", as in "Shao Ze", meant "extremely small". This view of the vascular structures coursing to the fingers indicates how the dorsal branches of the proper palmar digital arteries peter out by the time they inhabit the fingertips. Their "marshiness" or ability to suffuse the nail bed with blood becomes minimal at this site. That said, however, the considerations relevant to neuromodulation pertain to ways in which the abundant nervi vasorum activate the autonomics body-wide.

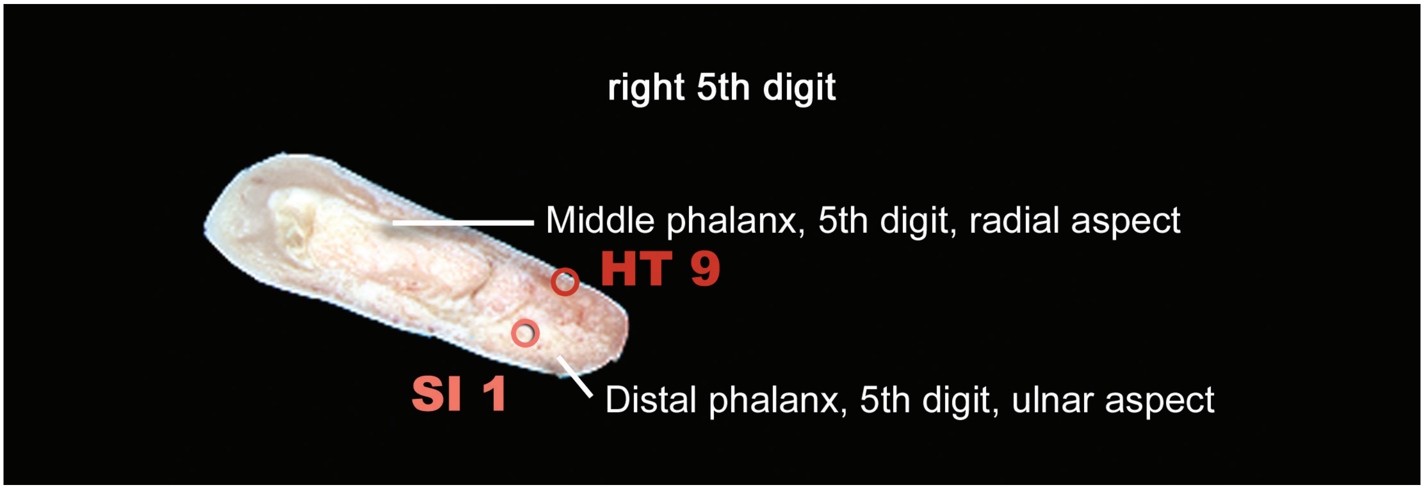

right 5th digit
Middle phalanx, 5th digit, radial aspect
HT 9
SI 1
Distal phalanx, 5th digit, ulnar aspect

Figure 6-2. Both SI 1, “Lesser Marsh” and HT 9, “Lesser Surge” live on the little finger and impact much the same anatomy, signifying the turning point from the HT channel into SI.

References

1. Wei L, Wang H, Han Y, et al. Clinical observation on the effects of electroacupuncture at Shaoze (SI 1) in 46 cases of postpartum insufficient lactation. *J Tradit Chin Med.* 2008;28(3):168-172.
2. Wiseman N. *Chinese Medical Characters 2 Acupoint Vocabulary.* Paradigm Publications. 2005, p. 142.

SI 2

Qian Gu "Front Valley"

On the ulnar side of the little finger, in a depression distal to the 5th metacarpophalangeal joint.

Muscles

- **Abductor digiti minimi muscle of the hand:** Abducts the little finger at the metacarpophalangeal joint. Refer to Figure 6-4 for the anatomic representation of the origin, belly, and insertion of the abductor digiti minimi muscle.

Clinical Relevance: Pathologic nodules and cords that develop in patients with Dupuytren's disease arise from the fascia of the palm and digits. They contain contractile myofibroblasts that shorten and diminish range of motion of the metacarpophalangeal and proximal interphalangeal joints, occasionally involving the distal interphalangeal joint.[1] Digital cords in Dupuytren's contracture will, at times, form within one finger; these isolated cords typically afflict the ulnar aspect of the little finger, within SI channel territory. Cords in this digit may arise from the musculotendinous junction of the abductor digiti minimi or other sites within the finger. They lead to flexion deformities of the proximal interphalangeal joint. Early acupuncture, massage, stretching, and laser therapy may counteract the otherwise inevitable shortening of these myofascial bands that require surgery.

The myotendinous insertion of the abductor digiti minimi muscle (seen on Figure 6-4) contains Golgi tendon organs that serve as proprioceptive sensory receptors that sense stretch and signals force produced by the muscle. Acupuncture treatment at SI 2 will influence impulses sent to the spinal cord and affect muscle firing.

Nerves

- **Common palmar digital branches of the superficial branch of the ulnar nerve:** Supply sympathetic motor innervation to the palmar and dorsal skin of the little finger and ulnar half of the ring finger.
- **Dorsal digital nerves:** Supply the ulnar aspect of the little finger, derived from the ulnar nerve.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as supplies sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), as well as the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Patients with amyotrophic lateral sclerosis (ALS) experience hand muscle wasting that usually affects the thenar muscles and spares, to some degree, the hypothenar muscles such as the abductor digiti minimi.[2] Although the ulnar nerve supplies both the first dorsal interosseous muscle and the abductor digiti minimi, the former undergoes atrophy in ALS

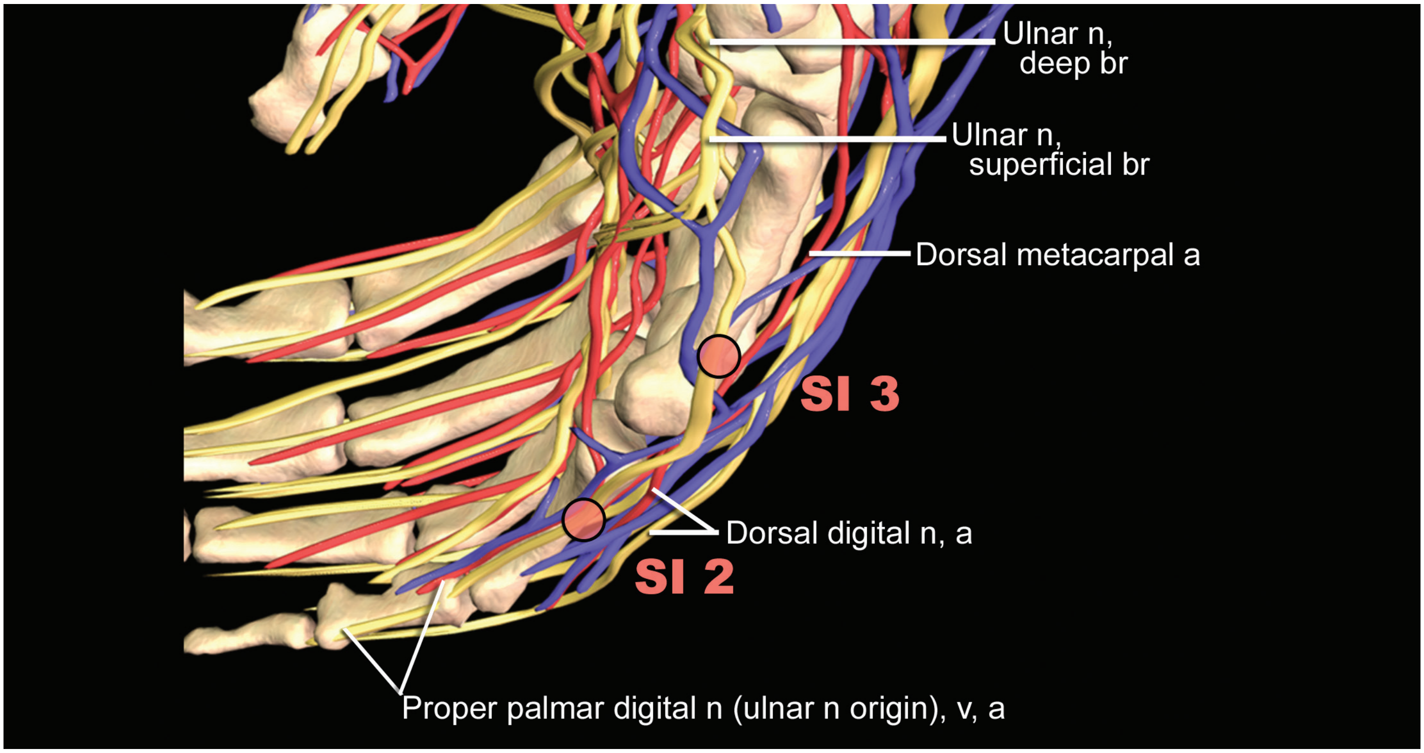


Figure 6-3. Viewing the 5th metacarpophalangeal joint as a mountain facing the fingertip, "Front Valley" (SI 2) and "Back Ravine" (SI 3) refer to the depressions on either side. Note the numerous neurovascular structures crossing this region.

while the latter less so. Whether the underlying mechanism relates to ion channel differences, cortical influences, or differential oxidative stress, this phenomenon called the "split hand syndrome" is considered a useful diagnostic sign in early cases of ALS, with a high degree of specificity. If a patient complains of having problems with a pincer or precision grip, consider ALS within the differential. Although acupuncture and related techniques may assist in preserving hand function, these treatments should not delay appropriate referral and diagnostics.

Metacarpophalangeal (MCP) joint pain in the 5th digit from degenerative joint disease affects local neurovasculature and muscle tension. Acupuncture and related techniques alleviate joint pain by impacting local neurovascular control and reducing myofascial restriction. Acupuncture for joint pain would typically include, for this joint, SI 2 and SI 3.

Vessels

- **Dorsal digital artery:** Arises from the dorsal carpal branch of the ulnar artery.
- **Proper palmar digital artery:** Arises from the superficial palmar arch, derived from the ulnar artery.

Clinical Relevance: Isolated digital cords in cases of Dupuytren's contracture can overlie, displace, or otherwise disturb neurovascular structures of the finger.[3] Resulting pressure or traction on nerves and vessels could produce neuropathic pain and circulatory compromise. Acupuncture and related techniques can loosen the muscles and fascia as well as improve circulation and nerve function.

Indications and Potential Point Combinations

- **Numbness or pain in the pinky finger:** SI 2, plus isolate sources of discomfort to determine whether osseous, arthrodial, neural, or myofascial in origin and treat accordingly.
- **Headache originating in the neck:** SI 2, BL 10, GB 20, GB 21, GV 14, GV 20, and associated trigger points.

References

1. Strickland JW and Bassett RL. The isolated digital cord in Dupuytren's contracture: anatomy and clinical significance. *The Journal of Hand Surgery*. 1985;10A:118-124.
2. Eisen A and Kuwabara S. The split hand syndrome in amyotrophic lateral sclerosis. *J Neurol Neurosurg Psychiatry*. 2012;83(4):399-403.
3. Strickland JW and Bassett RL. The isolated digital cord in Dupuytren's contracture: anatomy and clinical significance. *The Journal of Hand Surgery*. 1985;10A:118-124.

SI 3

Hou Xi "Back Stream"

On the ulnar side of the little finger, in a depression proximal to the metacarpophalangeal joint when a loose fist is made, at the dorsal/palmar skin junction. Some advise needling from SI 3 in the direction of LI 4.[1]

Muscles

- **Abductor digiti minimi muscle of the hand:** Abducts the little finger (5th digit).
- **Flexor digiti minimi brevis muscle:** Flexes the proximal phalanx of the little finger.
- **Opponens digiti minimi muscle:** Allows the little finger to oppose the thumb.
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.

Clinical Relevance: Ulnar tunnel syndrome at the hand occurs usually as a result of ganglions, cysts, repetitive motion injury, bicycling, lipomas, and other activities in which the wrist is hyperextended for prolonged periods of time or during which continued pressure impacts the ulnar nerve in the hypothenar eminence. For those cases in which myofascial dysfunction is restricting nerve gliding and reducing circulation, acupuncture and related techniques relaxes the tissue, improves hemodynamics, and facilitates neural repair. The image in Figure 6-4 shows that aspect of the hand impacted by these activities or growths. The motor branch of the ulnar nerve inhabits the ulnar tunnel; the superficial branch appears here beneath SI 3.

Nerves

- Ulnar nerve (C8-T1): The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles.

Clinical Relevance: The benefits of SI 3 for neck pain likely arise from the spinal cord neuromodulation afforded by this distal, muscular point on the SI line. Afferent input arises from muscle, joint, skin, and vascular tissues. This multifaceted information arises at C8/T1 at the bottom or most caudal spinal cord segments. It then ascends along the neck to the head, inducing analgesia along the SI channel and its myofascial continuity.

Ulnar nerve entrapment at the elbow accounts for 20% of focal neuropathies, making it the second most common entrapment neuropathy.[8] Acupuncturists should keep this in mind, because when treating weakness of the ulnar-innervated hand muscles, one should determine the source of nerve injury and not only the result. Patients with ulnar nerve entrapment at the elbow exhibit sensory disturbances along ulnar nerve territory, elbow pain, and weakness in the intrinsic hand muscle supplied by the ulnar nerve. The adductor digiti minimi, i.e., the 3rd palmar interosseous muscle, often displays more weakness than the abductor digiti minimi; this causes Wartenberg's sign where the little finger remains abducted. The pattern and extent of motor compromise correspond to the components of the ulnar nerve that are damaged. In other cases, the pinky may "override" the ring finger, when tone in the adductor overrides that of the abductor.

Guyon's canal syndrome, a compression neuropathy of the ulnar nerve in the wrist or hand, can cause loss of sensory, motor, or their combined functions.[9] Acupuncture treatment of Guyon's canal syndrome would likely require inputs directed toward points on both the HT and SI lines local to the wrist, hand, and elbow.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Dorsal digital artery:** Arises from the dorsal carpal branch of the ulnar artery.

Clinical Relevance: Variants in musculature local to the wrist can lead to ulnar and median entrapment as well as thrombosis in the vessels.[10]

Indications and Potential Point Combinations

- **Neck, shoulder, and back pain and myofascial restriction:** SI 3, BL 62, tender trigger points, BL 10, GV 20, BL line points related to the involved spinal segment.
- **Neurologic dysfunction affecting the thoracic limb, especially in the ulnar nerve distribution:** SI 3 plus additional points along the ulnar nerve, including SI 8 (needle carefully); add cervical spinal nerve root points to address involved spinal segments. Consider adding Baxie (web space points on the hand) and LI 4.
- **Tinnitus:** SI 3, TH 5, local ear points and trigger points of muscles attaching to the temporal bone, BL 10.

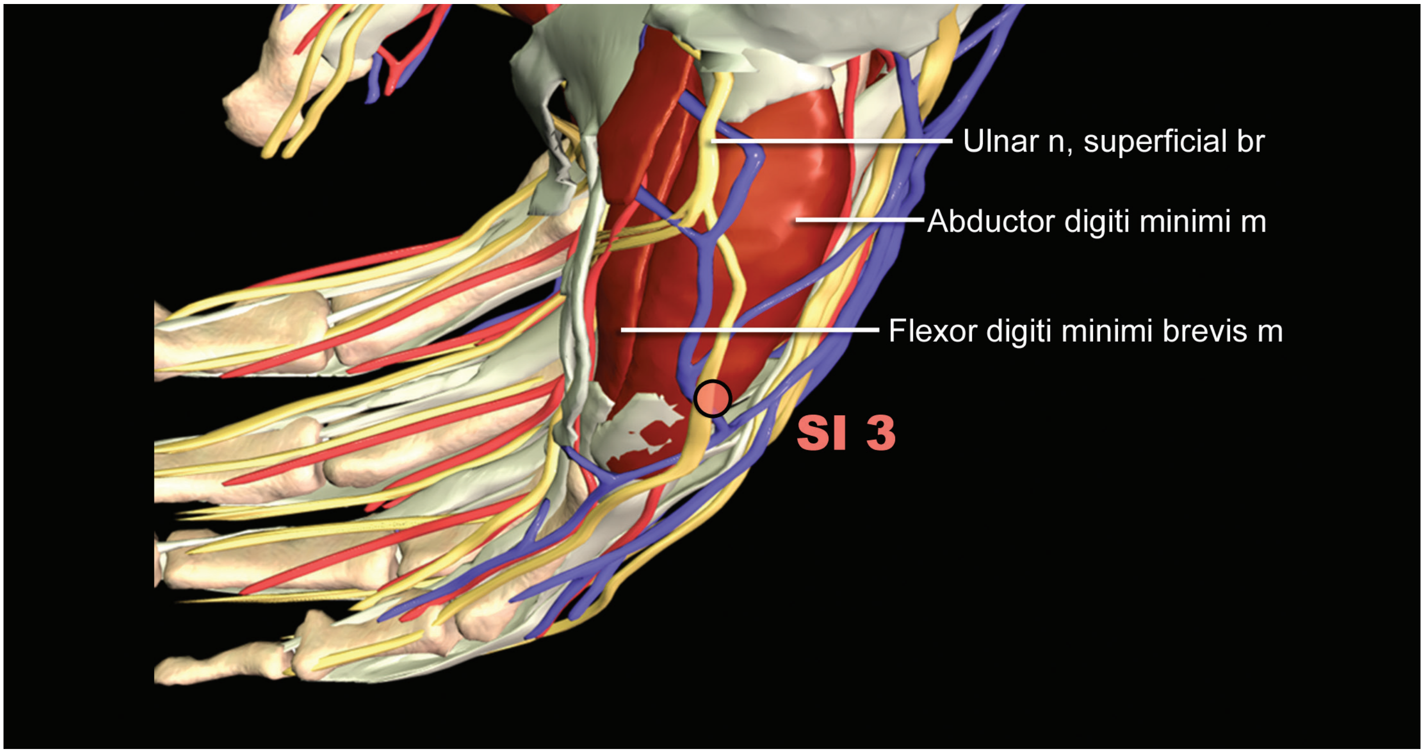


Figure 6-4. One of the strongest indications for SI 3 pertains to its effects on neck pain. Mechanisms involve neuromodulation of C8/T1 spinal cord segments through its input via the ulnar nerve.

Evidence-Based Applications

- Electroacupuncture applied to SI 3, BL 62, and four locations on the ear relating to the spinal cord contributed significantly to neurologic and functional recoveries in patients with **spinal cord injuries.**[2]
- Electroacupuncture at LI 4 and SI 3 produce significant changes in **skin temperature of the hand.**[3]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **dry eye, or KCS.**[4]
- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud's syndrome**, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[5]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain**: KI 3, KI 10, SI 3, SI 18, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, and GB 44.[6]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[7]
- Acupuncture at SI 3 and Luo Zhen (M-UE-24; also called "dorsal PC 8" because it can be found on the dorsum of the hand on the other side of PC 8) alleviated neck pain in patients with **acute torticollis.**[11]

References

1. Lu R, Liu M. Clinical application of single acupoint for treatment. *Journal of Traditional Chinese Medicine*. 1991;11(4):284-285.
2. Wong AMK, Leong CP, SU TY, Yu SW, Tsai WC, and Chen CPC. Clinical trial of acupuncture for patients with spinal cord injuries. *American Journal of Physical Medicine & Rehabilitation*. 2003;82:21-27.
3. Landry MD and Scudds RA. The cooling effects of electroacupuncture on the skin temperature of the hand. *J Hand Ther*. 1996;9:359-366.
4. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2*. New York: Plenum Press, 1998. pp. 1011-1016.
5. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine*. 1997;241:119-124.
6. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture*. 2004;15(3):17-18.
7. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ*. 2001;322:1-6.
8. Iyer V and Thirkannad S. Focal hand dystonia in a patient with ulnar nerve neuropathy at the elbow. *Hand*. 2010;5:453-457.
9. Ozdemir O, Calisaneller T, Gulsen S, et al. Ulnar nerve entrapment in Guyon's canal due to recurrent carpal tunnel syndrome: case report. *Turkish Neurosurgery*. 2011;21(3):435-437.
10. Georgiev GP and Jelev L. Unusual coexistence of a variant abductor digiti minimi and reversed palmaris longus and their possible relation to median and ulnar nerves entrapment at the wrist. *Rom J Morphol Embryol*. 2009;50(4):725-727.
11. Samuels N. Acupuncture for acute torticollis: a pilot study. *Am J Chin Med*. 2003;31(5):803-807.

SI 4

Wan Gu "Wrist Bone"

On the ulnar side of the hand, in a depression between the pisiform bone and the base of the 5th metacarpal, at the dorsal/palmar skin junction.

Muscles

- **Abductor digiti minimi muscle of the hand:** Abducts the little finger (5th digit).
- **Flexor digiti minimi brevis muscle:** Flexes the proximal phalanx of the little finger.
- **Opponens digiti minimi muscle:** Allows the little finger to oppose the thumb.
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.

Clinical Relevance: Ulnar tunnel syndrome at the hand occurs usually as a result of ganglions, cysts, repetitive motion injury, bicycling, lipomas, and other activities in which the wrist is hyperextended for prolonged periods of time or during which continued pressure impacts the ulnar nerve in the hypothenar eminence. For those cases in which myofascial dysfunction is restricting nerve gliding and reducing circulation, acupuncture and related techniques relaxes the tissue, improves hemodynamics, and facilitates neural repair. The image in Figure 6-4 shows that aspect of the hand impacted by these activities or growths. The motor branch of the ulnar nerve inhabits the ulnar tunnel; the superficial (dorsal) branch is visible here traveling from SI 5 toward SI 1.

SI 4 coincides with the motor point of the abductor digiti minimi muscle.[1] Acupuncture and related techniques treat pain along the ulnar aspect of the hand due to myofascial restriction, whether at the motor point/central trigger point (SI 4) or the myotendinous junctions of the abductor digiti minimi muscle at SI 3 and SI 5.

Nerves

- **Common palmar digital branches of the superficial branch of the ulnar nerve:** Supply sympathetic motor innervation to the palmar and dorsal skin of the little finger and ulnar half of the ring finger.
- **Dorsal digital nerves:** Supply the ulnar aspect of the little finger, derived from the ulnar nerve.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger

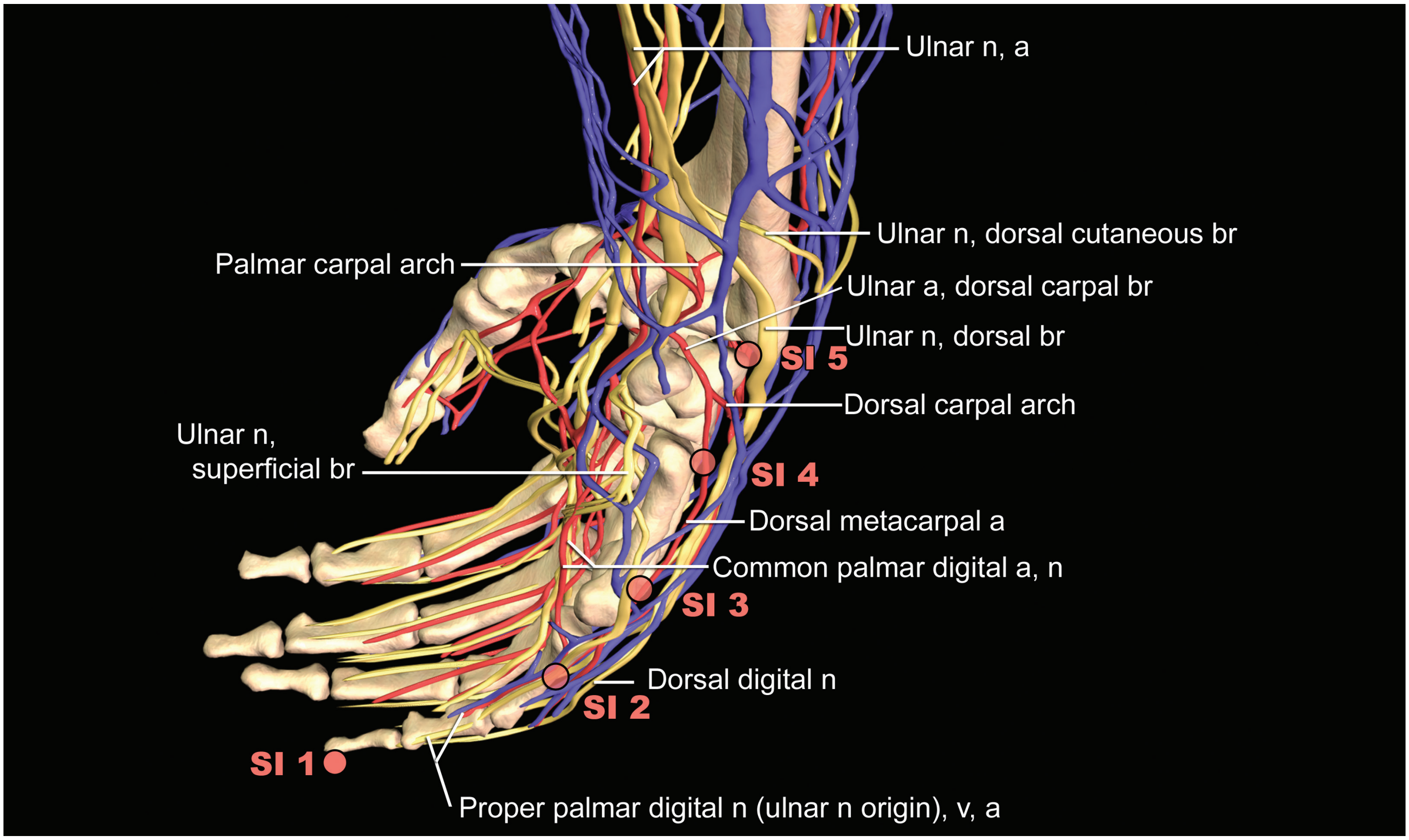


Figure 6-5. The descriptive name for SI 4, "Wrist Bone" refers to the bony juncture of the wrist and hand, comprising the intersection of the 4th metacarpal, ulna, and the pisiform bone.

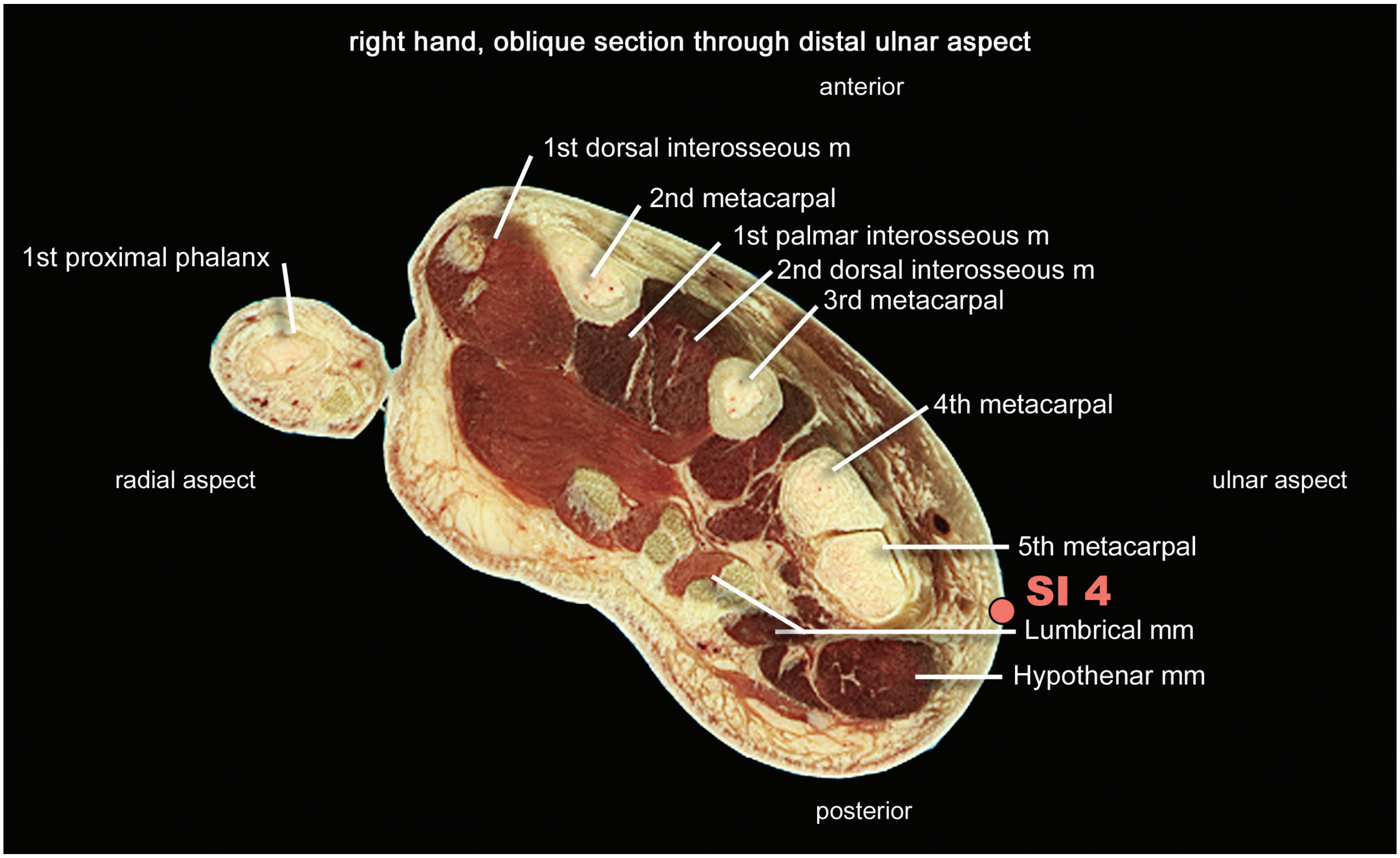


Figure 6-6. Cross sections such as this connect the layout of the underlying anatomy with the acupuncture point, indicating the insertion angle necessary to achieve clinical success, depending on the goal(s).

and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles.

Clinical Relevance: Guyon's canal syndrome, a compression neuropathy of the ulnar nerve in the wrist or hand, can cause loss of sensory, motor, or their combined functions.[2] Acupuncture treatment of Guyon's canal syndrome would likely require inputs directed toward points on both the HT and SI lines local to the wrist, hand, and elbow.

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.
- **Superficial palmar arch:** This constitutes the main termination of the ulnar artery. The superficial palmar arch gives rise to three common palmar digital arteries. These arteries anastomose with the palmar metacarpal arteries, which arise from the deep palmar arterial arch. In contrast to the superficial palmar arch which arises mainly from the ulnar artery, the radial artery provides the main arterial basis for the deep palmar arch.
- **Deep branch of the ulnar artery:** Anastomoses with the radial artery to complete the deep palmar arch.
- Common palmar digital artery for 4th and 5th digits: Each common palmar digital artery divides into proper palmar digital arteries, which give rise to a dorsal branch innervating the finger tips with vessels known as the dorsal branches of the proper palmar digital arteries. The proper palmar digital arteries course along the adjacent sides of digits II through IV.
- **Common palmar digital veins for 4th and 5th digits:** The superficial and deep palmar venous arches accompany the superficial and deep palmar arterial arches.

Clinical Relevance: Figure 6-5 shows the anatomical relationship between SI 4 and underlying vessels, including the dorsal carpal arterial arch, the dorsal metacarpal artery, and associated venous networks. Treating this region with acupuncture, massage, and/or laser therapy would improve circulation in the ulnar aspect of the wrist. Better blood flow brings oxygen, nutrients, and supportive xenobiotics to the region to aid in tissue repair and maintenance.

Indications and Potential Point Combinations

- **Shoulder, neck, elbow, headache, or temporomandibular joint (TMJ) pain related to the SI channel distribution:** SI 4 (or SI 3; the anatomy overlaps), adding local points neuroanatomically related to the pain, spinal segmental points neuroanatomically related to the pain, and myofascial trigger points as found.

For shoulder pain, add relevant tender trigger points over the scapula. For neck pain along the SI line, examine the sternocleidomastoid muscle and additional potentially restricted zones extending to the clavicle and trapezius muscle. For head pain referring to the vertex, palpate BL points on the head (especially BL 7 and BL 8) and neck (BL 10); consider adding GV 20 if heat present. For TMJ pain, add tender myofascial trigger points over the shoulder and neck, as well as SI 18 and SI 19.

- **Local wrist pain:** SI 4 if pain localizes to the ulnar aspect of the wrist. Localize source of pain if possible; closely examine the flexor carpi ulnaris muscle which may radiate pain to the SI 4, SI 5 region.

References

1. Liu Y, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med.* 1975;3(4):347-358.
2. Ozdemir O, Calisaneller T, Gulsen S, et al. Ulnar nerve entrapment in Guyon's canal due to recurrent carpal tunnel syndrome: case report. *Turkish Neurosurgery.* 2011;21(3):435-437.

SI 5

Yang Gu "Yang Valley"

On the ulnar side of the wrist, in the depression between the ulnar styloid process, the triquetrum, and the pisiform bone.

Connective Tissues

- **Extensor retinaculum:** Holds the extensor tendons of the wrist in place.

Clinical Relevance: Myofascial dysfunction involving the extensor retinaculum at the wrist may cause compression of ulnar nerve branches, seen in Figure 6-7 coursing beneath the structure on the palmar and dorsal aspects of the wrist. Acupuncture and related techniques directed toward SI 5 and nearby points aid in alleviating tissue compression in this tightly contained region, i.e., the wrist.

Muscles

- **Extensor carpi ulnaris tendon:** Extends and adducts the hand at the wrist.
- **Flexor carpi ulnaris tendon:** Flexes and adducts the hand at the wrist.
- **Pronator quadratus muscle:** Binds together the ulna and radius; pronates the antebrachium.

Clinical Relevance: SI 5 resides in a region imbued with both flexor and extensor attachments. Repetitive motions of the wrist such as computer work with a mouse, and compressive forces generated by tasks like bicycle riding can cause pain and debility in the wrist.

Nerves

- **Ulnar nerve (C8-T1):** The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the extensor carpi ulnaris muscle as well as others leading to the hand.
- **Anterior interosseous nerve (from the median nerve (C8, T1)):**

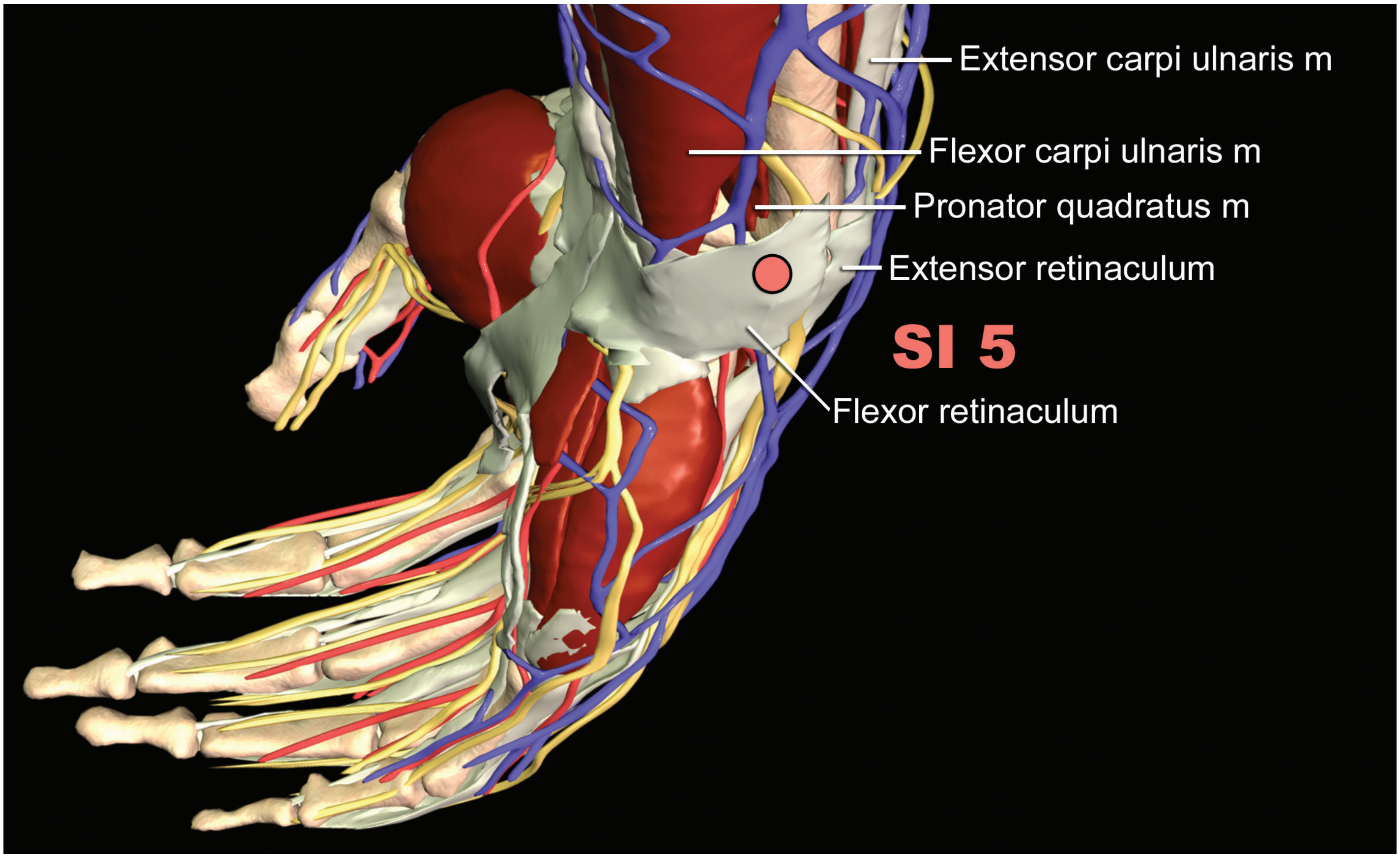


Figure 6-7. SI 5, "Yang Valley", rests in a nook ("valley") along the ulnar (Yang) surface of the wrist.

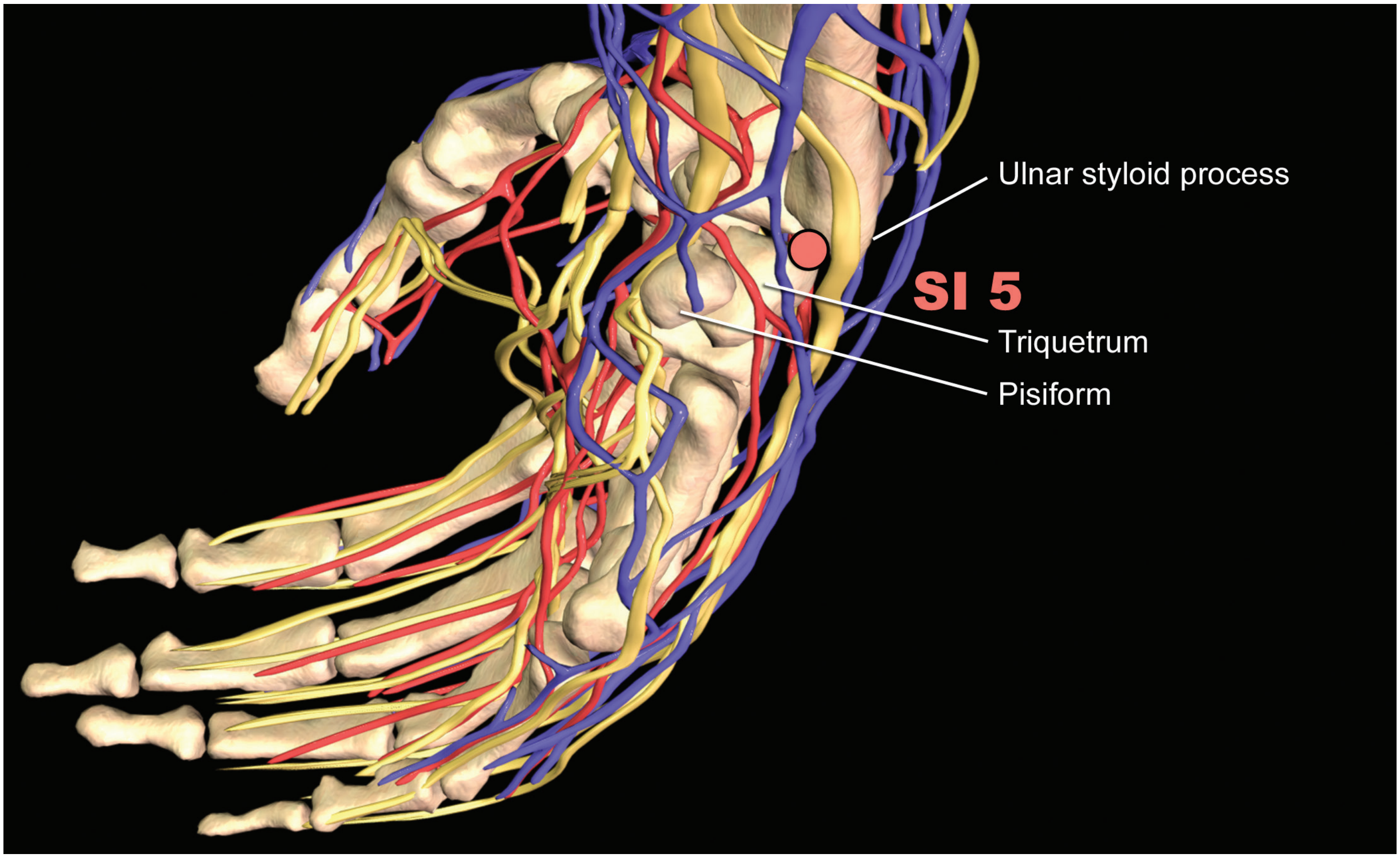


Figure 6-8. SI 5 as "Yang Valley" is bounded by the pisiform bone, triquetrum, and the ulnar styloid process. The point is often tender to palpation, more likely to be so than SI 1 to SI 4, considering the range of motion and mechanical strain affecting this location.

Supplies the pronator quadratus muscle.

Clinical Relevance: Guyon's canal syndrome, a compression neuropathy of the ulnar nerve in the wrist or hand, can cause loss of sensory, motor, or their combined functions.[1] Acupuncture treatment of Guyon's canal syndrome would likely require inputs directed toward points on both the HT and SI lines local to the wrist, hand, and elbow.

Vessels

- **Deep branch of the ulnar artery:** Anastomoses with the radial artery to complete the deep palmar arch.
- **Dorsal carpal branch of the ulnar artery:** Arises from the ulnar artery at the wrist. Anastomoses with branches of the radial artery, thereby providing collateral circulation for the wrist joint via dorsal and palmar carpal arches.
- **Paired ulnar veins:** Accompany the ulnar artery. Anastomose readily with paired veins accompanying the radial artery.
- **Basilic vein:** The basilic vein courses along the medial aspect of the arm and ultimately empties into the axillary vein after merging with the brachial veins. The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm. At the elbow, it joins the median cubital vein.

Clinical Relevance: Acupuncture at SI 5 will improve blood flow through the vessels inhabiting the ulnocarpal joint seen in Figure 6-8.

Indications and Potential Point Combinations

- **Agitation:** SI 5, HT 7, and KI 3
- **Wrist pain:** SI 5 if tender. Explore for trigger points in the flexor carpi ulnaris muscle.

References

1. Ozdemir O, Calisaneller T, Gulsen S, et al. Ulnar nerve entrapment in Guyon's canal due to recurrent carpal tunnel syndrome: case report. *Turkish Neurosurgery.* 2011;21(3):435-437.

SI 6

Yang Lao "Support the Aged"

Proximal to the wrist, in a dorsal depression proximal to the radial aspect of the head of the ulna.

Alternate method of location: When the patient's palm faces the chest, the point sits in the cleft on the radial aspect of the high point of the ulnar styloid process when the wrist is flexed and the index finger points to the sternum.

Muscles

- **Extensor carpi ulnaris tendon:** Extends and adducts the hand at the wrist. Its musculotendinous unit confers both agonist and antagonist action in wrist motion, imparting the act of throwing darts, for example.[1] Forceful wrist supination, flexion, or ulnar deviation can rupture the extensor carpi ulnaris tendon sheath, a connective tissue structure that stabilizes the tendon inside a groove along the distal ulna. Patients who complain of a painful snapping or clicking sensation over the dorsoulnar wrist during antebrachial rotation could be experiencing extensor carpi ulnaris instability. Asking the patient to simulate the action of scooping ice cream with the involved hand against examiner resistance and palpation accentuates tendon subluxation and allows identification of subtle instabilities.[2]
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.
- **Extensor digitorum muscle:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.

Clinical Relevance: Athletes and musicians develop wrist pathologies, myofascial strain syndromes, and nerve entrapments as a consequence of specific overuse disorders.[3] Palpation and in-depth history taking should help identify the sources and consequences of pain and restriction, indicating where and how to treat the condition with acupuncture and related techniques.

Carpal stability depends upon the shapes of bones interacting at the wrist as well as the intrinsic and extrinsic ligaments and muscles crossing the joint.[4] The neuromuscular system controls joint stability through a sophisticated network of proprioceptive orchestration. Considering the impact of the extensor carpi ulnaris on stability of the distal radioulnar joint, conservative (i.e., non-surgical) treatment of carpal instability should target tendons that cross the joint and retrain proprioceptive control.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1), ulnar branch:** Arises from the medial cord of the brachial plexus.
- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus,

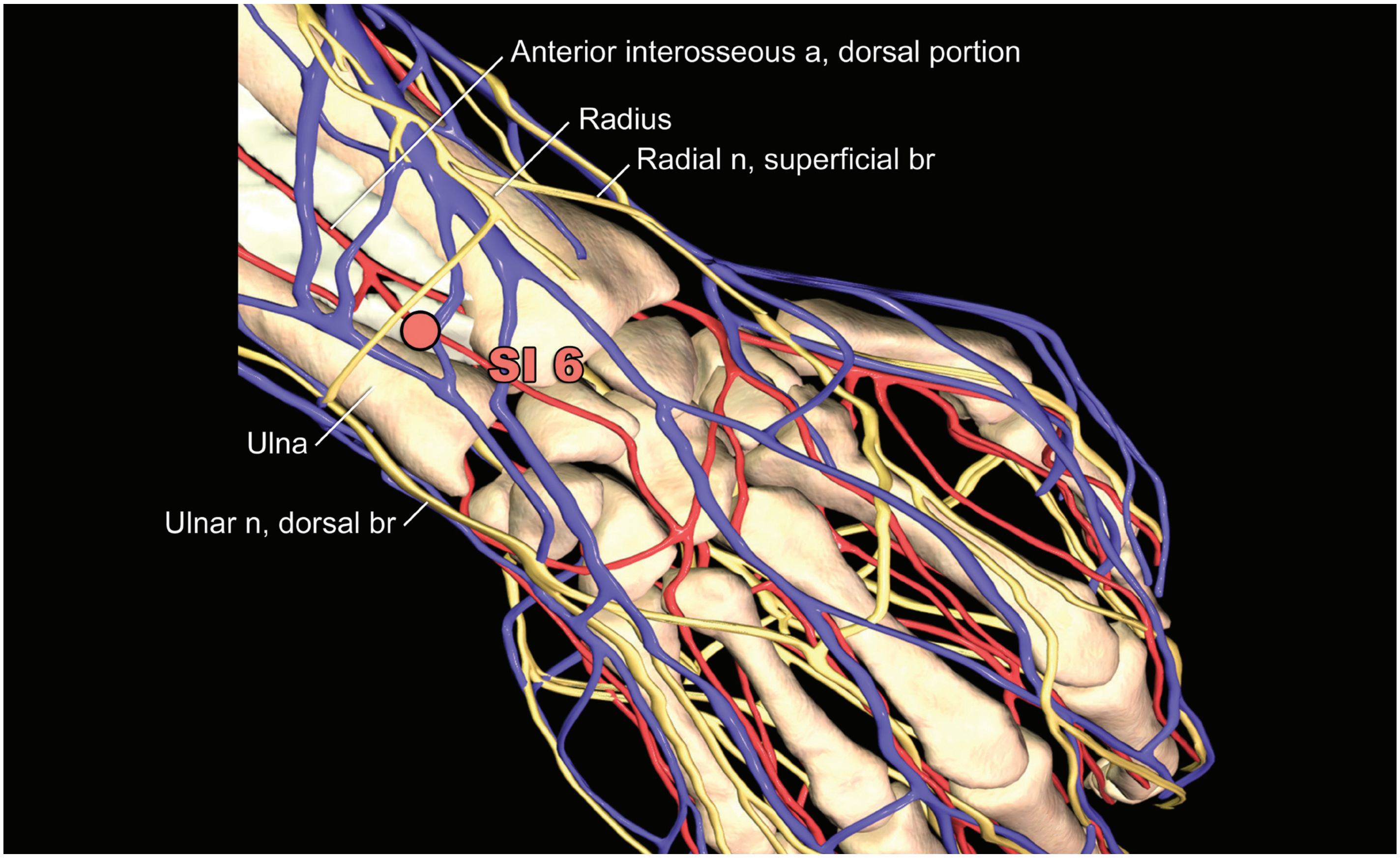


Figure 6-9. SI 6 sits atop a high-traffic neurovascular section of the wrist. This image also shows a connecting branch between the ulnar and radial nerves. Although the posterior interosseous nerve is not shown, it follows the course of the artery atop the interosseous membrane.

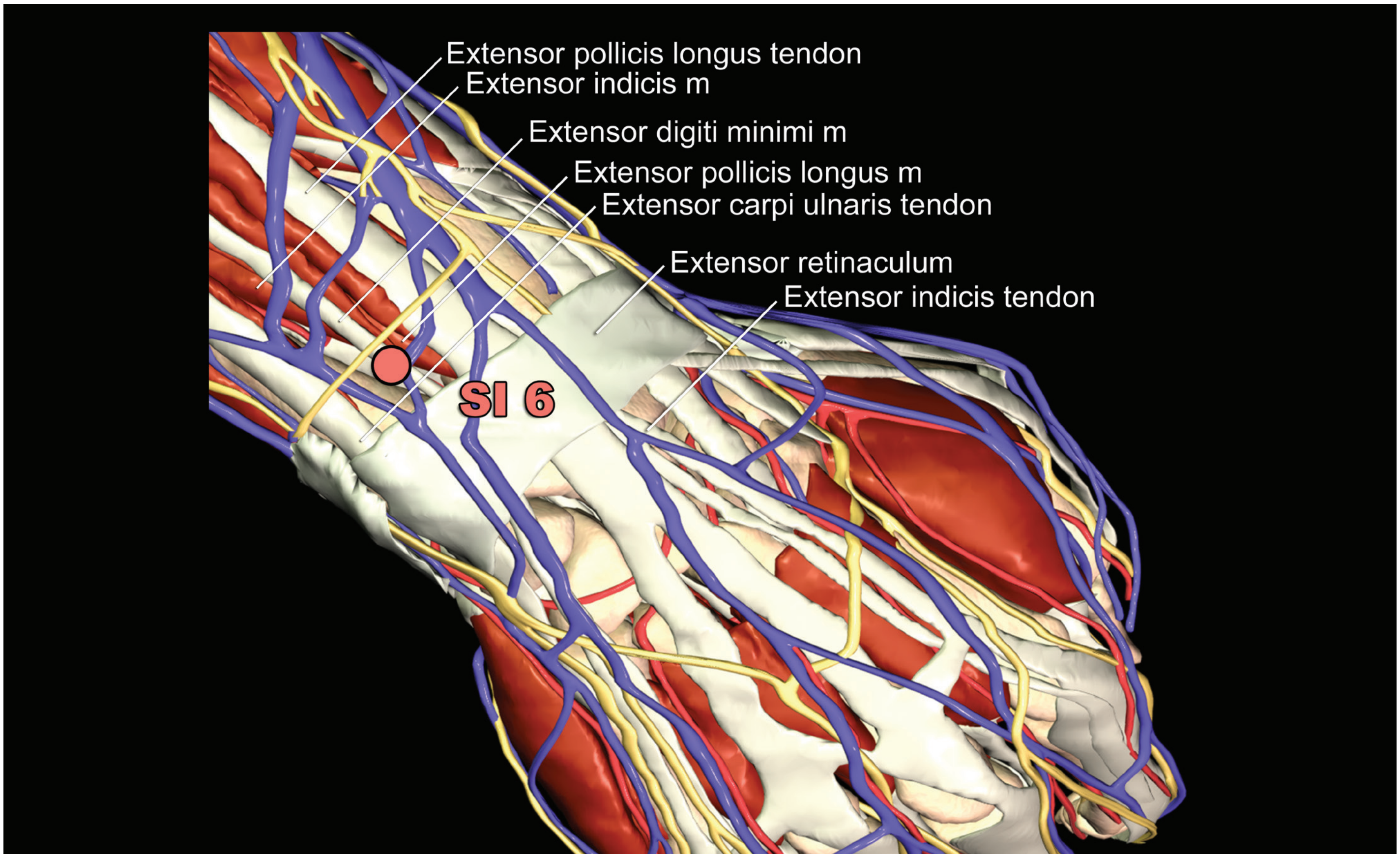


Figure 6-10. SI 6, "Nursing the Aged", lands where elderly exhibit tremor. The name for SI 6 conjures the image of an elderly woman sitting with her elbow resting on the arm of her chair and her fingers pointing to her chest, making the depression where SI 6 lands more visible. This typical posture may come about because contractures, weakness, or arthritis have led to shortening of the flexor tendons of the wrist, causing the wrist to assume this position of ease. Note how the extensor carpi ulnaris tendon stands apart from the bulk of other tendons coursing within its own sheath. It contributes substantial dynamic stability to the carpus along with the distal radioulnar joint.

extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles.

Clinical Relevance: Although acupuncture needling is often employed to support nerve recovery and alleviate entrapment, cases exist of nerve injury following acupuncture. If a needle traumatizes a vessel wall, a resulting hematoma could cause neural compression. In addition, a fractured needle tip can irritate or otherwise injure a nerve. In some cases, the needle may lead to a nerve laceration. Relevant to SI 6, posterior interosseous nerve palsy has been reported following needle acupuncture.[5]

Vessels

- **Basilic vein:** The basilic vein courses along the medial aspect of the arm and ultimately empties into the axillary vein after merging with the brachial veins. The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm. At the elbow, it joins the median cubital vein.
- **Posterior and anterior interosseous arteries:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that emerges through the distal posterior portion of the interosseous membrane.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Figure 6-9 depicts the rich neurovascular supply of the underlying region. Acupuncture and related techniques improve local circulation which supports tissue healing and maintenance.

Indications and Potential Point Combinations

- **Pain along the SI channel in the mid-thoracic region, posterior shoulder, posteromedial arm, or medial elbow along the SI channel distribution:** SI 6 as a distal point, plus check for trigger points in the latissiumus dorsi, supraspinatus, infraspinatus, teres minor, teres major, subscapularis, and deltoid muscles. Consider SI 9, SI 10, SI 11, SI 12, SI 13, SI 14.
- **Eye diseases:** blurred vision, conjunctivitis: SI 6, BL 1, TH 23, ST 36.
- **Occipital headache:** SI 6, plus examine sternocleidomastoid muscle for trigger points, consider SI 16, TH 16, GB 20, BL 10, GV 20.

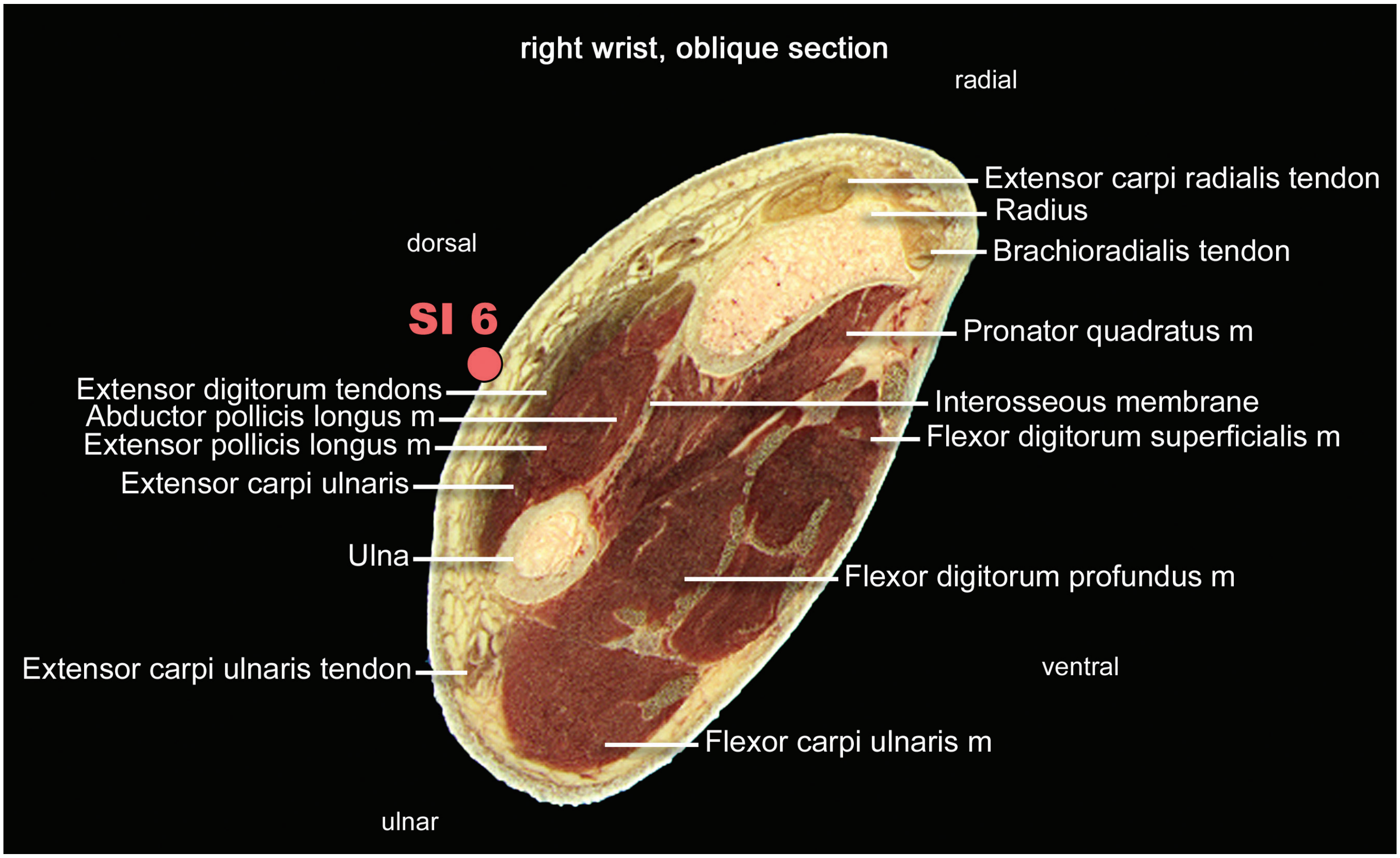

right wrist, oblique section
radial
dorsal
SI 6
Extensor carpi radialis tendon
Radius
Brachioradialis tendon
Pronator quadratus m
Extensor digitorum tendons
Abductor pollicis longus m
Extensor pollicis longus m
Interosseous membrane
Flexor digitorum superficialis m
Extensor carpi ulnaris
Ulna
Flexor digitorum profundus m
Extensor carpi ulnaris tendon
ventral
Flexor carpi ulnaris m
ulnar

Figure 6-11. Trigger points affecting muscles and tendons housed in this small compartment below SI 6 can compromise wrist/hand function and strength. Clearly, in order to access myofascial trigger points in the extensor and abductor pollicis longus muscles, one would need to insert an acupuncture needle more deeply than when treating extensor digitorum longus tendon trigger points.

- **Torticollis, neck pain:**[6] SI 6, with neck and shoulder trigger points.
- **Wrist pain:** SI 6 as proximal point, plus local tender or trigger points.

Evidence-Based Applications

- Dry needling stimulation with de qi sensation applied to SI 6 and HT 7 elicited different **blood oxygen level dependent responses** during functional magnetic resonance imaging (fMRI).[7] Clinical significance unknown.

References

1. Kalson NS, Malone PSC, Bradley RS, et al. Fibre bundles in the human extensor carpi ulnaris tendon are arranged in a spiral. *Journal of Hand Surgery.* 2011;37E(6):550-554.
2. Ng CY and Hayton MJ. Ice cream scoop test: a novel clinical test to diagnose extensor carpi ulnaris instability. *The Journal of Hand Surgery.* 2012 1753193412460816.
3. Graham TJ. Pathologies of the extensor carpi ulnaris (ECU) tendon and its investments in the athlete. *Hand Clin.* 2012;28(3):345-356.
4. Heras-Palou C. Commentary on 'Role of the extensor carpi ulnaris and its sheath on dynamic carpal stability' by G. Salva-Coll et al. *J Hand Surg Eur.* 2012;37:544-548.
5. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *J Hand Surg Eur.* 2012;37:467-469.
6. Wang D. Seventy-five cases of stiff neck treated by acupuncture at acupoint yanglao (SI 6). *J Tradit Chin Med.* 1994;14(4):269-271.
7. Chen SJ, Liu B, Fu WB et al. A fMRI observation on different cerebral regions activated by acupuncture of Shenmen (HT 7) and Yanglao (SI 6). *Zhen Ci Yan Jiu.* 2008;33(4):267-271. [Abstract in English, paper in Chinese].

SI 7

Zhi Zheng "Branch of the Correct"

On the ulnar aspect of the antebrachium, 5 cun proximal to the wrist joint, on a line joining SI 5 and SI 8, between the ventral border of the ulna and the flexor carpi ulnaris muscle belly.

Muscles

- **Flexor carpi ulnaris muscle:** Adducts and flexes the hand at the wrist. The flexor carpi ulnaris contains two heads, between which the ulnar nerve courses in the distal portion of the forearm. One head attaches to the humerus, and the other to the ulna.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges at the distal interphalangeal joints of the fingers. Aids flexion of the hand.

Clinical Relevance: Myofascial dysfunction affecting muscles within reach of SI 7 (i.e., the flexor carpi ulnaris, flexor digitorum superficialis, and flexor digitorum profundus) may collectively compress the ulnar nerve and vessels coursing between them. The cross section shown in Figure 6-14 illustrates these relationships. Muscles impacted by needling at SI 7 will vary according to the direction and depth of needling. Trigger point pathology in the flexor carpi ulnaris muscle refers pain strongly to the ulnar aspect of the wrist along the HT channel (HT 5-HT 7). Acupuncture needling can reproduce referred pain stemming from myofascial trigger points, reaffirming site selection.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Ulnar nerve (C8-T1):** Arises as a terminal branch of the medial cord of the brachial plexus, receiving fibers from C8, T1, and often C7. It courses down the medial aspect of the arm and provides articular branches to the elbow joint. At the elbow, it continues posterior to the medial epicondyle and enters the antebrachium (forearm).

Clinical Relevance: Both the medial antebrachial cutaneous and ulnar nerves are susceptible to injury by dint of their position on the ulnar surface of the antebrachium where blunt force against the bone can injure the nerves. In addition, phlebotomy hasa been reported to damage the nerve, albeit rarely, causing paresthesia and forearm pain.[2] Acupuncture and related techniques would support nerve healing and provide analgesia to the area. Note the position of the ulnar nerve in relation to the bone in Figure 6-13.

Another source of nerve injury relates to subluxation-related ulnar neuropathy resulting from dorsal radioulnar joint instability. In this condition, antebrachial rotation produces a sensory deficit, ordinarily following a history of trauma to the wrist or forearm.[3] Paresthesias become most severe in the maximally pronated position; motor symptoms are infrequent. If patients do complain of motor difficulty, the problem has likely become chronic. Stabilization reduces neurologic injury. Acupuncture applied to SI 7 and nearby regions can reduce myofascial dysfunction impacting the nerves.

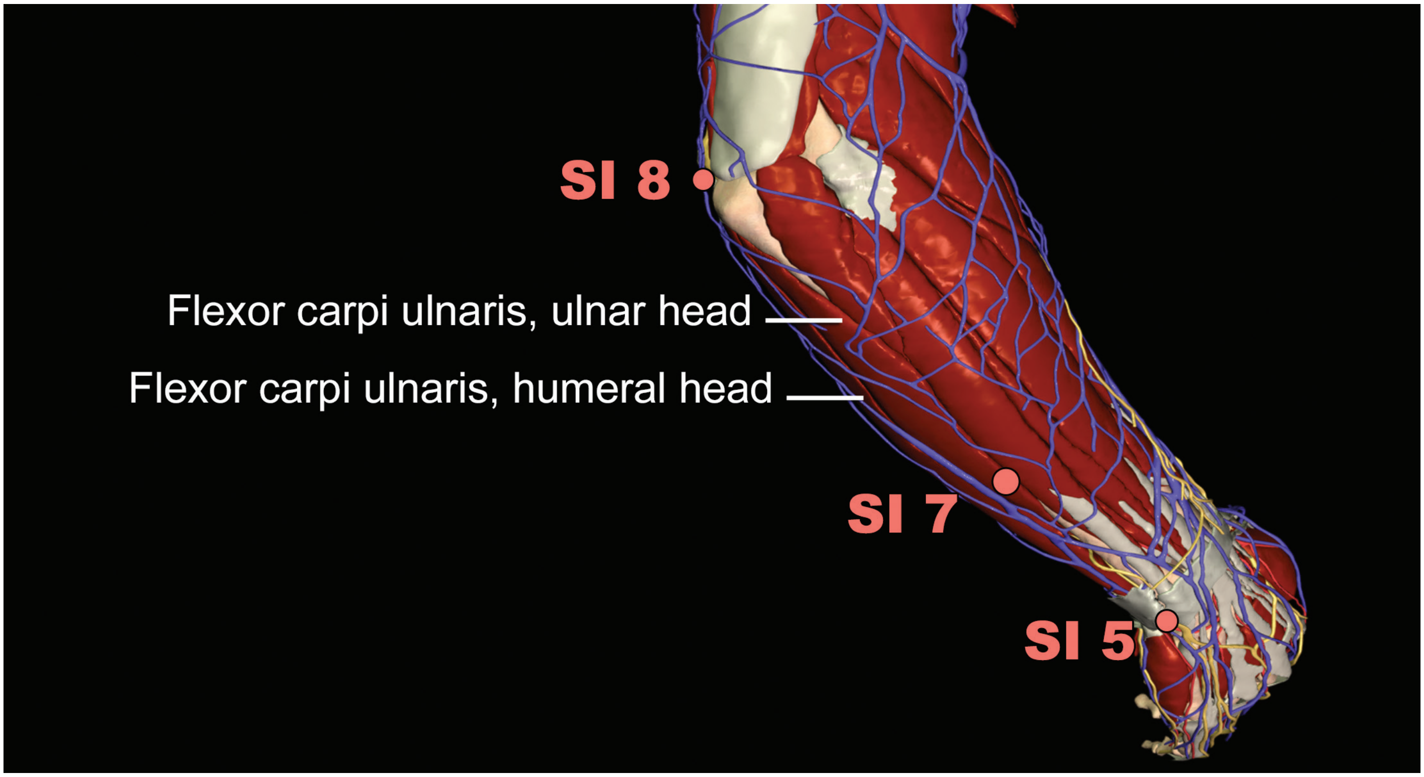

SI 8
Flexor carpi ulnaris, ulnar head
Flexor carpi ulnaris, humeral head
SI 7
SI 5

Figure 6-12. SI 7 begins the SI channel's migration from the extensor surface of the thoracic limb at SI 6 to the flexor aspect from SI 7 to SI 8. As such, SI 7 engages include predominantly flexors. The tunnel between SI 7 and SI 8 corresponds to the cubital tunnel that houses the ulnar nerve. The myofascial cleavage plane between the ulnar and humeral heads of the flexor carpi ulnaris describes the course of the ulnar nerve where compression commonly occurs. A fibrous brand from the medial intermuscular septum may cross the ulnar nerve to compress it further. Myofascial restriction in the flexor carpi ulnaris, flexor digitorum profundus, and flexor digitorum superficialis can contribute to the problem.

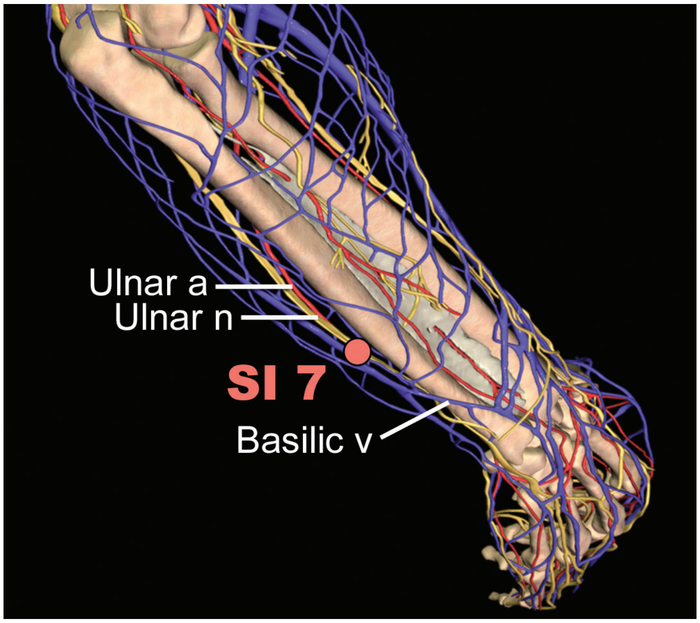

Ulnar a
Ulnar n
SI 7
Basilic v

Figure 6-13. The name, "Branch to the Correct" for SI 7 refers to the deviation of the SI channel toward the HT line's territory along the antebrachium, i.e., the ulnar neurovasculature. In addition, "Branch to the Correct" connotes the way in which the radius overrides the ulna during pronation, as tree limbs might cross. The ulna, however, leads to the HT and SI channels while the radius takes one to the LU and LI lines.

Vessels

- **Basilic vein:** The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm.
- **Ulnar artery:** Arises near the neck of the radius in the cubital fossa. It provides several branches, including the anterior and posterior (branches of the) ulnar recurrent arteries, the common interosseous artery, the anterior and posterior interosseous arteries, and the dorsal and palmar carpal branches, which anastomose with the radial artery.
- **Ulnar veins:** These paired veins drain the forearm and accompany the ulnar artery. They receive tributaries from muscles lying nearby.

Clinical Relevance: Figure 6-14 depicts the proximity of SI 7 to the basilic vein. Figure 6-13 illustrates how the basilic vein joins SI 6 to SI 7, corresponding to the original vascular basis of acupuncture. Acupuncturists treating patients after shoulder surgery or arthroscopy should be vigilant for pain and swelling in the thoracic limb that can reflect deep venous thrombosis in the axillary, basilic, and brachial veins.[4]

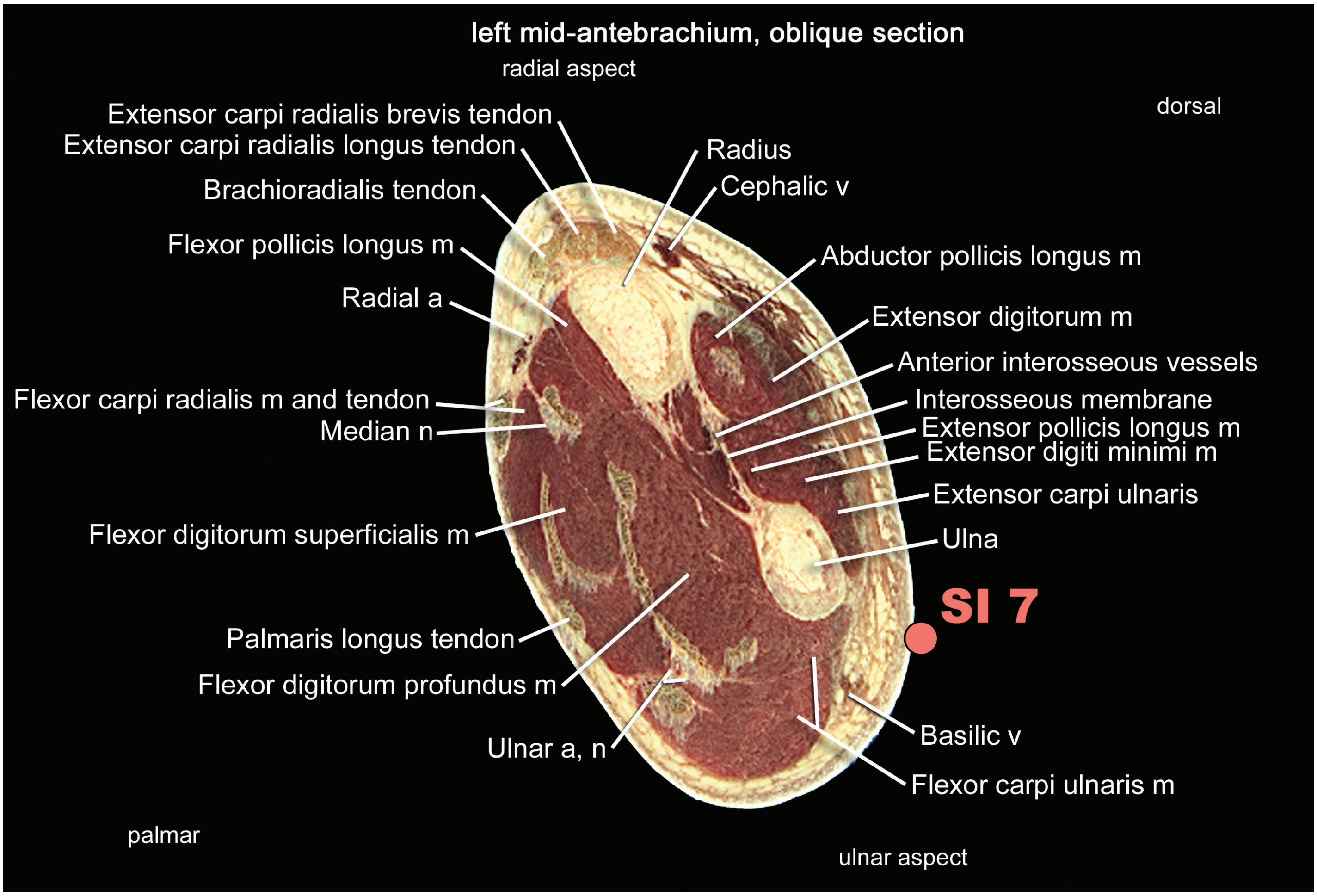

left mid-antebrachium, oblique section
radial aspect
dorsal
Extensor carpi radialis brevis tendon
Extensor carpi radialis longus tendon
Brachioradialis tendon
Flexor pollicis longus m
Radial a
Flexor carpi radialis m and tendon
Median n
Flexor digitorum superficialis m
Palmaris longus tendon
Flexor digitorum profundus m
Ulnar a, n
Radius
Cephalic v
Abductor pollicis longus m
Extensor digitorum m
Anterior interosseous vessels
Interosseous membrane
Extensor pollicis longus m
Extensor digiti minimi m
Extensor carpi ulnaris
Ulna
SI 7
Basilic v
Flexor carpi ulnaris m
palmar
ulnar aspect

Figure 6-14. This cross section illustrates how SI 7 "straddles the fence" that separates the flexor and extensor surfaces of the forearm. It denotes the location where the SI line travels from the dorsal to the palmar surface of the forearm.

Indications and Potential Point Combinations

- **Forearm or elbow pain:** Select SI 7 if tender. Isolate which, if any, muscles are generating the pain. Needle the central trigger points in the endplate zones of the muscles and assess for associated enthesopathy expressed as attachment trigger points.
- **Inability to grasp with hand:** Identify neural dysfunction and treat accordingly. If ulnar neuropathy, target SI 7 plus SI 6 and HT 7. Consider cervical spinal nerve points in caudal cervical region to address spinal nerve roots supplying the ulnar nerve.
- **Ulnar neuralgia:** Consider ulnar nerve entrapment in the cubital tunnel. This tunnel constitutes a narrow passageway bordered laterally by the elbow joint, medially by the two heads (humeral and ulnar) of the flexor carpi ulnaris muscle, and anteriorly by the medial epicondyle of the humerus.

References

1. Karatas Ay, Apaydin N, Uz A, et al. Regional anatomic structures of the elbow that may potentially compress the unlar nerve. *J Shoulder Elbow Surg*. 2009;18:627-631.
2. Ashegan M, Khatibi A, and Holisaz MT. Paresthesia and forearm pain after phlebotomy due to medial antebrachial cutaneous nerve injury. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2011;6:5.
3. Malone PS, Hutchinson CE, Kalson NS, et al. Subluxation-related ulnar neuropathy (SUN) syndrome related to distal radioulnar joint instability. *J Hand Surg Eur*. 2012;37(7):652-664.
4. Delos D and Rodeo SA. Venous thrombosis after arthroscopic shoulder surgery: pacemaker leads as a possible cause. *HSSJ*. 2011;7:282-285.

SI 8

Xiao Hai "Small Sea"

On the posteromedial elbow, over the ulnar groove (also known as the humeral sulcus for the ulnar nerve), in the depression between the medial epicondyle of the humerus and the olecranon. Locate with the elbow slightly flexed.

Caution with needling to avoid traumatizing the vulnerable ulnar Nerve at SI 8.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Ulnar nerve (C8-T1):** Arises as a terminal branch of the medial cord of the brachial plexus, receiving fibers from C8, T1, and often C7. It courses down the medial aspect of the arm and provides articular branches to the elbow joint. At the elbow, it continues posterior to the medial epicondyle and enters the antebrachium (forearm). The ulnar nerve supplies the flexor carpi ulnaris and ulnar half of the flexor digitorum profundus muscle, which sends tendons to the 4th and 5th digits. The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep branches. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, as well as sensation to the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, as well as the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), and the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Entrapment of the ulnar nerve typically occurs at four sites: the arcade of Struthers (medial intermuscular septum), the ulnar groove, the cubital tunnel (humeroulnar arcade), and the exit point between the two heads of the flexor carpi ulnaris.[1] Compressive neuropathy of the ulnar nerve at the elbow is one of the most common nerve compressions of the thoracic limb.[2] Figure 6-15 reveals the abundance of muscular and connective tissue elements that might contribute to compression. An aponeurosis may form between the flexor digitorum superficialis and the flexor carpi ulnaris muscles, entrapping the nerve. Motor and/or sensory abnormalities can develop over the ulnar aspect of the forearm and hand. Flexion of the elbow increases intraneural pressure six-fold.[3] The size of the canal through which the ulnar nerve travels narrows by more than half as the oval passageway becomes elliptical. Cubitus valgus deformity, whether acquired or congenital, increases the likelihood of ulnar neuropathy. Athletes may acquire ulnar neuropathy after repeated valgus stress at the elbow. Sports putting the nerve at risk include baseball, javelin throwing, tennis, gymnastics, and football.[4] Acupuncture, manual therapy, laser therapy, and stretching can contribute to conservative management to alleviate myofascial restriction compressing the nerve. SI 8 would constitute the primary treatment focus.

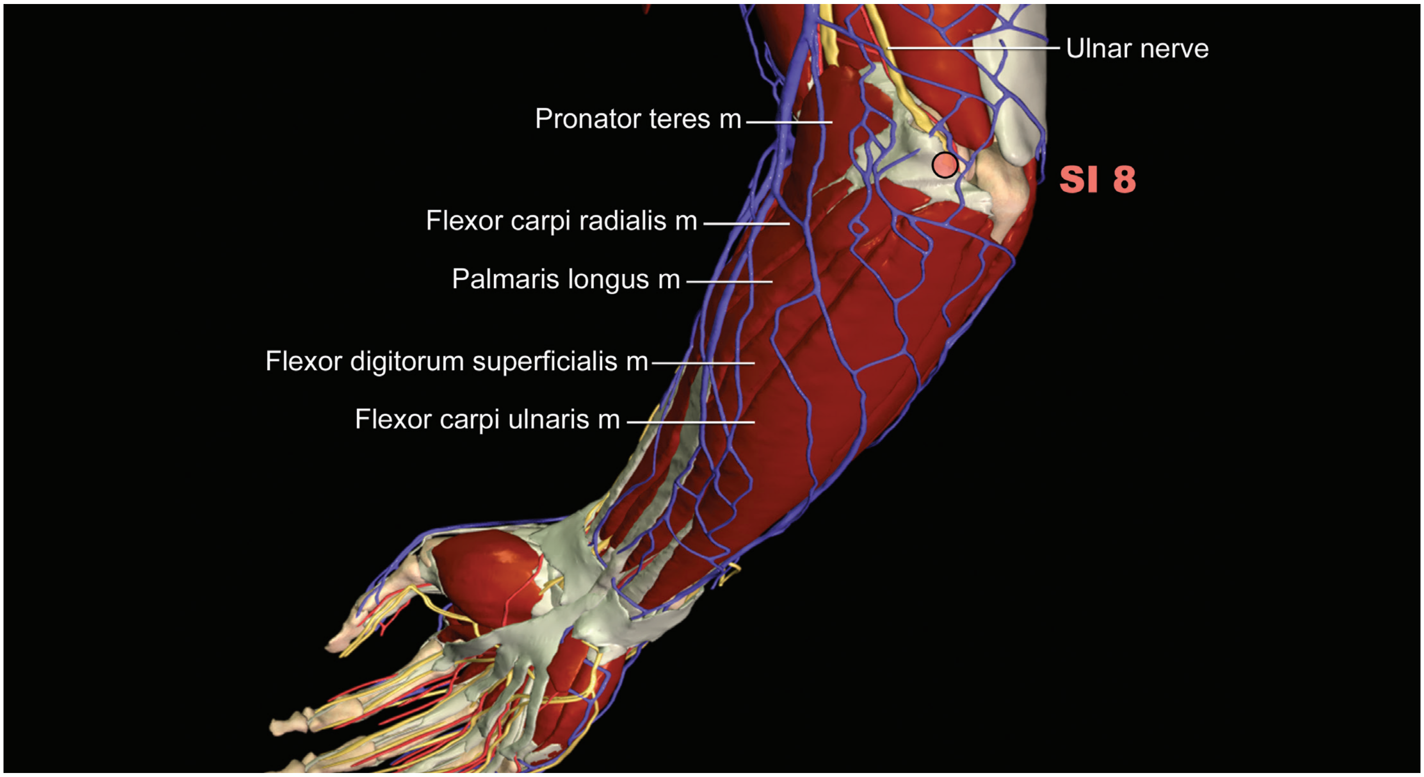


Figure 6-15. SI 8 sits directly over the ulnar nerve in the ulnar groove, vulnerable to compression and traction.

Vessels

- **Basilic vein:** The basilic vein courses along the medial aspect of the arm and ultimately empties into the axillary vein after merging with the brachial veins. The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm. At the elbow, it joins the median cubital vein.
- **Superior ulnar collateral artery:** This artery arises from the brachial artery near the middle of the arm and travels with the ulnar nerve toward the humerus. It anastomoses with the posterior branch of the ulnar recurrent artery and inferior ulnar collateral artery which participate in the elbow anastomoses.
- **Posterior (branch of the) ulnar recurrent artery:** Arises from the ulnar artery just past the elbow joint. It joins with the ulnar collateral and interosseous recurrent arteries to form the elbow anastomoses. It supplies the adjacent muscles.
- **Inferior ulnar collateral artery:** This artery arises from the brachial artery about 5 cm proximal to the cubital crease. It joins the elbow anastomoses via its connection with the anterior branch of the ulnar recurrent artery.

Clinical Relevance: Despite the abundant anastomoses around the elbow, arterial injuries at the elbow have a high risk of causing muscle necrosis.[5] Elbow trauma leading to fracture and requiring orthopedic fixation may injure the brachial artery and cause ischemic injury to the hand.[6] Elbow dislocations, in particular, run the risk of concomitant periarticular neurovascular

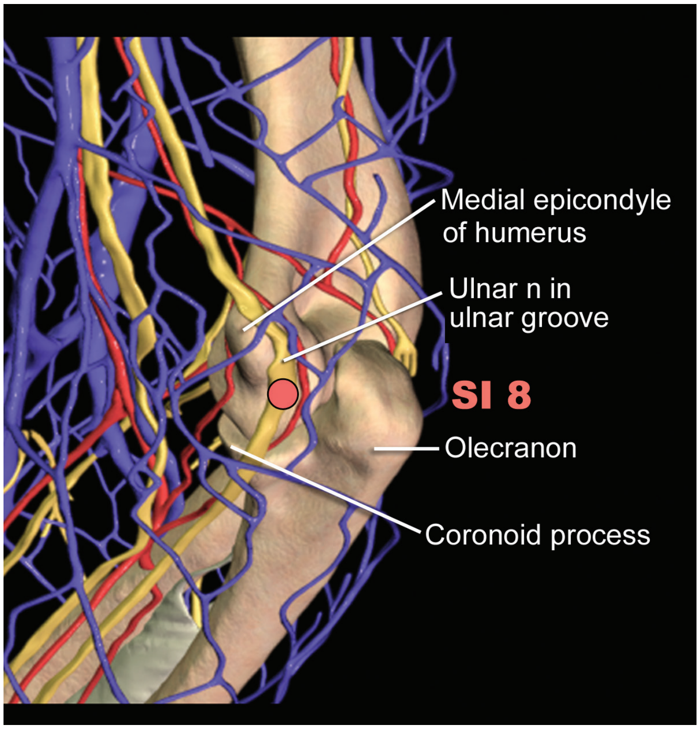

Medial epicondyle of humerus
Ulnar n in ulnar groove
SI 8
Olecranon
Coronoid process

Figure 6-16. "Small Sea" for SI 8 describes the depression formed by the ulnar groove in the medial epicondyle of the humerus.

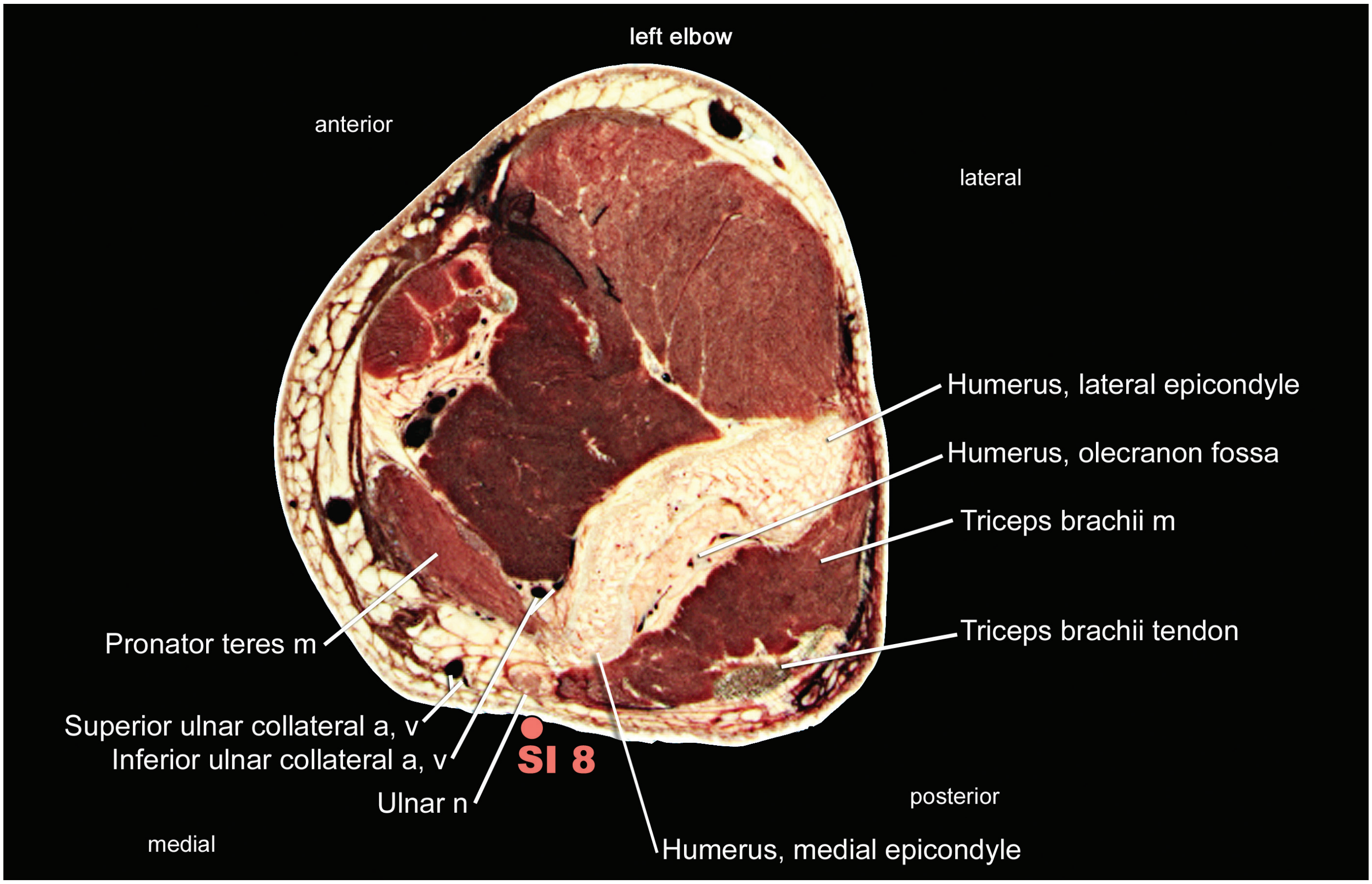

left elbow
anterior
lateral
Humerus, lateral epicondyle
Humerus, olecranon fossa
Triceps brachii m
Triceps brachii tendon
Pronator teres m
Superior ulnar collateral a, v
Inferior ulnar collateral a, v
SI 8
Ulnar n
posterior
medial
Humerus, medial epicondyle

Figure 6-17. The ulnar groove and its neural content shown beneath SI 8 are what people commonly refer to as the "funny bone" due to the uncomfortable, tingly feeling experienced when the elbow hits the corner of a table or similar object.

injury. The arterial and venous anatomoses surrounding the elbow appear in Figure 6-16.

Indications and Potential Point Combinations

- **Medial epicondylitis:** SI 8, not needled deeply. Examine proximal and distal to the elbow for trigger points and tender enthesiopathies.
- **Pain or stiffness along the SI channel:** Aside from myofascial strain leading to or accentuating ulnar nerve entrapment and thereby making the case for treating SI 8, selecting other points along the SI channel that associate with more myofascial tissue and less risk of injuring the nerve seems more prudent.

References

1. Robertson C and Saratsiotis J. A review of compressive ulnar neuropathy at the elbow. *J Manipulative Physiol Ther*. 2005;28:345.e1-345.e18.
2. Green JR and Rayan GM. The cubital tunnel: anatomic, histologic, and biomechanical study. *J Shoulder Elbow Surg*. 1999;8:466-470.
3. Di Rocco F, Doglietto F, Rufo T, et al. Posttraumatic immobilization in flexion of a congenital valgus elbow and cubital tunnel syndrome – a case report. *Surgical Neurology*. 2009;71:7009-712.
4. Rokito AS, McMahon PJ, and Jobe FW. Cubital tunnel syndrome. *Operative Techniques in Sports Medicine*. 1996;4(1):15-20.
5. Lowrie AG, Berry MG, Kirkpatrick JJ, et al. Arterial injuries at the elbow carry a high risk of muscle necrosis and warrant urgent revascularization. *Ann R Coll Surg Engl*. 2012;94(2):124-128.
6. Brahmamdam P, Plummer M, Modrall JG, et al. Hand ischemia associated with elbow trauma in children. *J Vasc Surg*. 2011;54(3):773-778.
7. Ayel J-E, Bonnevialle N, Lafosse J-M, et al. Acute elbow dislocation with arterial rupture. Analysis of nine cases. *Orthopaedics & Traumatology: Surgery & Research*. 2009;95:343-351.

SI 9

Jian Zhen "True Shoulder", "Central Shoulder"

On the dorsal shoulder, 1 cun cranial to the end of the start of the axillary fold (see channel drawing at beginning of this chapter, in a depression caudal to the infraglenoid tubercle (see Figure 6-19), lateral to the lateral border of the scapula. The point occurs along the caudal border of the deltoid muscle.

The point relates closely to the quadrangular space (see Figure 6-18).

Muscles

- **Deltoid muscle:** The posterior part extends the arm and rotates it laterally. The anterior part flexes the arm and rotates it medially. The middle part abducts the arm.
- **Teres minor muscle:** Adducts the arm and rotates it medially. The teres minor tendon crosses and unites with the caudal shoulder joint capsule.

Clinical Relevance: Axillary neuropathy in cases of quadrilateral space syndrome or other sources of injury to the axillary nerve may cause pain and weakness in the shoulder and be mistaken for rotator cuff syndrome.[1] However, patients with denervation of the teres minor muscle due to axillary neuropathy differs from rotator cuff syndrome in that patients may have no history of trauma or show display torn tendons. Selective compression of the axillary nerve branch supplying the teres minor and/or compression of the posterior humeral circumflex artery can induce selective teres minor atrophy. Humeral head decentering caused by caudal glenoid wear secondary to osteoarthritis may also lead to isolated teres minor atrophy.

Causes of axillary nerve compression include fibrous bands in the quadrilateral/quadrangular space and space-occupying lesions such as caudal paralabral cysts, lipomas, and venous dilations. Differential diagnoses include cranial shoulder dislocation, humeral neck fracture, stretch injury of the brachial plexus, and thoracic inlet or outlet syndromes. Imaging and electrophysiologic studies assist in the diagnosis when physical examination and palpation cannot sufficiently delineate the cause of pain and/or weakness.

Myofascial pain syndrome in the shoulder warrants early intervention with acupuncture and/or related techniques in order to avert progression to rotator cuff tendinopathy, subacromial impingement syndrome, or other problems. SI 9 overlies the trigger point of the teres minor muscle; this site of somatic dysfunction refers pain strongly to the distal dorsal deltoid and dorsal proximal brachium.

Nerves

- **Axillary nerve (C5, C6):** Innervates the deltoid muscle and teres minor muscle. Also supplies the shoulder joint and the skin overlying the inferior deltoid region.

Clinical Relevance: The axillary nerve can suffer iatrogenic injury during orthopedic surgical procedures such as arthroscopy, thermal shrinkage of the shoulder capsule, and plate fixation of the proximal humerus.[2] Traumatic stretching or repetitive motion injury also has the potential to damage the nerve.

When the axillary nerve enters the quadrangular space, it divides into anterior and posterior branches that supply the deltoid, teres minor, and skin. The anterior branch provides

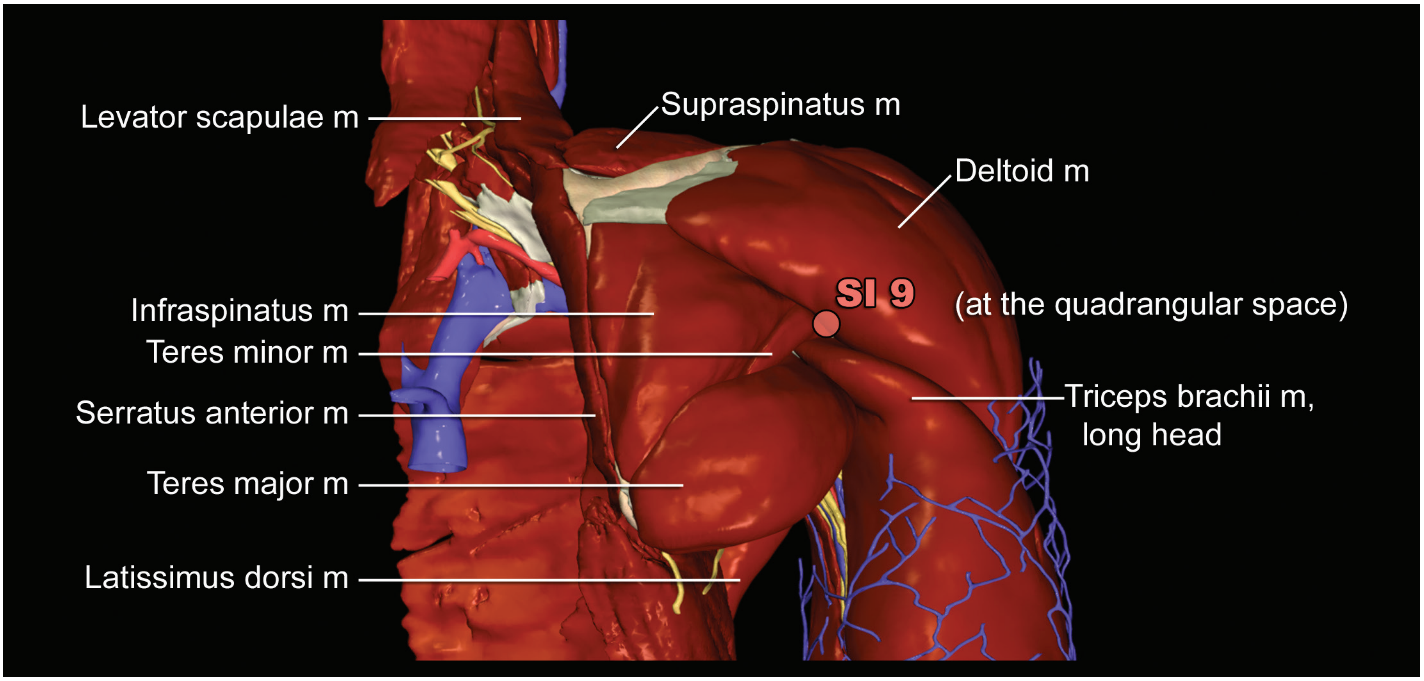


Figure 6-18. The "hole" one palpates at SI 9, identifies the quadrangular (quadrilateral) space, bordered by the long head of the triceps medially, the surgical neck of the humerus laterally, superiorly by the teres minor muscle, and inferiorly by the teres major muscle. The quadrangular space transmits the axillary nerve and posterior circumflex humeral artery. When compressed by the fibrous bands, myofascial restriction, or space-occupying lesions, the axillary nerve suffers entrapment, accompanied by a sensory deficit over the lateral shoulder and proximal dorsal brachium.[12] Relaxing muscle tension through acupuncture and related technique releases pressure on the nerve and accompanying artery.

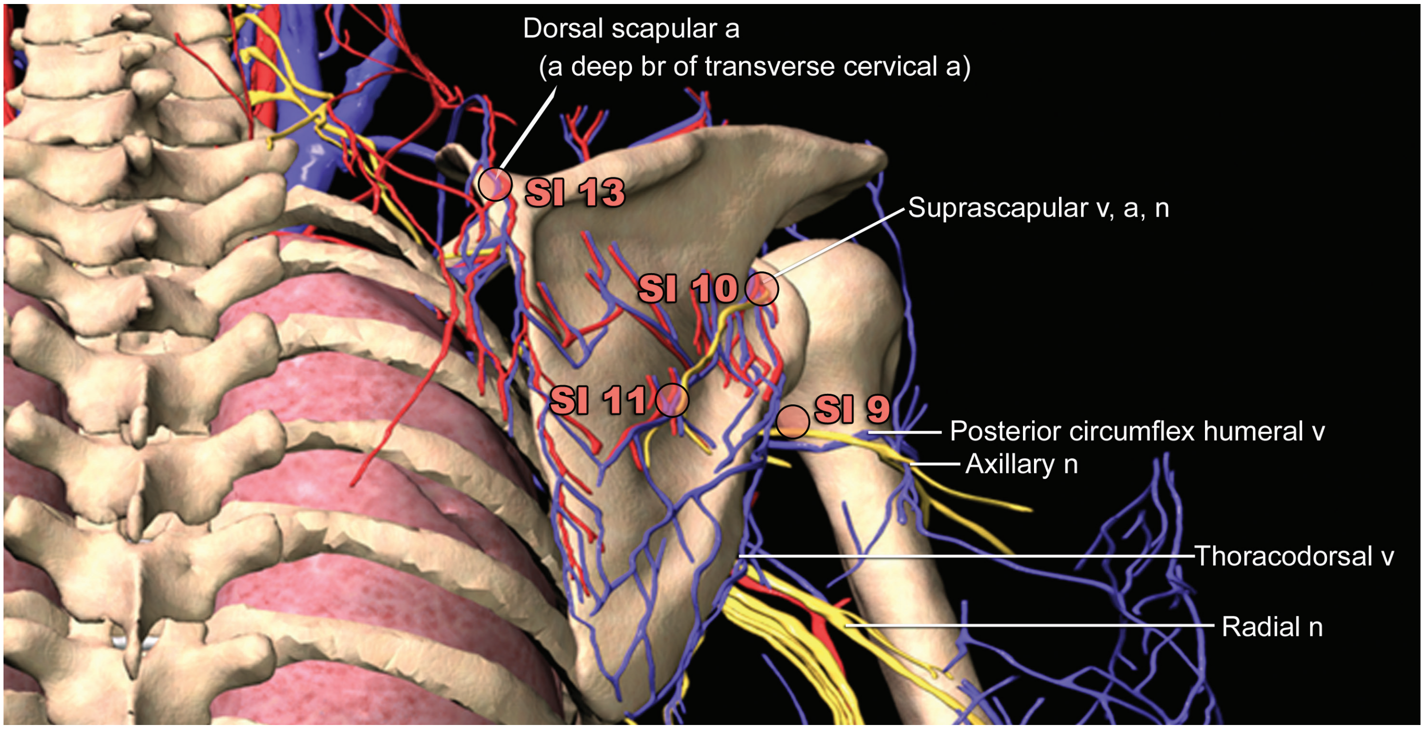


Figure 6-19. This neurovascular view of SI 9 explains its titles "True Shoulder" and "Central Shoulder". Its location over the axillary nerve and posterior circumflex humeral vessels appears as a hub at the joint around which the other SI points revolve.

branches to the joint capsule along with the anterior and middle deltoid heads. The teres minor muscle and deltoid muscle receive innervation from the posterior branch. Branching patterns often vary between individuals, raising the possibility of iatrogenic injury due to unpredictable courses of the nerves.

Glenohumeral arthrosis and associated humeral osteophytes may compress the axillary neurovascular bundle. A large, caudal humeral osteophyte known as a "goat's beard deformity" sometimes extends into the caudal portion of the glenohumeral joint capsule, potentially injuring the axillary nerve. Axillary nerve compression can then lead to fatty infiltration of the teres minor, evident on magnetic resonance imaging.[3]

Quadrilateral space syndrome involves compression of the posterior humeral circumflex artery and the axillary nerve by fibrotic bands that cross the space.[4] The quadrilateral space is the most common location of isolated compressive neuropathy of the axillary nerve.[5] Acute shoulder trauma and repetitive overuse as in baseball throwing are precursors to quadrilateral space syndrome.[6] Neuromodulation via acupuncture and related techniques may alleviate myofascial contributions to quadrangular (quadrilateral) space syndrome and improve nerve function in cases of axillary neuropathy.

Vessels

- **Posterior circumflex humeral artery:** Arises from the axillary artery and passes through the quadrangular space with the axillary nerve. Anastomoses with the anterior circumflex humeral artery to provide a circular anastomosis around the surgical neck of the humerus.
- **Posterior circumflex humeral vein:** Accompanies the posterior circumflex humeral artery.

Clinical Relevance: Dysfunction or trauma affecting the quadrangular space can injure the posterior circumflex humeral artery, leading to serious ischemic complications if misdiagnosed as a musculoskeletal problem.[7] Treatment targeting SI 9, SI 10, SI 11, and other local points can support tissue healing in conjunction with conventional approaches to vascular injury.

Indications and Potential Point Combinations

- **Pain or restricted movement of the shoulder or arm, chronic shoulder pain,[8] frozen shoulder:** SI 9 plus tender local trigger points.[9]
- **Rotator cuff tendinitis:** Palpate region and select points based on tenderness or other abnormalities; especially consider SI 9, SI 11, SI 12, LI 15, LI 14, TH 15, TH 14, BL 44, SI 14, and distal points including LI 11, SI 6, SI 3, TH 3, GB 34, and LU 2.[10]
- **Paresis or paralysis of the arm:** SI 9 if axillary involvement; as evidenced by weakness of deltoid, teres major and minor, and/or long head of the triceps muscles.
- **Brachial plexus injury:[11]** HT 1, SI 9, LI 4, LI 11, PC 6, caudal cervical spinal nerve sites.
- **Quadrangular (Quadrilateral) space syndrome:** SI 9, TH 13, LI 14; add laser therapy and massage.

References

1. Brestas PS, Tsouroulas M, Nikoakopoulou Z, et al. Ultrasound findings of teres minor denervation in suspected quadrilateral space syndrome. *J Clin Ultrasound.* 2006;34:343-347.
2. Loukas M, Grabska J, Tubbs RS, et al. Mapping the axillary nerve within the deltoid muscle. *Surg Radiol Anat.* 2009;31:43-47.
3. Millett PJ, Schoenahl J-Y, Allen MJ, et al. An association between the inferior humeral head osteophyte and teres minor fatty infiltration: evidence for axillary nerve entrapment in glenohumeral osteoarthritis. *J Shoulder Elbow Surg.* 2013;22(2):215-221.

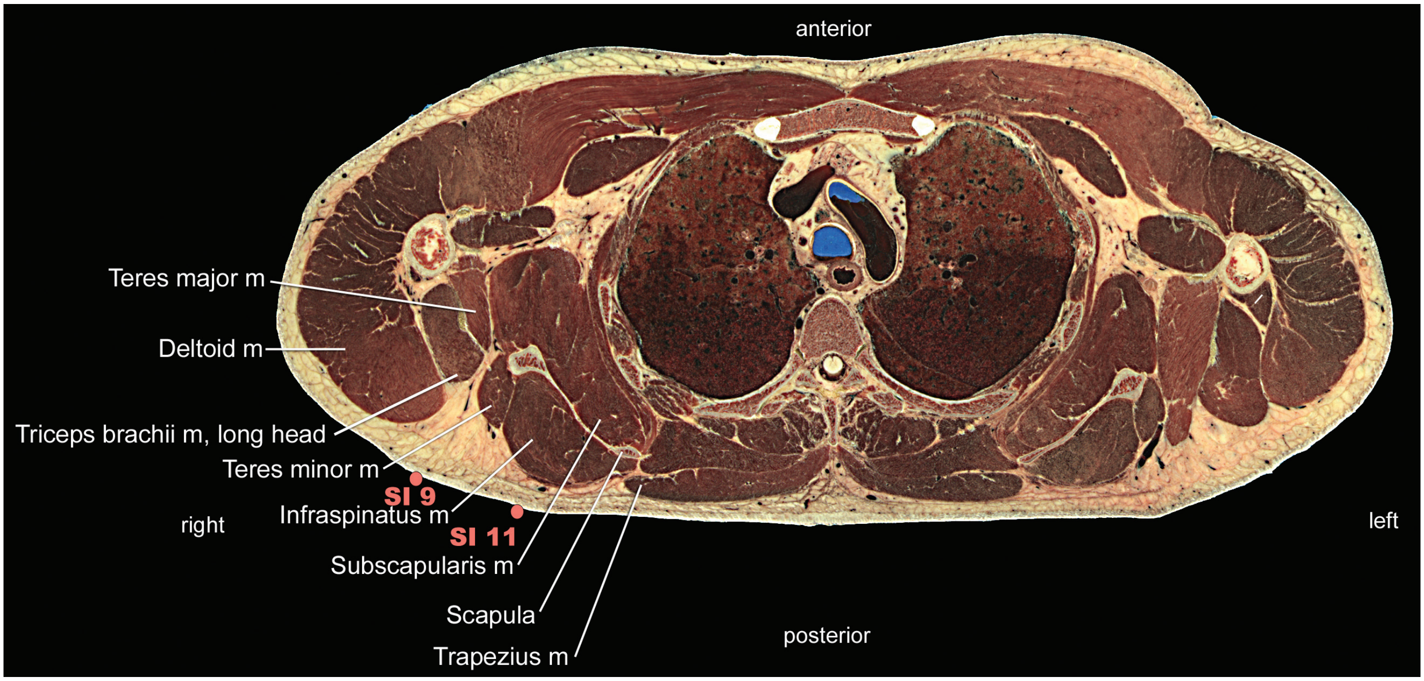


Figure 6-20. Most of the SI points on the shoulder relate to bulky muscles. SI 9, however, is different. It inhabits a pocket (shown here) interposed between overlapping shoulders known as the quadrangular or quadrilateral space containing the axillary nerve and posterior circumflex humeral vessels.

4. Lester B, Jeong GK, Weiland AJ, et al. Quadrilateral space syndrome: diagnosis, pathology, and treatment. *Am J Orthop*. 1999;28(12):718-722, 725.

5. Brestas PS, Tsouroulas M, Nikolakopoulou Z, et al. Ultrasound findings of teres minor denervation in suspected quadrilateral space syndrome. *J Clin Ultrasound*. 2006;34:343-347.

6. Cummins CA and Schneider DS. Peripheral nerve injuries in baseball players. *Phys Med Rehabil Clin N Am*. 2009;20(1):175-193, x.

7. Atema JJ, Unlu C, Reekers JA, et al. Posterior circumflex humeral artery injury with distal embolisation in professional volleyball players: a discussion of three cases. *Eur J Vasc Endovasc Surg*. 2012;44(2):195-198.

8. Lathia AT, Jung SM, and Chen LX. Efficacy of acupuncture as a treatment for chronic shoulder pain. *J Alt Complement Med*. 2009;15(6):613-618.

9. Osborne NJ and Gatt IT. Management of shoulder injuries using dry needling in elite volleyball players. *Acupunct Med*. 2010;28(1):42-45.

10. Kleinhenz J, Streitberger K, Windeler J, et al. Randomised clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis. *Pain*. 1999;83:235-241.

11. Luo W and Cheng JZ. Clinical study on acupuncture and Tuina for treatment of birth brachial plexus injury. *Zhongguo Zhen Jiu*. 2010;30(11):918-920.

12. Tubbs RS, Tyler-Kabara EC, Aikens AC, et al. Surgical anatomy of the axillary nerve within the quadrangular space. *J Neurosurg*. 2005;102:912-914.

SI 10

Nao Shu "Upper Arm Shu"

On the posterior aspect of the shoulder, In a depression inferior to the acromial end of the scapular spine, directly superior to SI 9 and the posterior axillary fold that appears when the arm is adducted.

Connective Tissues

- **Inferior transverse ligament (spinoglenoid ligament):** This weak, membranous band stretches from the lateral border of the scapular spine to the margin of the glenoid cavity. This ligament becomes an arch that covers the transverse scapular vessels and suprascapular nerve as it enters the infraspinous fossa.

Clinical Relevance: Ossification or hypertrophy of the inferior transverse ligament can narrow the notch through which the suprascapular nerve and vessels pass, predisposing these structures to compression and pathology. The inferior transverse ligament becomes taut during adduction and internal rotation of the thoracic limb, as happens in the follow-through phase of throwing.

Muscles

- **Deltoid muscle:** The posterior part extends the arm and rotates it laterally. The anterior part flexes the arm and rotates it medially. The middle part abducts the arm.
- **Infraspinatus muscle:** Rotates the arm laterally. Assists the teres minor muscle in keeping the humeral head within the glenoid cavity of the scapula.

Clinical Relevance: As shown in Figure 6-23, a needle entering SI 10 would first encounter the deltoid muscle, followed by the insertion of the infraspinatus muscle onto the greater tubercle of the humerus. SI 10 lands over the trigger point of the dorsal division of the deltoid. It refers pain strongly to the dorsal shoulder joint and proximal dorsal brachium.

Nerves

- **Axillary nerve (C5, C6):** Innervates the deltoid muscle and teres minor muscle. Supplies the shoulder joint and continues on as the superior lateral cutaneous nerve, innervating the skin overlying the inferior deltoid region.
- **Suprascapular nerve (C4-C6):** Supplies the supraspinatus and infraspinatus muscles.
- **Lateral supraclavicular nerve (C3, C4):** Supplies the skin over the shoulder.

Clinical Relevance: Figure 6-22 indicates the relationship between SI 10 and the suprascapular nerve. Depending on the site of entry of an acupuncture needle and the angle of its insertion, stimulation of SI 10 can impact suprascapular nerve function and circulation of the territory its accompanying vessels supply. As with the axillary nerve at SI 9, traction or compression can damage the suprascapular nerve at SI 10. More are recognizing suprascapular neuropathy as a source of shoulder pain and weakness, whether or not the patient has concomitant shoulder joint pathology.[1] Etiologies include repetitive overhead activity such as volleyball, baseball, tennis, basketball, swimming, painting the ceiling, etc. that places traction on the nerve. In addition, space-occupying lesions such as a ganglion cysts and lipomas as well as myofascial tension may compress the nerve. Retraction of a large rotator cuff tear contributes to

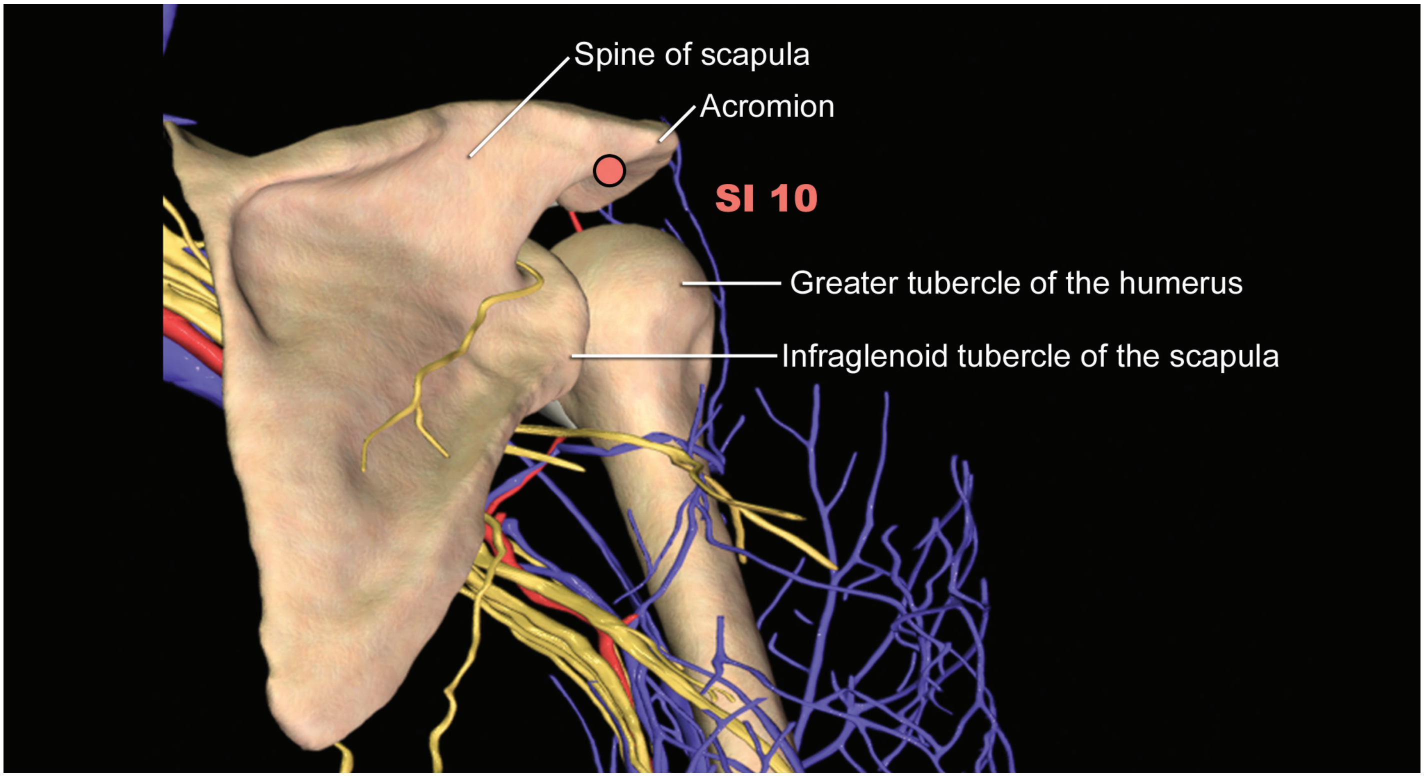

Spine of scapula
Acromion
SI 10
Greater tubercle of the humerus
Infraglenoid tubercle of the scapula

Figure 6-21. The structures traveling through SI 10, "Upper Arm Transport" include the infraspinatus tendon, the suprascapular nerve, and the circumflex scapular artery.

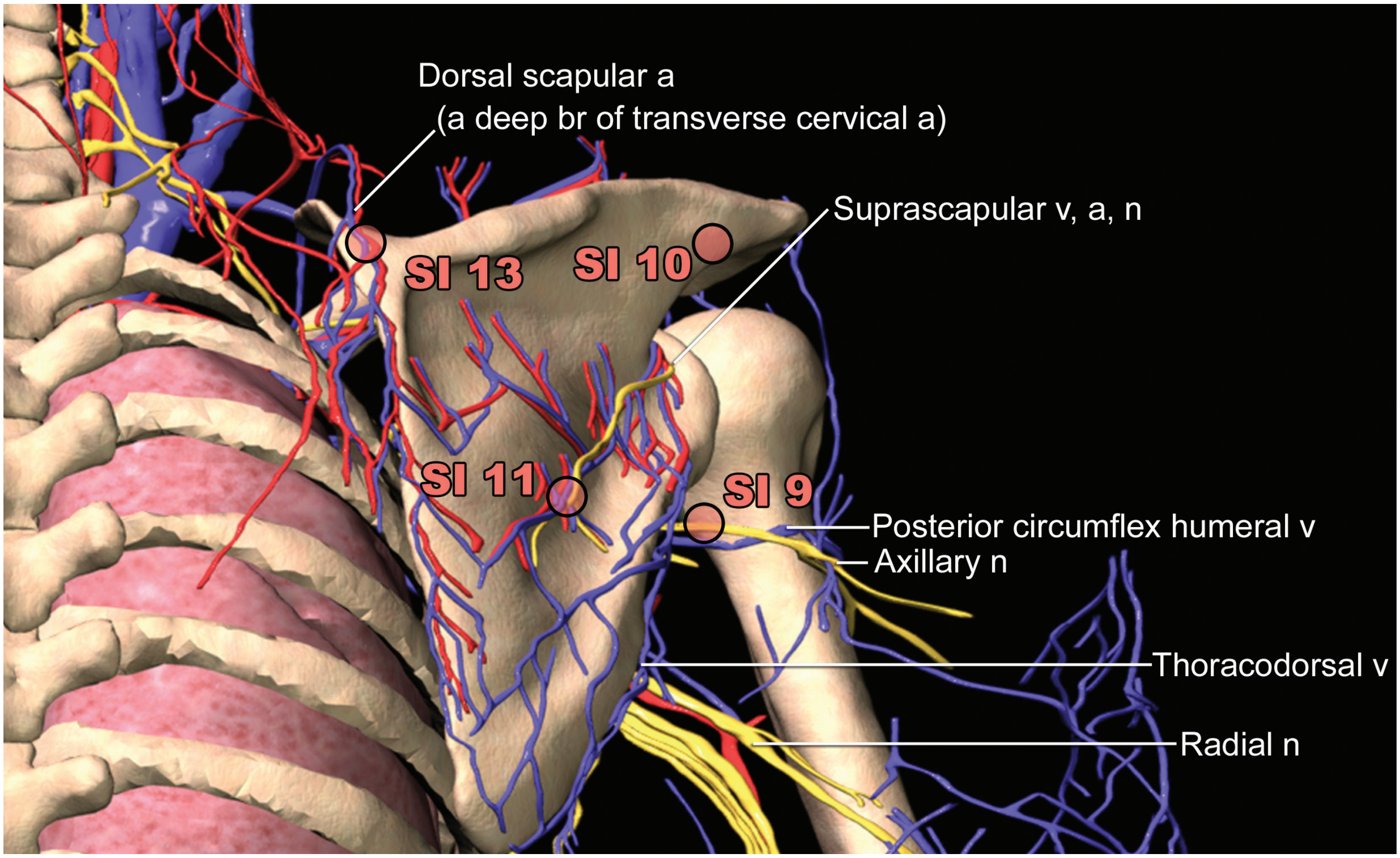


Figure 6-22. The company kept by SI 10 includes several other scapular SI points such as SI 9, SI 11, SI 12 (not shown), and SI 13 that typically cause the patient to report tenderness upon their palpation. This neurovascular layer exposes the rich scapular anastomotic network of vessels.

traction injury as the pull of the shortening infraspinatus muscle drags the suprascapular nerve in a medial direction against the suprascapular notch. Patients with suprascapular neuropathy may show marked infraspinatus muscle atrophy. Conservative treatment through physical therapy and neuromodulation, including acupuncture, are first-line approaches.

Vessels

- **Suprascapular artery:** Arises from the thyrocervical trunk (from the subclavian artery). Supplies the supraspinatus and infraspinatus muscles.
- **Suprascapular vein:** Accompanies the suprascapular artery. Empties into the external jugular vein.
- **Circumflex scapular artery:** This artery arises from the subscapular artery and reaches its destination to supply the muscles on the dorsum of the scapula by curving around the axillary border of the scapula. It takes part in the scapular anastomoses. Several vessels participate in the arterial anastomoses around the scapula, on both its anterior and posterior surfaces. These include the dorsal scapular, subscapular (via the circumflex scapular), and suprascapular arteries. These anastomoses create a potential collateral circulation pathway for the arm in the event of axillary artery obstruction or ligation.

Clinical Relevance: An "extremely intricate" vascular anastomosis surrounds the scapula.[2] The abundant vasculature provides for collateral circulation to the shoulder and scapula in the event of injury or acute blockade of the axillary artery. The circumflex scapular artery, appearing in Figure 6-22 between SI 10 and SI 9, is vulnerable to damage during a dorsal approach open reduction and internal fixation for scapular fracture. It encompasses the "at risk area" for the circumflex scapular artery where the ascending branch of the circumflex scapular artery anastomoses with the suprascapular artery.

Indications and Potential Point Combinations

- **Pain or weakness in the shoulder or arm:** Isolate cause (myofascial dysfunction, arthritis, neurologic impairment, etc.) and treat accordingly. SI 10 frequently appears in shoulder treatment protocols given its central placement on the posterior shoulder. near the joint.
- **Shoulder arthritis and pain:** SI 10, LI 15, TH 14, local trigger points.

References

1. Freehill MT, Shi LL, Tompson JD, et al. Suprascapular neuropathy: diagnosis and management. *Phys Sportsmed.* 2012;40(1):72-83.

2. Ebraheim NA, Ramineni SK, Alla SR, et al. Anatomical basis of the vascular risk related to the circumflex scapular artery during posterior approach to the scapula. *Surg Radiol Anat.* 2010;32:51-54.

SI 11

Tian Zong “Celestial Gathering”

In approximately the center of the infraspinous fossa in the belly of the infraspinatus muscle. Identify the site of maximal tenderness.

Muscles

- **Infraspinatus muscle:** Rotates the arm laterally. Assists the teres minor muscle in keeping the humeral head within the glenoid cavity of the scapula.

Clinical Relevance: Trigger points in the infraspinatus muscle, at SI 11 and surrounding sites refer strongly to the entire deltoid muscle and along the LU and LI channels. Manual therapy of active trigger points in the infraspinatus (SI 11), supraspinatus (SI 12), and subscapularis (dorsal to HT 1) significantly reduces spontaneous pain and tenderness to palpation in patients with shoulder impingement syndrome.[4]

The distribution of trigger point pathology in breast cancer patients following lumpectomy or mastectomy affects the infraspinatus, upper trapezius, sternocleidomastoid, levator scapulae, scalene, and pectoralis major muscles.[5] Widespread pain hypersensitivity and myofascial trigger points in the neck and shoulder in patients with postmastectomy pain develop as a result, at least in part, of peripheral and central sensitization.[6] Acupuncture and ischemic compression therapy reduce symptoms in patients with chronic shoulder pain of myofascial origin.[7,8]

Deactivation of trigger points in the infraspinatus (SI 11), supraspinatus (SI 12), gluteus and piriformis muscles lessened pain and discomfort associated with interstitial cystitis and pelvic pain.[9]

Nerves

- **Spinal nerves T2-T5:** Innervate the skin.
- **Suprascapular nerve (C4-C6):** Supplies the supraspinatus and infraspinatus muscles.

Clinical Relevance: Figure 6-22 indicates the relationship between SI 10 and the suprascapular nerve. Depending on the site of entry of an acupuncture needle and the angle of its insertion, stimulation of SI 10 can impact suprascapular nerve function and circulation of the territory its accompanying vessels supply. As with the axillary nerve at SI 9, traction or compression can damage the suprascapular nerve at SI 10. More are recognizing suprascapular neuropathy as a source of shoulder pain and weakness, whether or not the patient has concomitant shoulder joint pathology.[10] Etiologies include repetitive overhead activity such as volleyball, baseball, tennis, basketball, swimming, painting the ceiling, etc. that places traction on the nerve. In addition, space-occupying lesions such as a ganglion cysts and lipomas as well as myofascial tension may compress the nerve. Retraction of a large rotator cuff tear contributes to traction injury as the pull of the shortening infraspinatus muscle drags the suprascapular nerve in a medial direction against the suprascapular notch. Patients with suprascapular neuropathy may show marked infraspinatus muscle atrophy. Conservative treatment through physical therapy and neuromodulation, including acupuncture, are first-line approaches.

The relationship of SI 11 to lactation[11] can be explained through dermatomal overlap at the level of the spinal cord and neuroendocrine effects from reducing sympathetic facilitation.[12]

Vessels

- **Suprascapular artery:** Arises from the thyrocervical trunk (from the subclavian artery). Supplies the supraspinatus and infraspinatus muscles.
- **Suprascapular vein:** Accompanies the suprascapular artery. Empties into the external jugular vein.
- **Circumflex scapular artery:** This artery arises from the subscapular artery and reaches its destination to supply the

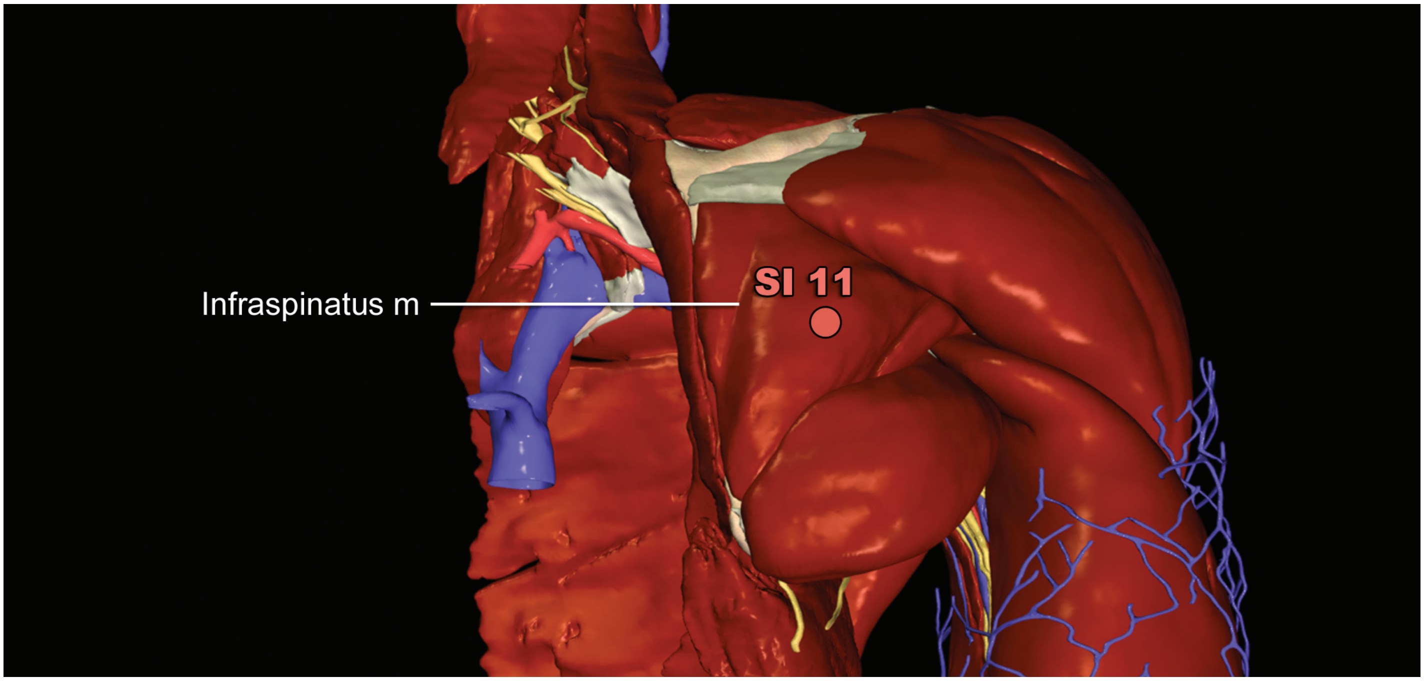


Figure 6-23. The infraspinatus and its caudal neighbor seen here, the teres major, exhibit a high prevalence of myofascial trigger points in patients with pain in the shoulder.[15]

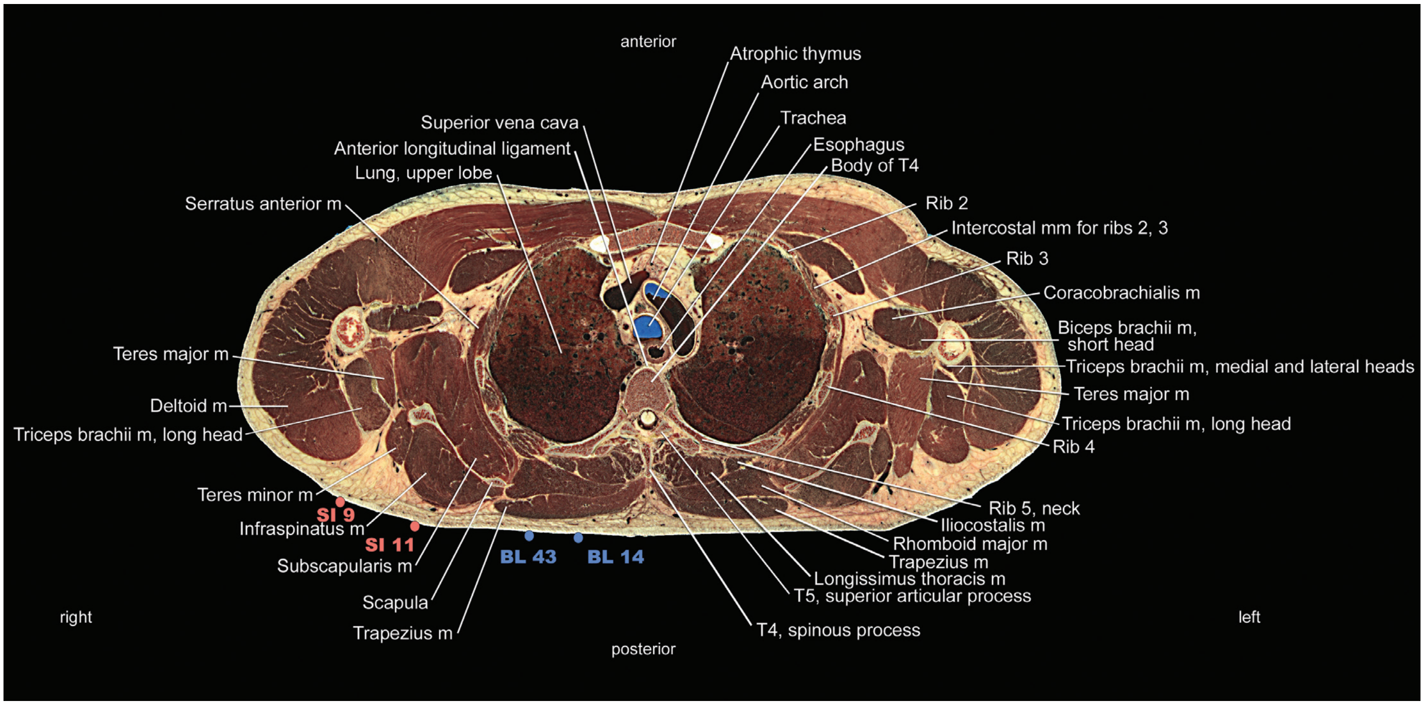

anterior
Atrophic thymus
Aortic arch
Trachea
Superior vena cava
Anterior longitudinal ligament
Esophagus
Lung, upper lobe
Body of T4
Serratus anterior m
Rib 2
Intercostal mm for ribs 2, 3
Rib 3
Coracobrachialis m
Biceps brachii m, short head
Teres major m
Triceps brachii m, medial and lateral heads
Teres major m
Deltoid m
Triceps brachii m, long head
Triceps brachii m, long head
Rib 4
Teres minor m
SI 9
Rib 5, neck
Infraspinatus m
Iliocostalis m
SI 11
BL 43
BL 14
Rhomboid major m
Subscapularis m
Trapezius m
Longissimus thoracis m
Scapula
T5, superior articular process
right
left
Trapezius m
T4, spinous process
posterior

Figure 6-24. "Celestial Gathering" relates to the proximity of SI 11 to the lungs and heart, gathered in the center of this cross section.

muscles on the dorsum of the scapula by curving around the axillary border of the scapula. It takes part in the scapular anastomoses. Several vessels participate in the arterial anastomoses around the scapula, on both its anterior and posterior surfaces. These include the dorsal scapular, subscapular (via the circumflex scapular), and suprascapular arteries. These anastomoses create a potential collateral circulation pathway for the arm in the event of axillary artery obstruction or ligation.

Clinical Relevance: An "extremely intricate" vascular anastomosis surrounds the scapula.[13] The abundant vasculature provides for collateral circulation to the shoulder and scapula in the event of injury or acute blockade of the axillary artery. The location of SI 11 in the middle of the infraspinatus (also known as infraspinous) fossa seen in Figure 6-22 denotes not only the neural but also the vascular underpinning of SI 11. Trigger point deactivation involves not only nerve stimulation and dysfunctional motor endplate disruption, but also improvement of tissue perfusion and oxygen tension. Thus, stimulation of SI 11 needs to affect both the suprascapular nerve and its similarly named vessels in order to successfully resolve infraspinatus dysfunction.

Indications and Potential Point Combinations

- **Shoulder and arm pain made worse by applying pressure to the infraspinatus muscle:** SI 11; add associated trigger points in the anterior deltoid, supraspinatus muscle, biceps brachii, teres major, and latissimus dorsi muscles. In addition, Travell and Simon suggest palpating the subscapularis and pectoralis major muscles for myofascial trigger points.[1] Treat bilaterally even with unilateral shoulder and arm pain due to the role of central sensitization in maintaining and accruing further trigger points.[2,3]
- **Lactation disorders:** SI 11, SI 1, LI 4.[14]

References

1. Simons DG, Travell JG, and Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd edition.* Baltimore: Eilliams & Wilkins, 1999. Pp. 558-559.
2. Ge H-Y, Fernandez-de-las-Penas C, Madeleine P, et al. Topographical mapping and mechanical pain sensitivity of myofascial trigger points in the infraspinatus muscle. *European Journal of Pain.* 2008;12:859-865.
3. Hsieh Y-L, Kao M-J, Kuan T-S, et al. Dry needling to a key myofascial trigger point may reduce the irritability of satellite MTrPs. *American Journal of Physical Medicine & Rehabilitation.* 2007; 86(5):397-403.
4. Hidalgo-Lozano A, Fernandez de las Penas C, Diaz-Rodriguez L, et al. Changes in pain and pressure pain sensitivity after manual treatment of active trigger points in patients with unilateral shoulder impingement: a case series. *Journal of Bodywork & Movement Therapies.* 2011;15:399-404.
5. Fernandez-Lao C, Cantarero-Villanueva I, Fernandez de las Penas C, et al. Development of active myofascial trigger points in neck and shoulder musculature is similar after lumpectomy or mastectomy surgery for breast cancer. *Journal of Bodywork & Movement Therapies.* 2012;16:183-190.
6. Fernandez-Lao C, Cantarero-Villanueva I, Fernandez-de-las-penas C, et al. Myofascial trigger points in neck and shoulder muscles and widespread pressure pain hypersensitivity in patients with postmastectomy pain: evidence of peripheral and central sensitization. *Clin J Pain.* 2010;26(9):796-806.
7. Hains G, Descarreaux M, and Hains F. Chronic shoulder pain of myofascial origin: a randomized clinical trial using ischemic compression therapy. *J Manipulative Physiol Ther.* 2010;33(5):362-369.
8. Hsieh YL, Kao MJ, Kuan TS, et al. Dry needling to a key myofascial trigger point may reduce the irritability of satellite MTrPs. *Am J Phys Med Rehabil.* 2007;86(5):397-403.
9. Doggweiler-Wiygul R and Wiygul JP. Interstitial cystitis, pelvic pain, and the relationship to myofascial pain and dysfunction: a report on four patients. *World J Urol.* 2002;20(5):310-314.
10. Freehill MT, Shi LL, Tompson JD, et al. Suprascapular neuropathy: diagnosis and management. *Phys Sportsmed.* 2012;40(1):72-83.
11. Jenner C and Filshie J. Galactorrhoea following acupuncture. *Acupuncture in Medicine.* 2002;20(2-3):107-108.
12. Ge HY, Fernandez-de-las-Penas C, and Arendt-Nielsen L. Sympathetic facilitation of hyperalgesia evoked from myofascial tender and trigger points in patients with unilateral shoulder pain. *Clin Neurophysiol.* 2006;117(7):1545-1550.
13. Ebraheim NA, Ramineni SK, Alla SR, et al. Anatomical basis of the vascular risk related to the circumflex scapular artery during posterior approach to the scapula. *Surg Radiol Anat.* 2010;32:51-54.
14. Jenner C and Filshie J. Galactorrhoea following acupuncture. *Acupuncture in Medicine.* 2002;20(2-3):107-108.
15. Bron C, Dommerholt J, Stegenga B, et al. High prevalence of shoulder girdle muscles with myofascial trigger points in patients with shoulder pain. *BMC Musculoskeletal Disorders.* 2011;12:139.

SI 12

Bing Feng "Grasping the Wind"

In approximately in the center of the supraspinous fossa, directly above SI 11, in a depression that appears in the belly of the supraspinatus muscle when the arm is abducted.

Muscles

- **Trapezius muscle:** Acts on the scapula to elevate, retract, and rotate it.
- **Supraspinatus muscle:** Helps the deltoid muscle abducts the arm and initiates the abduction movement. Acts as a rotator cuff muscle along with the infraspinatus, teres minor, and subscapularis muscles.

Clinical Relevance: Myofascial trigger points in the supraspinatus muscle at and around SI 12 send pain referral patterns along the LI territory to the wrist, with pain accentuated at the deltoid and lateral elbow. Depressed individuals appear to harbor more latent trigger points in the trapezius, supraspinatus, serratus anterior, and rhomboid muscles than non-depressed people do.[1]

Nerves

- **Spinal nerves T2-T5:** Innervate the skin.
- **Supraclavicular nerve (C3, C4), lateral branches:** Supplies the skin over the shoulder

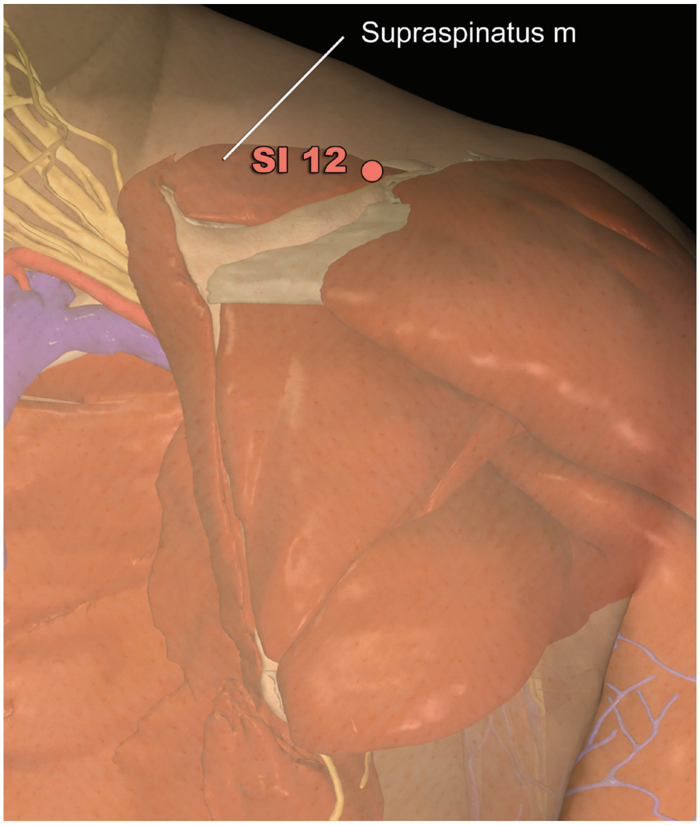


Figure 6-25. SI 12 resides in the center of the supraspinatus fossa. This image illustrates how the fossa curves around the shoulder, causing the supraspinatus muscle to become more horizontal than the infraspinatus.

- **Spinal accessory nerve (also known as the spinal root of the accessory nerve):** Provides motor function to the trapezius.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.
- **Suprascapular nerve (C4-C6):** Supplies the supraspinatus and infraspinatus muscles.

Clinical Relevance: The suprascapular nerve as it enters the supraspinatus fossa travels to a tunnel where it may suffer compression at three locations. Connective tissue places pressure on the nerve at the cranial and caudal incisurae or deep to fascia between the incisurae, creating a tunnel syndrome of entrapment for the suprascapular nerve. Acupuncture and related techniques designed to target the sources of this entrapment would need to treat the relevant, and deep, compressive structures.

Vessels

- **Suprascapular artery:** Arises from the thyrocervical trunk (from the subclavian artery). Supplies the supraspinatus and infraspinatus muscles.
- **Suprascapular vein:** Accompanies the suprascapular artery. Empties into the external jugular vein.

Clinical Relevance: Trigger point deactivation of SI 12 in the supraspinous fossa improves local blood flow and tissue oxygenation through the suprascapular vessels.

Indications and Potential Point Combinations

- **Stiffness or pain of the shoulder, especially as related to supraspinatus muscle trigger points, leading to a deep ache in the shoulder that may radiate to the lateral epicondyle of the humerus (LI 11) or even to the wrist (LI line):** SI 12, LI 15, TH 14, LI 11, SI 8.
- **Shoulder-arm syndrome (cervicothoracic brachialgia):**[3] SI 12, GB 21, relevant trigger points, consider SI 16, LI 14, TH 13, LI 11, LI 4.

References

1. Celik D and Mutlu EK. The relationship between latent trigger points and depression levels in healthy subjects. *Clin Rheumatol.* 2012;31:907-911.
2. Duparc F, Coquerel D, Ozeel J, et al. Anatomical basis of the suprascapular nerve entrapment and clinical relevance of the supraspinatus fascia. *Surg Radiol Anat.* 2010;32:277-284.
3. Liu H and Zhang C. 60 cases of shoulder-arm syndrome treated by electroacupuncture at Bingfeng (SI 12). *J Tradit Chin Med.* 1998;18(4):256-258.

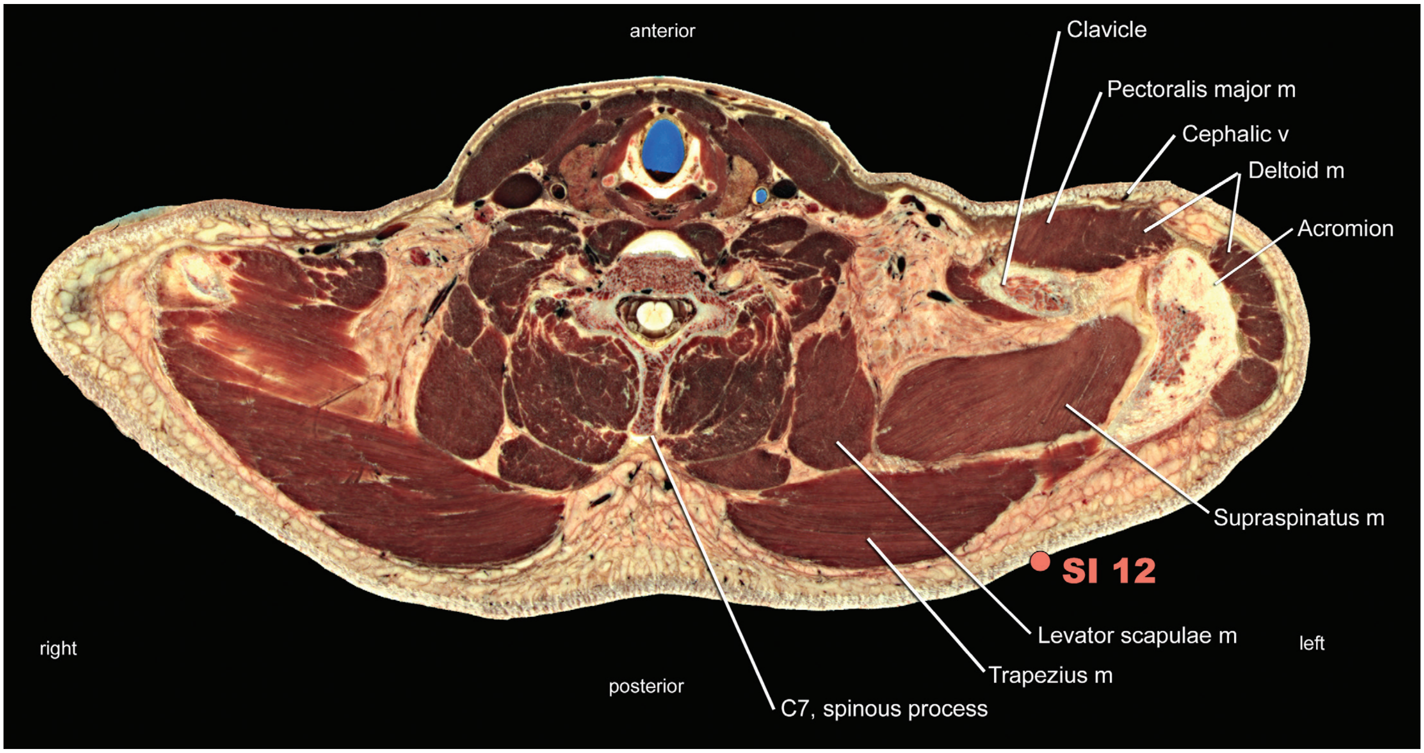

anterior
Clavicle
Pectoralis major m
Cephalic v
Deltoid m
Acromion
Supraspinatus m
SI 12
Levator scapulae m
Trapezius m
C7, spinous process
right
posterior
left

Figure 6-26. A needle designed to target the supraspinatus muscle, as in needling SI 12, first encounters lateral trapezius fibers as illustrated by this cross section.

SI 13

Qu Yuan "Crooked Wall"

In a depression dorsal to the medial end of the scapular spine at the medial limit of the supraspinous fossa. Occurs midway between SI 10 and the T2 spinous process as shown in Figure 6-22. Can be found by sliding a fingertip in a medial direction along the dorsal aspect of the scapular spine; the fingertip will land in a tender depression just lateral to the medial border of the scapula.

Muscles

- **Trapezius muscle:** Acts on the scapula to elevate, retract, and rotate it.
- **Supraspinatus muscle:** Helps the deltoid muscle abducts the arm and initiates the abduction movement. Acts as a rotator cuff muscle along with the infraspinatus, teres minor, and subscapularis muscles.

Clinical Relevance: Myofascial trigger points in the supraspinatus muscle at and around SI 12 and SI 13 send pain referral patterns along the LI territory to the wrist, with pain accentuated at the deltoid and lateral elbow. Depressed individuals appear to harbor more latent trigger points in the trapezius, supraspinatus, serratus anterior, and rhomboid muscles than non-depressed people do.[1]

Compare the location of SI 12 in the center of the supraspinatus muscle with SI 13 which, though unlabeled, would sit just lateral to the bony border between the levator scapulae muscle and the supraspinatus. The trapezius muscle's bulk mounts at SI 13. Thus, a needle entering SI 13 would affect both the trapezius and the supraspinatus muscles.

Nerves

- **Spinal nerves T1-T3:** Innervate the skin.
- **Spinal accessory nerve (also known as the spinal root of the accessory nerve):** Provides motor function to the trapezius.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.
- **Suprascapular nerve (C4-C6):** Supplies the supraspinatus and infraspinatus muscles.

Clinical Relevance: The suprascapular nerve as it enters the supraspinatus fossa travels to a tunnel where it may suffer compression at three locations.[2] Connective tissue places pressure on the nerve at the cranial and caudal incisurae or deep to fascia between the incisurae, creating a tunnel syndrome of entrapment for the suprascapular nerve. Acupuncture and related techniques designed to target the sources of this entrapment would need to treat the relevant, and deep, compressive structures.

Vessels

- **Suprascapular artery:** Arises from the thyrocervical trunk (from the subclavian artery). Supplies the supraspinatus and infraspinatus muscles.
- **Suprascapular vein:** Accompanies the suprascapular artery. Empties into the external jugular vein.
- **Transverse cervical artery:** Arises from the thyrocervical trunk, along with the suprascapular artery, to supply the muscles in the posterior cervical triangle, the trapezius, and the medial scapular muscles. After crossing the phrenic nerve and anterior scalene muscle, superior to the clavicle, the transverse cervical artery then courses through the trunks of the brachial plexus.

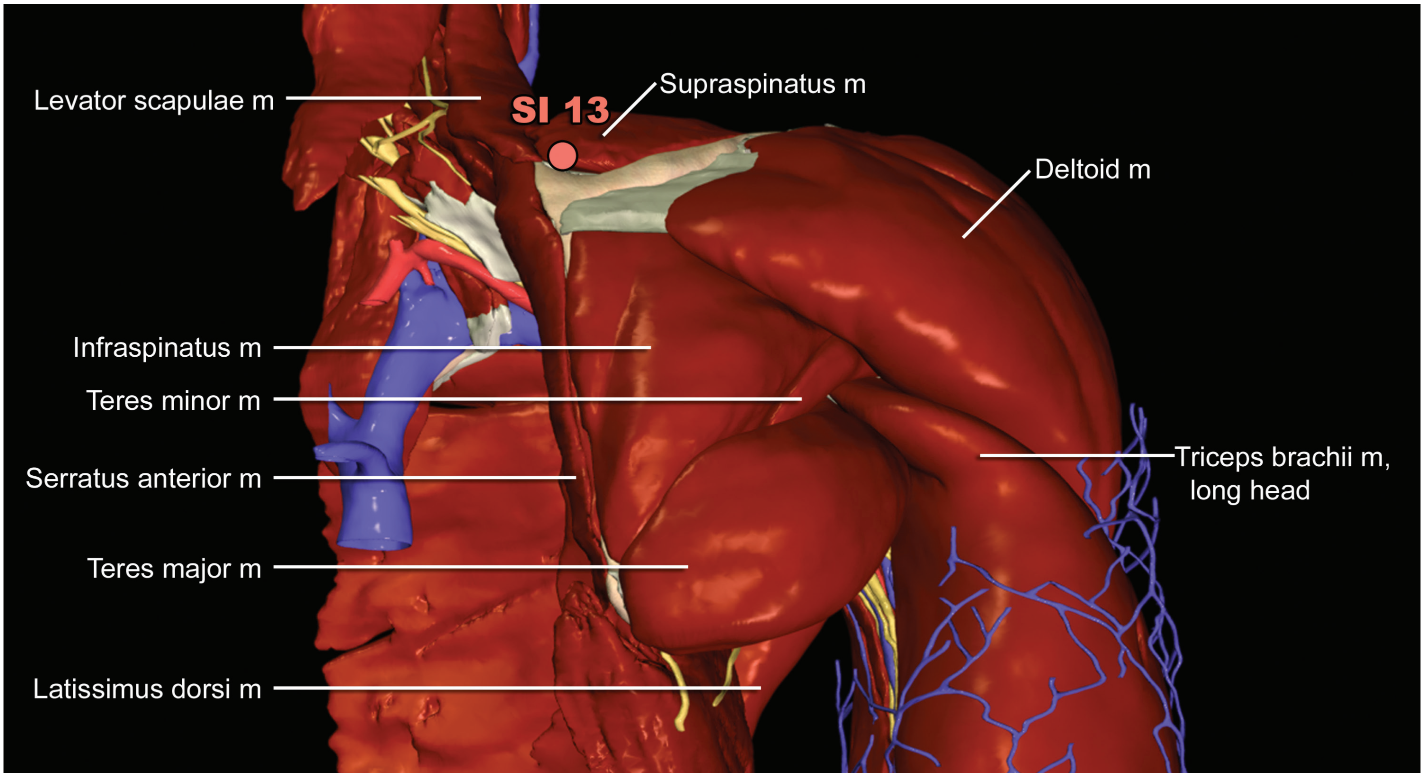


Figure 6-27. Myofascial trigger points fill the fossae of the scapula. Both SI 13 and SI 12 treat these supraspinatus trigger points.

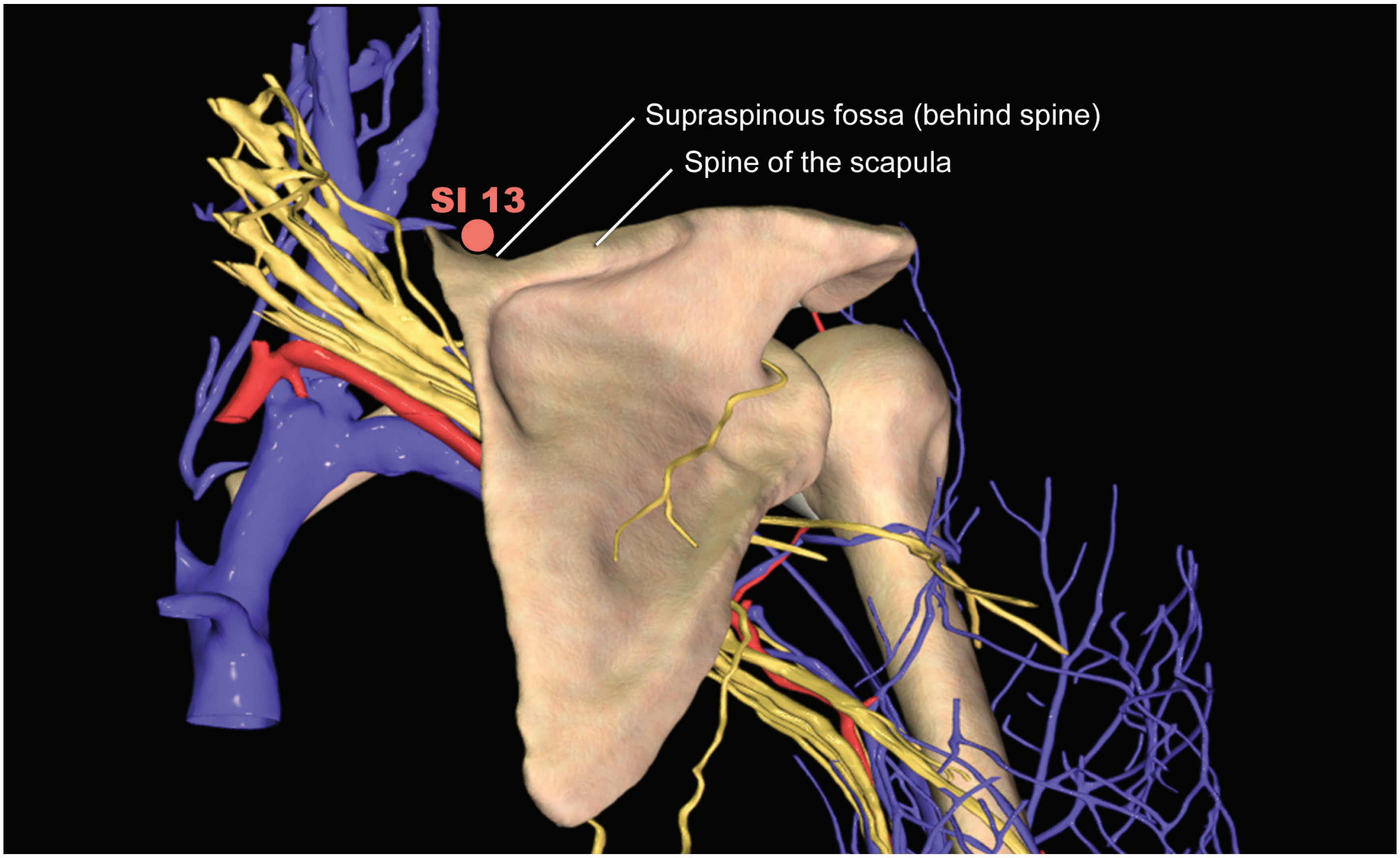


Figure 6-28. The name "Crooked Wall" for SI 13 refers to the uneven border of the medial angle of the scapula, shown in relation to other scapular SI points in Figure 6-22.

As it does so, it supplies branches to the vasa nervorum of the plexus. The dorsal scapular artery may branch from the transverse cervical artery, but it occasionally arises from the subclavian artery.

Clinical Relevance: Trigger point deactivation of SI 13 in the supraspinous fossa improves local blood flow and tissue oxygenation through the suprascapular vessels and the deep branch of the transverse cervical artery.

Indications and Potential Point Combinations

- **Shoulder pain or dysfunction, tension in the upper back:** SI 13 plus local trigger points, add BL 10 for neck pain.

References

1. Celik D and Mutlu EK. The relationship between latent trigger points and depression levels in healthy subjects. *Clin Rheumatol.* 2012;31:907-911.
2. Duparc F, Coquerel D, Ozeel J, et al. Anatomical basis of the suprascapular nerve entrapment and clinical relevance of the supraspinatus fascia. *Surg Radiol Anat.* 2010;32:277-284.

SI 14

Jian Wai Shu
"Outer Shoulder Transport"

Approximately 3 cun lateral to the dorsal midline, level with GV 13 (at the caudal border of the spinous process of T1), just medial and slightly caudal to the medial angle of the scapula, usually located 3 cun lateral to the midline.

Caution needling this point. Whereas the bony scapula would ordinarily stop an acupuncture needle at SI 11, SI 12, and SI 13 from entering the lungs, SI 14 lines up with the outer Bladder channel. As such, it lands over lung fields and specifically the cervical pleura, also known as the cupula of the pleura.

Muscles

- **Trapezius muscle:** Acts on the scapula to elevate, retract, and rotate it.
- **Levator scapulae muscle:** Tilts the glenoid cavity of the scapula inferiorly while rotating and elevating the scapula.
- **Rhomboid minor muscle:** Affixes the scapula against the thoracic wall. Rotates the scapula and retracts it, resulting in causing the glenoid cavity of the scapula to move in an inferior direction.

Clinical Relevance: Figure 6-30 exposes how an acupuncture needle entering SI 14 encounters the trapezius, rhomboid minor, and levator scapulae muscle, depending on needling depth. SI 13, SI 14, and SI 15 reside in a region customarily rich with myofascial trigger points. The cross section appearing in Figure 6-30 reveals the multilayered musculature at and around SI 14, presenting multiple opportunities for pain relief.

Trigger points in the trapezius near SI 14 propel pain toward GV 14 along the paraspinal region inhabited by BL 11, shown in Figure 6-29.

Levator scapulae trigger points focus pain strongly in the angle between the neck and shoulder. Pain from the levator scapulae muscle extends to the dorsal shoulder and medial scapular border, in rhomboid territory.

Rhomboid pain centralizes over the muscles themselves and emanates diffusely across the scapular region.

Nerves

- **Spinal nerves C8-T1:** Innervate the skin.
- **Spinal accessory nerve (also known as the spinal root of the accessory nerve):** Provides motor function to the trapezius.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.
- **Dorsal scapular nerve (C5, with contributions from C4-T1[2]):** Innervates the levator scapulae and rhomboid major and minor muscles.

Clinical Relevance: Dorsal scapular nerve injury from trauma presents as a sharp pain in the shoulder while lifting heavy objects overhead.[3] Mechanism of injury includes traction or compression of the nerve through extended overhead work. Lifting a heavy box overhead places the dorsal scapular nerve at risk, as do occupational activities (for painters, electricians, dry wallers, etc.) involving raising the arms for long periods of time. Hypertrophy of the middle scalene muscle can lead to dorsal scapular nerve entrapment. Pain arises from strain in compensatory or parascapular muscles or spasm in antagonists of the

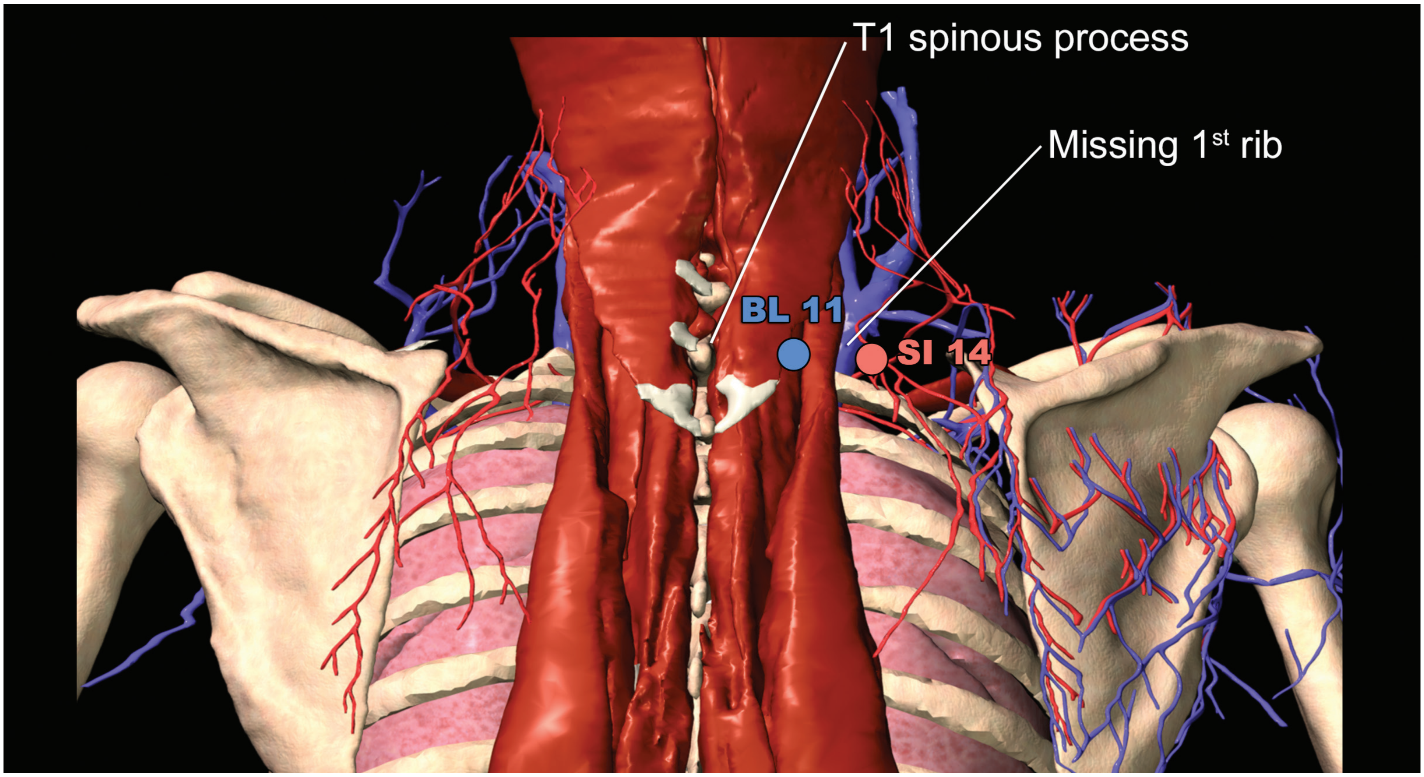


Figure 6-29. The location of SI 14, "Outer Shoulder Transport" puts it 3 cun from the midline, level with BL 11, in line with what will become the outer BL channel.

rhomboids and levator scapulae. On physical examination, the caudomedial border and caudal angle of the scapula become prominent ("winged"); the scapula as a whole moves laterad. Denervation or neuropathy of the dorsal scapular nerve causes the muscles it supplies or thins (levator scapulae and rhomboids) to atrophy; this becomes visible on magnetic resonance imaging. Scapular winging as a result of dorsal scapular neuropathy is much less common than winging from long thoracic nerve injury (supplying the serratus anterior muscle) or spinal accessory neuropathy (innervating the trapezius). Long thoracic nerve palsy produces winging that worsens with arm forward elevation and pushing with outstretched arms. Spinal accessory nerve injury is accentuated by slowly lowering the arms from the arm forward-elevated position. Dorsal scapular nerve injury can be distinguished from C5 root lesion by the absence of abnormal electromyographic findings in other muscles supplied by C5. Rehabilitation includes range of motion, strengthening, and proprioceptive retraining as well as neuromodulation through acupuncture and related techniques. Entrapment of the dorsal scapular nerve due to compression by tension in the middle scalene muscle that it pierces may respond to massage and gentle stretching.

Vessels

- **Transverse cervical artery:** Arises from the thyrocervical trunk, along with the suprascapular artery, to supply the muscles in the posterior cervical triangle, the trapezius, and the medial scapular muscles. After crossing the phrenic nerve and anterior scalene muscle, superior to the clavicle, the transverse cervical artery then courses through the trunks of the brachial plexus.

As it does so, it supplies branches to the vasa nervorum of the plexus. The dorsal scapular artery may branch from the transverse cervical artery, but it occasionally arises from the subclavian artery.

- **Dorsal scapular artery:** This artery arises either from the transverse cervical or subclavian artery, runs deep to the levator scapulae muscle, and supplies the rhomboid muscles. The dorsal scapular artery joins with other arteries (the suprascapular and the subscapular, via the circumflex scapular) around the scapula to form arterial anastomoses. This collateral circulatory route provides another avenue of blood flow in the event of an interruption of blood supply through either the subclavian or axillary arteries. This interruption may result from ligation, in cases of a lacerated axillary or subclavian artery, or from vascular stenosis in the axillary artery secondary to atherosclerosis. In either situation, blood flow in the subscapular artery reverses direction, thereby allowing blood to reach the third part of the axillary artery. (The subscapular artery receives blood from the suprascapular, transverse cervical, and intercostal arteries via several anastomotic junctures.)

Clinical Relevance: The dorsal scapular artery travels intimately with the dorsal scapular nerve. As such, compression or traction injuries of the dorsal scapular nerve would conceivably affect the accompanying artery and vein in a similar fashion.

The transverse cervical artery crosses the phrenic nerve about 3 cm cranial to the clavicle at a right angle; hence the name "Red Cross Syndrome" when ischemic neuropraxia results from arterial compression of the nerve. While it stands anatomically apart from the well-defined prevertebral fascia, surgical, anesthetic, or chiropractic procedures applied to the neck can stretch or transect the nerve. Trauma to the fascia and nerve may result in fibrosis and scarring in the area. Loss of tissue plane separation and adhesion of normally separate anatomical layers invites nerve compression and/or dysfunction.[4] Iatrogenic or traumatic injury to the cervical fascia may similarly impact the transverse cervical artery. Changes to the course and caliber of the artery from anatomical changes, preceding trauma, and/

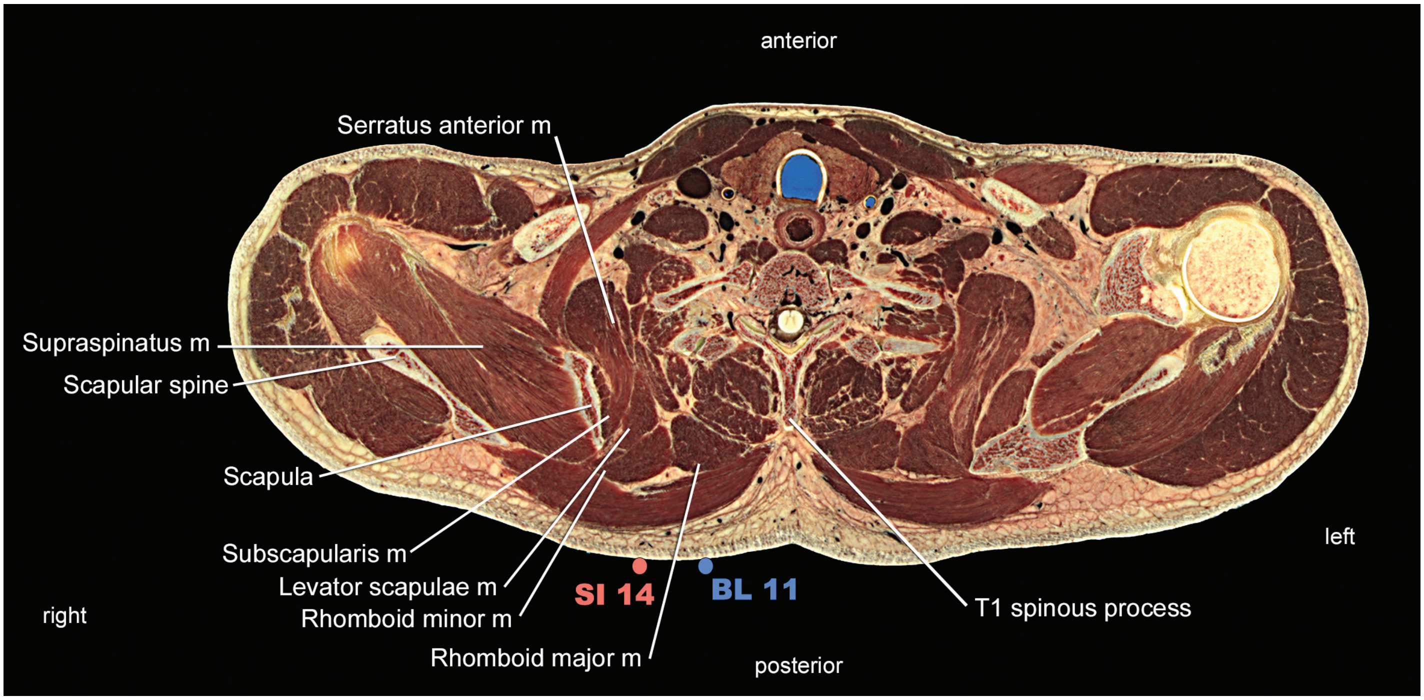


Figure 6-30. The thick, layered musculature beneath SI 14 in this well-developed individual connects the point to its main indication of myofascial trigger point deactivation.

or inflammation can induce further compression of the phrenic nerve that lies deep to it. Phrenic nerve injury in the neck from transverse cervical artery is one source of diaphragm paralysis from peripheral causes.

Indications and Potential Point Combinations

- **Shoulder, neck, upper back pain:** SI 14 included as a local trigger point along with additional regional points exhibiting tenderness to palpation. SI 9, GV 14, SI 6.

Evidence-Based Applications

- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[1]

References

1. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. *Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain.* BMJ. 2001;322:1-6.
2. Tubbs RS, Tyler-Kabara EC, Aikens AC, et al. Surgical anatomy of the dorsal scapular nerve. *J Neurosurg.* 2005;102:910-911.
3. Akgun K, Aktas I, and Terzi Y. Winged scapula caused by a dorsal scapular nerve lesion: a case report. *Arch Phys Med Rehabil.* 2008;89:2017-2020.
4. Kaufman MR, Willekes LJ, Elkwood AI, et al. Diaphragm paralysis caused by transverse cervical artery compression of the phrenic nerve: The Red Cross syndrome. *Clinical Neurology and Neurosurgery.* 2012;114:502-505.

SI 15

Jian Zhong Shu
"Central Shoulder Transport"

Approximately 2 cun lateral to the posterior midline, level with GV 14 (at the inferior border of the spinous process of C7). The point occurs at about 2/3 the distance from the midline to the medial border of the scapula.

Muscles

- **Trapezius muscle:** Acts on the scapula to elevate, retract, and rotate it.
- **Levator scapulae muscle:** Tilts the glenoid cavity of the scapula inferiorly while rotating and elevating the scapula.
- **Rhomboid minor muscle:** Affixes the scapula against the thoracic wall. Rotates the scapula and retracts it, resulting in causing the glenoid cavity of the scapula to move in an inferior direction.

Clinical Relevance: Figure 6-32 indicates how an acupuncture needle entering SI 15 encounters the trapezius, rhomboid minor, and levator scapulae muscle, depending on needling depth. SI 13, SI 14, and SI 15 reside in a region rich with myofascial trigger points.

Trigger points in the trapezius near SI 15 propel pain toward GV 14. The relationship of these two points appears in Figure 6-31. Levator scapulae trigger points focus pain strongly in the angle between the neck and shoulder. Pain from the levator scapulae muscle extends to the dorsal shoulder and medial scapular border, in rhomboid territory.

Rhomboid pain centralizes over the muscles themselves and emanates diffusely across the scapular region.

Nerves

- **Spinal root of the accessory nerve:** Provides motor output to the trapezius muscle. It also provides motor activity to the SCM, and to the striated muscles of the soft palate, larynx, and pharynx via fibers that join the vagus nerve.
- **C3 and C4 spinal nerves:** Provide pain and proprioceptive function to the trapezius muscle; also supply the levator scapulae muscle.
- **C7 and C8 spinal nerves:** Provide cutaneous sensation to the region.
- **Dorsal scapular nerve (C4,C5):** Innervates the rhomboid minor and major muscles; occasionally innervates the levator scapulae muscle.

Clinical Relevance: Dorsal scapular nerve injury from trauma presents as a sharp pain in the shoulder while lifting heavy objects overhead.[1] Mechanism of injury includes traction or compression of the nerve through extended overhead work. Lifting a heavy box overhead places the dorsal scapular nerve at risk, as do occupational activities (for painters, electricians, dry wallers, etc.) involving raising the arms for long periods of time. Hypertrophy of the middle scalene muscle can lead to dorsal scapular nerve entrapment. Pain arises from strain in compensatory or parascapular muscles or spasm in antagonists of the rhomboids and levator scapulae. On physical examination, the

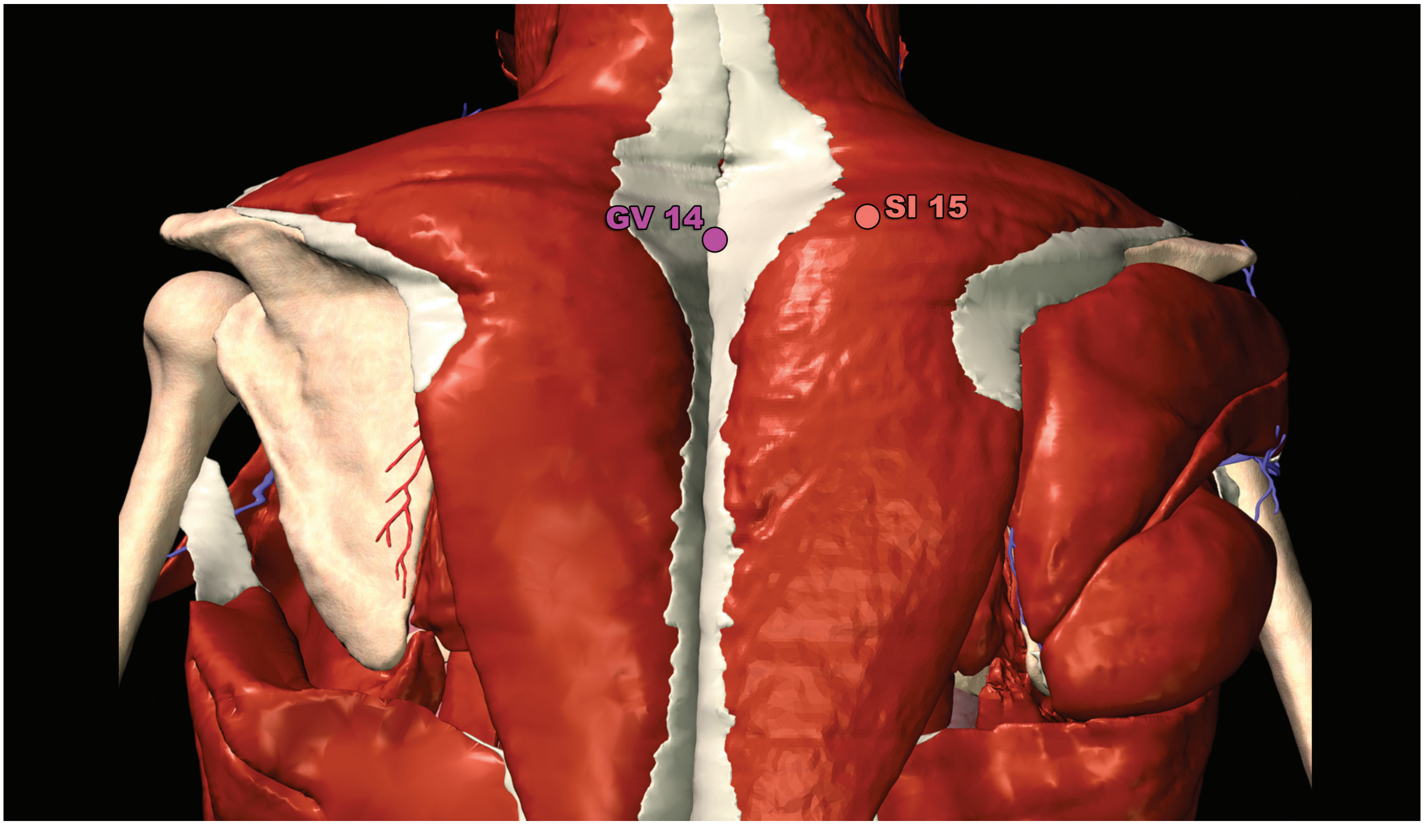


Figure 6-31. Palpating for trigger points in the shoulder and upper back requires careful examination not only of the trapezius muscle, but also underlying layers as becomes apparent in Figure 6-32.

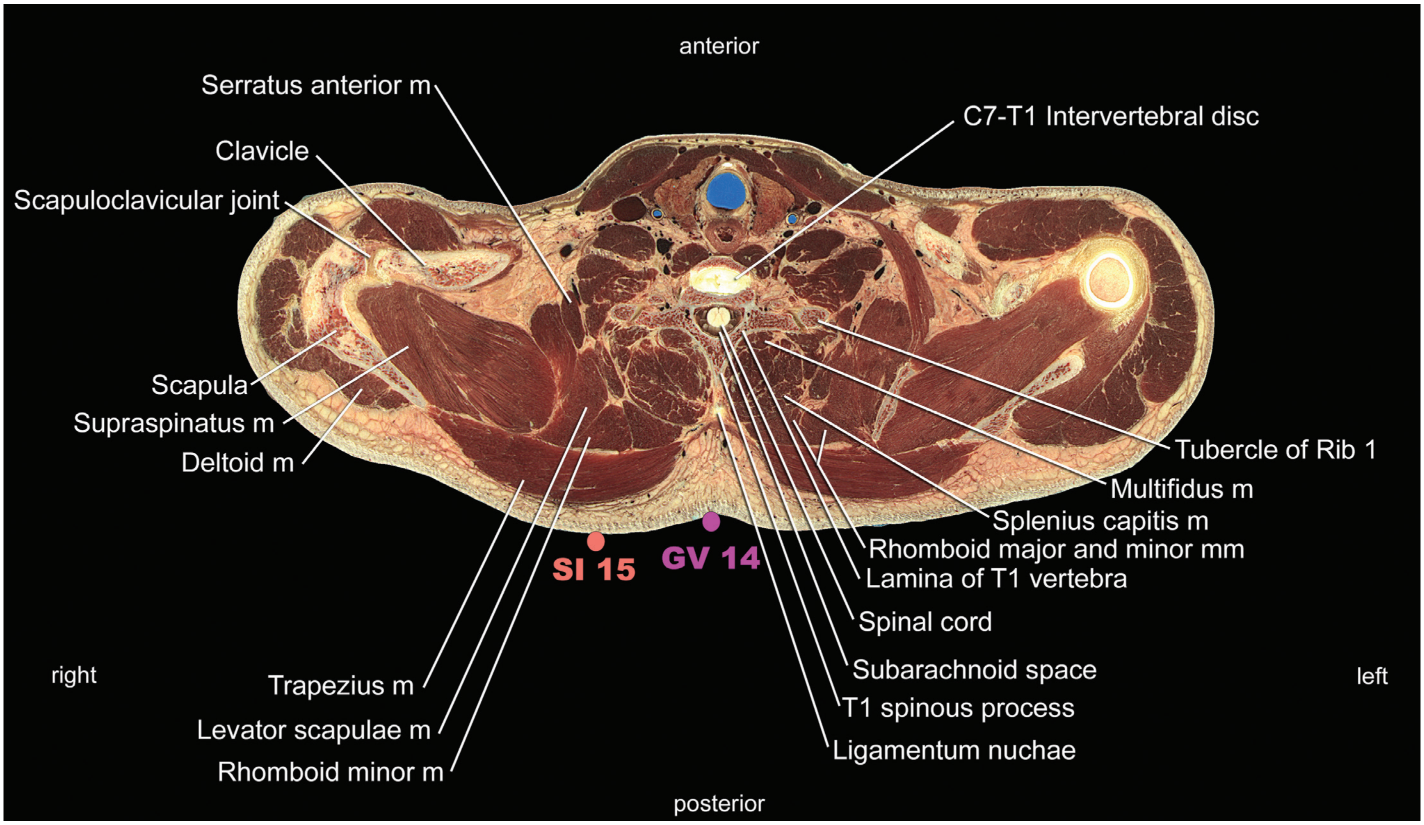


Figure 6-32. Compared to the "Outer Shoulder Shu" (SI 14) in Figure 6-29, the "Central Shoulder Shu" (SI 15) here relates to a more substantive trapezius muscle layer.

caudomedial border and caudal angle of the scapula become prominent ("winged"); the scapula as a whole moves laterad. Denervation or neuropathy of the dorsal scapular nerve causes the muscles it supplies or thins (levator scapulae and rhomboids) to atrophy; this becomes visible on magnetic resonance imaging. Scapular winging as a result of dorsal scapular neuropathy is much less common than winging from long thoracic nerve injury (supplying the serratus anterior muscle) or spinal accessory neuropathy (innervating the trapezius). Long thoracic nerve palsy produces winging that worsens with arm forward elevation and pushing with outstretched arms. Spinal accessory nerve injury is accentuated by slowly lowering the arms from the arm forward-elevated position. Dorsal scapular nerve injury can be distinguished from C5 root lesion by the absence of abnormal electromyographic findings in other muscles supplied by C5. Rehabilitation includes range of motion, strengthening, and proprioceptive retraining as well as neuromodulation through acupuncture and related techniques. Entrapment of the dorsal scapular nerve due to compression by tension in the middle scalene muscle that it pierces may respond to massage and gentle stretching.

Vessels

- **Transverse cervical artery:** Supplies the trapezius and medial scapular muscles, and sends branches to the muscles in the posterior cervical triangle.
- **Dorsal scapular artery:** This artery arises either from the transverse cervical or subclavian artery, runs deep to the levator scapulae muscle, and supplies the rhomboid muscles. The dorsal scapular artery joins with other arteries (the suprascapular and the subscapular, via the circumflex scapular) around the scapula to form arterial anastomoses. This collateral circulatory route provides another avenue of blood flow in the event of an interruption of blood supply through either the subclavian or axillary arteries. This interruption may result from ligation, in cases of a lacerated axillary or subclavian artery, or from vascular stenosis in the axillary artery secondary to atherosclerosis. In either situation, blood flow in the subscapular artery reverses direction, thereby allowing blood to reach the third part of the axillary artery. (The subscapular artery receives blood from the suprascapular, transverse cervical, and intercostal arteries via several anastomotic junctures.)

Clinical Relevance: The dorsal scapular artery travels intimately with the dorsal scapular nerve. As such, compression or traction injuries of the dorsal scapular nerve would conceivably affect the accompanying artery and vein in a similar fashion.

The transverse cervical artery crosses the phrenic nerve about 3 cm cranial to the clavicle at a right angle; hence the name "Red Cross Syndrome" when ischemic neuropraxia results from arterial compression of the nerve. While it stands anatomically apart from the well-defined prevertebral fascia, surgical, anesthetic, or chiropractic procedures applied to the neck can stretch or transect the nerve. Trauma to the fascia and nerve may result in fibrosis and scarring in the area. Loss of tissue plane separation and adhesion of normally separate anatomical layers invites nerve compression and/or dysfunction.[2] Iatrogenic or traumatic injury to the cervical fascia may similarly impact the transverse cervical artery. Changes to the course and caliber of the artery from anatomical changes, preceding trauma, and/or inflammation can induce further compression of the phrenic nerve that lies deep to it. Phrenic nerve injury in the neck from transverse cervical artery is one source of diaphragm paralysis from peripheral causes.

Acupuncture and related techniques alleviate myofascial restriction in the shoulder to allow better blood flow and improve tissue impair. Points to treat include SI 14, SI 15, SI 16, ST 10, ST 11, and LI 18.

Indications and Potential Point Combinations

- **Regional pain or tension:** Palpate the entire region for trigger points, remaining cognizant of the various muscle depths where trigger points may arise; take SI 15 if tender.
- **Respiratory conditions (bronchitis, asthma, cough):** Palpate for trigger points in this region that either impair full thoracic cage expansion or accompany upper thoracic tension due to difficulty breathing or coughing spells. Add LU 7, LI 4, ST 36, BL 13, BL 23.

References

1. Akgun K, Aktas I, and Terzi Y. Winged scapula caused by a dorsal scapular nerve lesion: a case report. *Arch Phys Med Rehabil.* 2008;89:2017-2020.
2. Kaufman MR, Willekes LJ, Elkwood AI, et al. Diaphragm paralysis caused by transverse cervical artery compression of the phrenic nerve: The Red Cross syndrome. *Clinical Neurology and Neurosurgery.* 2012;114:502-505.

SI 16

Tian Chuang "Celestial Window"

On the anterolateral neck, on the dorsal margin of the sternocleidomastoid muscle, level with the laryngeal prominence and LI 18. If the laryngeal prominence is indistinct, first find the depression formed by the lower border of the hyoid bone and the upper border of the thyroid cartilage, along the midline. The laryngeal prominence will lie just below this site.

CAUTION! If one enters the external jugular vein along the dorsal border of the SCM, the tough, investing layer of deep cervical fascia will hold its lumen open. Negative intrathoracic pressure coming from the thorax will cause air to enter the vein, resulting in a venous air embolism, cyanosis, and dyspnea. Thus, either needle superficially or elect to treat with a non-needle neuromodulatory technique.

Muscles

- **Platysma muscle:** Widens the mouth and draws its corners in an inferior direction, as when expressing sadness or fear. Draws the skin covering the neck in a superior direction when one clenches one's teeth.

Clinical Relevance: The platysma muscle presents little resistance to an acupuncture needle here entering SI 16; it would be unusual to treat platysma tension at this site. The cross section in Figure 6-34 illustrates the proximity of the anterior, middle, and posterior scalene muscles to SI 16. Risk of injuring the jugular veins may dissuade medical acupuncturists from inserting needles deeply enough to reach the muscle layer, tempting as it may be to do so. Instead, careful soft tissue therapy provides relief of neuro-compressive muscle tension.

Nerves

- **Transverse cervical nerve (C2 and C3):** Innervate the skin over the anterior triangle, curving around the middle of the posterior border of the SCM, going deep to the platysma muscle.
- **Cervical branch of the facial nerve (CN VII):** Provides motor function to the platysma muscle.
- **Supraclavicular nerves (C3, C4):** Provide sensation to the skin of the neck and part of the shoulder.

Clinical Relevance: SI 16 is located near the site for an interscalene brachial plexus block.[1] The potential for nerve entrapment in this region by tense scalene muscles suggests that carefully performed acupuncture, massage, and laser therapy would aid in the release of myofascial dysfunction as a cause of pain as well as nerve compression.

Vessels

- **External jugular vein and its tributaries:** The external jugular vein drains the side of the face and most of the scalp. It forms as a result of the union of the retromandibular vein and the posterior auricular vein.
- **Ascending cervical artery:** A terminal branch of the thyrocervical trunk, the ascending cervical artery supplies the lateral muscles of the upper neck.

Clinical Relevance: Figure 6-33 exposes the relationship of SI 16 and SI 17 to the external jugular vein. It also shows how the unlabeled SI 18, caudal to the zygomatic arch, lands near the facial vein and SI 19 at the TMJ associates with the superficial vein. Collectively, these correspondences illustrate the vascular basis of acupuncture points and the need for caution when needling sites over large vessels.

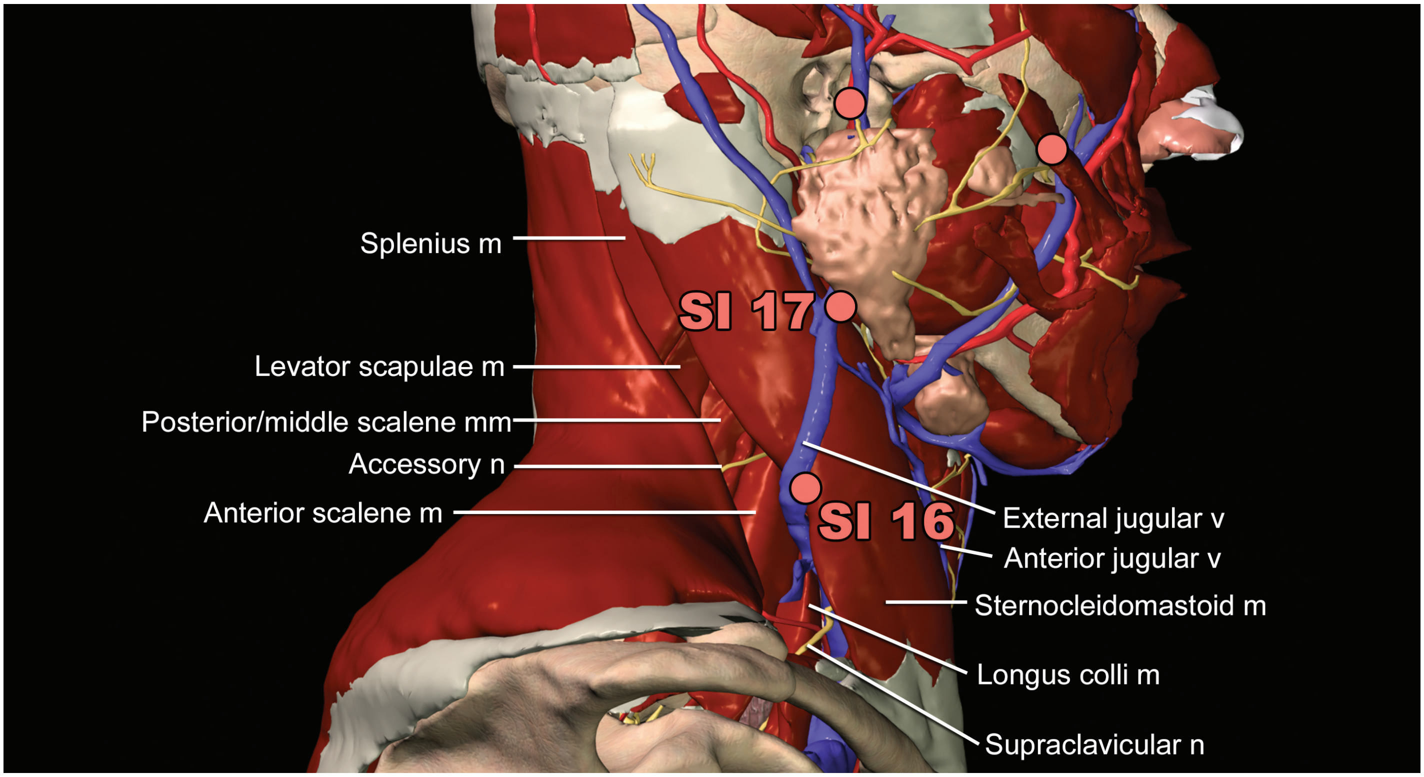


Figure 6-33. Consistent with the SI channel's actions of treating myofascial restriction, SI 16 relates to several muscles that produce neck and head pain, including the anterior, middle, and posterior scalenes, and the sternocleidomastoid muscles.

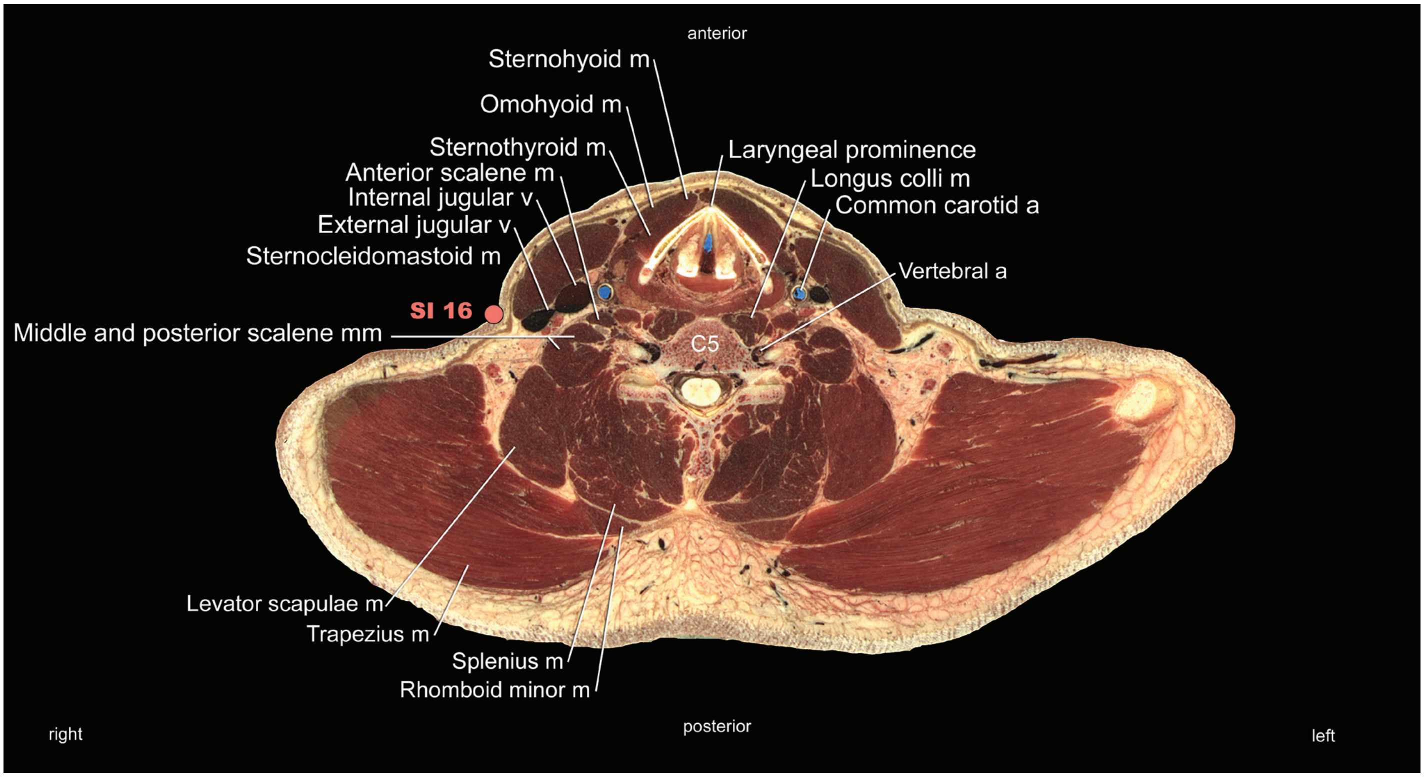

anterior
Sternohyoid m
Omohyoid m
Sternothyroid m
Anterior scalene m
Internal jugular v
External jugular v
Sternocleidomastoid m
SI 16
Middle and posterior scalene mm
Laryngeal prominence
Longus colli m
Common carotid a
Vertebral a
C5
Levator scapulae m
Trapezius m
Splenius m
Rhomboid minor m
right
posterior
left

Figure 6-34. SI 16, the "Celestial Window" describes an access point to the head, metaphorically described as the heavens. As such, it treats problems associated with the head and neck via accessing related nerves and thoracic limb dysfunction by means of its proximity to the brachial plexus.

Indications and Potential Point Combinations

- **Neck pain and restricted motion:** SI 16 if tender to palpation. Determine source of neck pain and additional trigger points. That is, if neck pain stems from upper thoracic myofascial restriction, select additional SI and BL points. If, however, the pain stems from more lateral or anterior sources, a channel-based approach would includes local, proximal, and distal points along that channel, adding neuroanatomically appropriate cervical spinal nerve points supplying those regions and pain sources.
- **Whiplash injury:** SI 16, GB 20, GB 21, GV 20, and relevant trigger points.[2]
- **Torticollis:** SI 16 plus attachment sites of sternocleidomastoid muscle, including GB 12, GB 20, SI 11, CV 22.
- **Tinnitus:** SI 16 with additional points in the neck associated with muscles attaching to the temporal bone, especially the sternocleidomastoid. Add TH points around the ear that express tenderness to palpation.
- **Trismus:** SI 16, SI 17, SI 18, ST 6, ST 7.
- **Throat disorders (pharyngitis, tonsillitis, laryngitis, dysphonia):** SI 16, ST 9, CV 22, CV 23.

References

1. Tainter CR. An evidence-based approach to traumatic pain management in the emergency department. *Emergency Medicine Practice*, EBMedicine.net. 2012;14(8).
2. Rosted P and Jorgensen A. Acupuncture for a patient with whiplash-type injury. *Acupunct Med.* 2010;28(4):205-206.

SI 17

Tian Rong "Celestial Countenance"

Immediately caudal to the angle of the mandible, in a depression between the angle of the mandible and the ventral border of the sternocleidomastoid muscle. Lands ventral to the transverse process of C2.

Caution needling! This is a highly neurovascular location. See Figure 6-36.

Muscles

- **Posterior belly of the digastricus muscle:** Raises and steadies the hyoid bone when speaking and swallowing. Depresses the mandible.
- **Stylohyoid muscle:** Lengthens the floor of the mouth by elevating and retracting the hyoid bone.

Clinical Relevance: Most individuals report tenderness to palpation at SI 17.[5] This discomfort worsens with temporomandibular joint (TMJ) disorders. However, uncertainty exists about whether the posterior belly of the digastric is indeed palpable. Nonetheless, the myofascial structures found at SI 17 exhibit heightened sensitivity and tension in TMJ dysfunction, teeth clenching, and bruxism. The posterior digastric trigger point has been classically located at or near SI 17. It refers pain strongly to the mastoid and the lateral occipitotemporal region caudad and toward the hyoid bone rostrad.

Trigger points in the digastric group can be compounded by myofascial pathology in the masseter muscle (an antagonist muscle) or the lateral pterygoid that works synergistically to depress the mandible (open the mouth). A "head forward" position develops as a result of contractural shortening of the posterior belly of the digastric muscle with contribution from the stylohyoid and neighboring structures.[6] Habitually carrying the head forward through sustained shortening of the "binding" muscles of the neck, i.e., the stylohyoid, both bellies of the digastric, sternocleidomastoid, and trapezius increases pressure on the upper cervical spine, its joints, and nerves.

Patients with voice disorders often present with myofascial dysfunction of the muscles or supporting structures of the larynx, including a high-held larynx, shortening or contracture of the stylohyoid and sternocleidomastoid muscles, and a weak deep flexor mechanism.

Myofascial restriction at this site, extending to the temporalis and suboccipital regions may perpetuate tinnitus by accentuating pressure or traction on the vestibulocochlear nerve.

Tenderness to palpation at SI 17 suggests further exploration into the source of the problem and treatment of dysfunction with acupuncture or related techniques. Keep in mind the nerves and vessels inhabiting this region.

Nerves

- **Facial nerve (CN VII), cervical branch:** Innervates the stylohyoid muscle and other superficial muscles of the neck, as well as the platysma muscle.
- **Great auricular nerve (C2, C3):** Innervates the parotid sheath and skin overlying the parotid gland; also supplies the posterior part of the auricle and the skin between the mandible and mastoid process.
- **Hypoglossal nerve (CN XII):** Supplies all of the extrinsic and intrinsic lingual muscles except for the palatoglossus. Carries

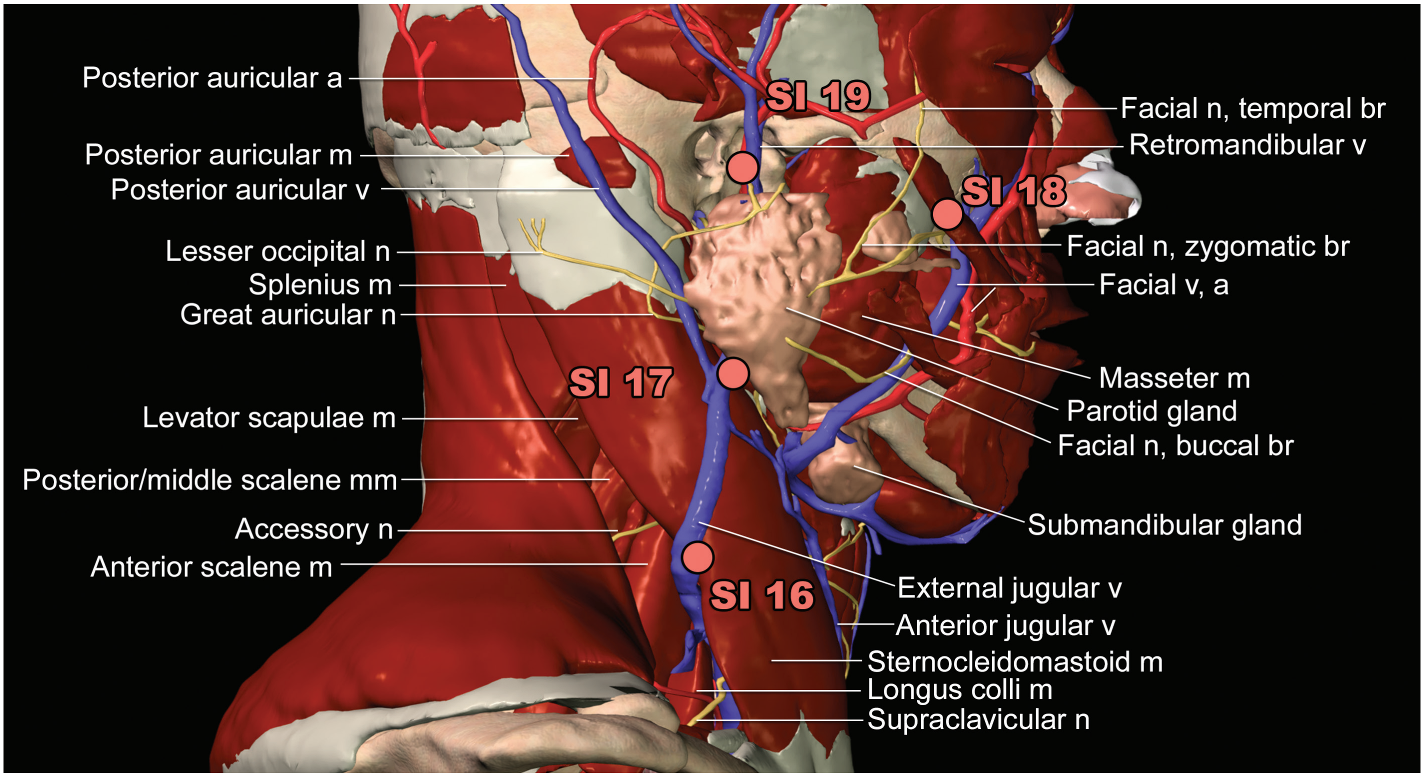

Posterior auricular a
Posterior auricular m
Posterior auricular v
Lesser occipital n
Splenius m
Great auricular n
Levator scapulae m
Posterior/middle scalene mm
Accessory n
Anterior scalene m
SI 19
SI 18
SI 17
SI 16
Facial n, temporal br
Retromandibular v
Facial n, zygomatic br
Facial v, a
Masseter m
Parotid gland
Facial n, buccal br
Submandibular gland
External jugular v
Anterior jugular v
Sternocleidomastoid m
Longus colli m
Supraclavicular n

Figure 6-35. SI 17, Celestial Countenance, refers to the migration of the SI line onto the face. Each of the points located here (SI 16 – SI 19) may exhibit tenderness to palpation in TMJ dysfunction. Myofascial restriction in SI 9 – SI 15 contributes to the syndrome.

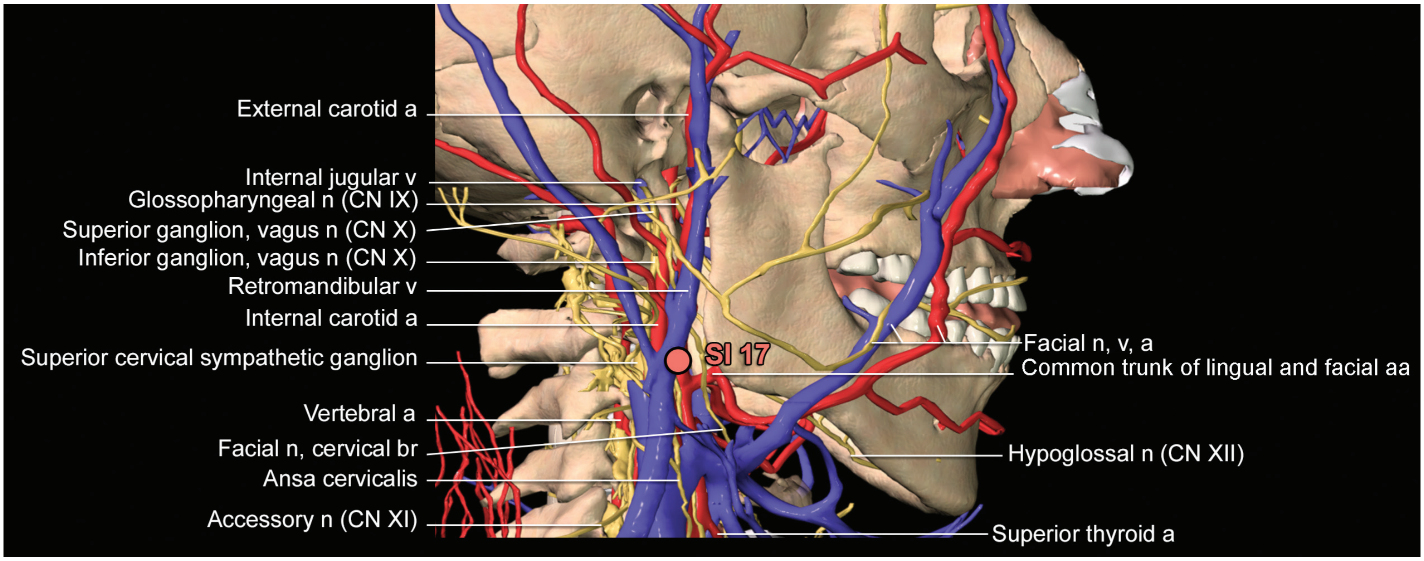


Figure 6-36. SI 17 associates with several significant neurovascular routes, justifying caution when introducing a needle into this area.

motor fibers from the C1 and C2 spinal nerves whose destination is the hyoid muscles (i.e., the thyrohoid and geniohyoid muscles). Carries proprioceptive fibers to the aforementioned muscles and, via a meningeal branch, the dura in the posterior cranial fossa.

- **Superior cervical ganglion of the sympathetic trunk (T1-T5):** Provides postsynaptic cephalic arterial rami, forming the internal carotid sympathetic plexus, which travel along the internal carotid artery and into the cranium. The superior cervical sympathetic ganglion also sends rami to the external carotid artery and branches to the C1-C4 spinal nerves. Postsynaptic fibers emerge from the superior cervical ganglion to their destination in the cardiac plexus of nerves via a cardiopulmonary splanchnic nerve.
- **Vagus nerve (CN X):** Provides taste sensation in the regions of the root of the tongue and epiglottis; proprioceptive and motor function to the muscles of the soft palate, pharynx, intrinsic laryngeal muscles (which afford phonation), and the palatoglossus muscles; sensation to the inferior pharynx, larynx, and thoracoabdominal viscera, and parasympathetic function to the thoracoabdominal viscera. The general sensory aspects of CN X relate predominantly to the superior ganglion of CN X, while the inferior ganglion relates largely to the visceral sensory functions of CN X. The nerve in this region connects to CN IX, CN XI, and the superior cervical sympathetic ganglion. Near the site of its exit from the jugular foramen, the vagal nerve receives a cranial root from CN XI, a meningeal branch from the dura mater, and the auricular branch of the vagus nerve. As the vagus nerve continues its descent, it enters the carotid sheath on its way the root of the neck. Branches of the vagus in this region include the pharyngeal nerves, superior laryngeal nerve, right recurrent laryngeal nerve, and the cardiac nerves. (The left recurrent laryngeal nerve branches from the vagus as it passes through the superior thoracic aperture into the thorax.)

Clinical Relevance: The rich supply of nerves and vessels at SI 17 translates into potentially powerful autonomic effects by stimulating the structures at this site. Both cranial and autonomic nerves traverse the region, as shown in Figure 6-36. Due to the revision in autonomic firing patterns that may result from needling this site, treat cautiously to avoid traumatizing delicate structures or inducing vasovagal syncope.

Vessels

- **External jugular vein and its tributaries:** The external jugular vein drains the side of the face and most of the scalp. It forms as a result of the union of the retromandibular vein and the posterior auricular vein.
- **Interior jugular vein (IJV):** The largest vein in the neck, the IJV drains blood from the deep cervical muscles and cervical viscera, the face, and the brain. It begins in the posterior cranial fossa at the jugular foramen, and comprises a direct continuation of the sigmoid sinus of the brain. It courses through the neck within the carotid sheath, along with the internal/common carotid artery and vagus nerve. (The cervical sympathetic trunk lies posterior to the carotid sheath, embedded within the prevertebral fascia.)
- **External carotid artery (ECA):** Supplies extracranial structures; the middle meningeal artery is a branch of the ECA that supplies intracranial structures. Terminates as the maxillary artery and superficial temporal artery. Other branches include the ascending pharyngeal, superior thyroid, lingual, facial, occipital, and posterior auricular arteries.

Clinical Relevance: Needling SI 17 may cause profound hemodynamic changes due to the autonomic fibers in the vicinity. Palpate the region carefully before inserting an acupuncture needle to target myofascial structures and not pulsating structures.

Indications and Potential Point Combinations

- **Throat and voice disorders:** SI 17, SI 16, CV 22, CV 23, ST 36.
- **TMJ problems:** SI 17, SI 18, SI 19, GB 21, BL 10.
- **Neck pain and tension in sternocleidomastoid (SCM) muscle, torticollis:** SI 17, SI 16, GB 20, BL 10, ST 11.
- **Tinnitus:** SI 17, SI 16, GB 12, GB 20, tender TH points encircling the ear, GV 20.

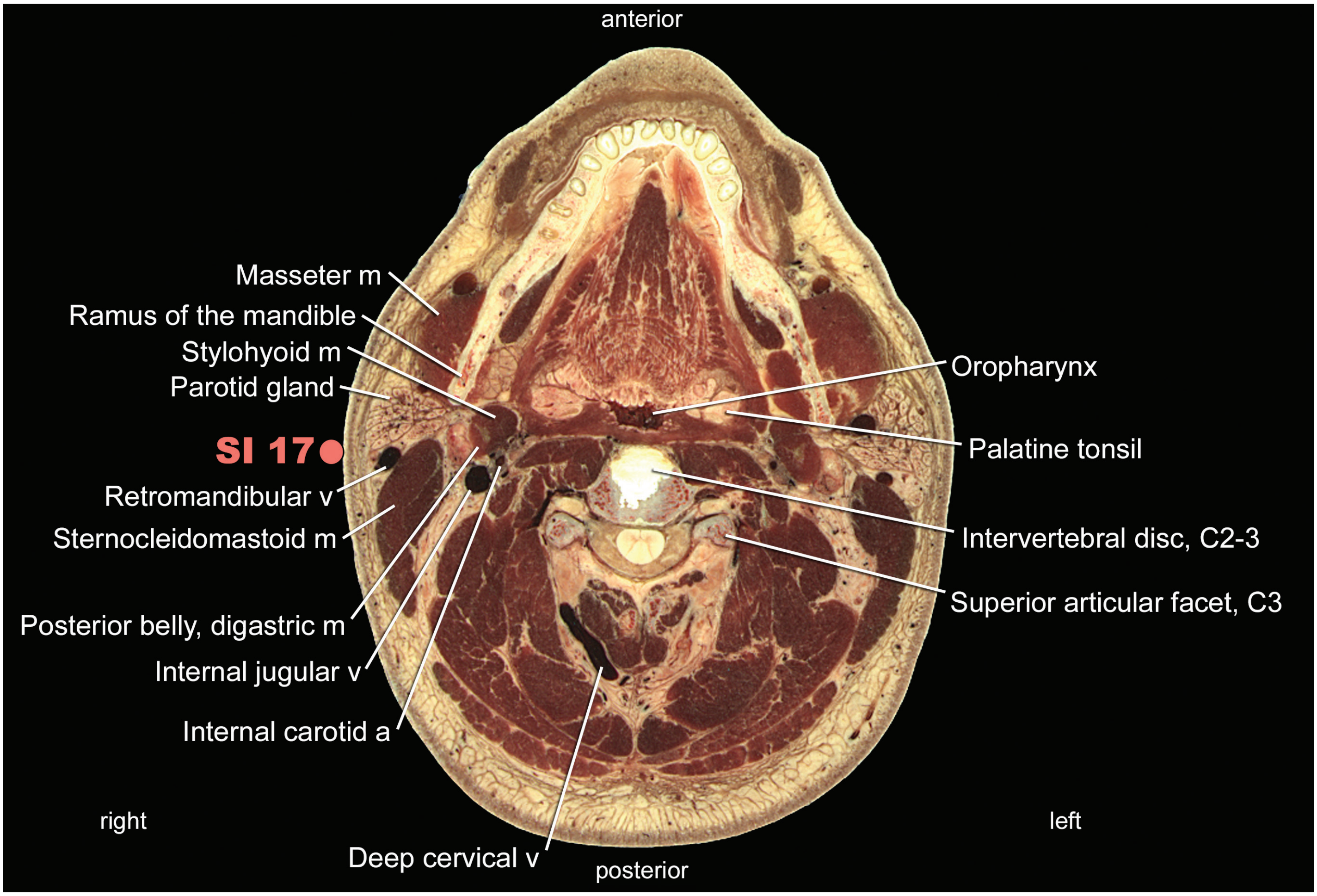

anterior
Masseter m
Ramus of the mandible
Stylohyoid m
Parotid gland
SI 17●
Retromandibular v
Sternocleidomastoid m
Posterior belly, digastric m
Internal jugular v
Internal carotid a
Oropharynx
Palatine tonsil
Intervertebral disc, C2-3
Superior articular facet, C3
right
left
Deep cervical v
posterior

Figure 6-37. Musculoskeletal patterns associated with voice disorders involve shortening of the stylohoid and sternocleidomastoid muscles, shown here in close approximation to SI 17.[7]

Evidence-Based Applications

- Stimulation of SI 17 may benefit **migraine** by inhibiting neurogenic inflammation of blood vessels in the dura mater on the affected side.[1,2]
- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[3]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[4]

References

1. Yu S, Kuang P, Zhang F, and Liu J. Anti-inflammatory effects of Tianrong acupoint on blood vessels of dura mater. *Journal of Traditional Chinese Medicine.* 1995;15(3):209-213.
2. Zhang X, Li Y, Ren S, Kuang P, Wu W, Zhang F, and Liu J. Efficacy and effect of SI 17 therapy on pancreatic polypeptide in vascular and tension-type headache. *Journal of Traditional Chinese Medicine.* 2000;20(3):206-209.
3. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases.* 2000;6:15-24.
4. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine.* 2003;21(4):138-149.
5. Turp JC, Arima T, and Minagi S. Is the posterior belly of the digastric muscle palpable? A qualitative systematic review of the literature. *Clinical Anatomy.* 2005;18:318-322.
6. Rubin JS, Blake E, and Mathieson L. Musculoskeletal patterns in patients with voice disorders. *Journal of Voice.* 1997;21(4):477-484.
7. Rubin JS, Blake E, and Mathieson L. Musculoskeletal patterns in patients with voice disorders. *Journal of Voice.* 2007;21(4):477-484.

SI 18

Quan Liao "Cheek Bone Hole"

In a depression below the zygoma, directly inferior to the lateral canthus of the eye. See Figure 6-39 to examine the bony relationships.

Muscles

- **Zygomaticus major muscle:** Draws the angle of the mouth in a superolateral direction, as when one smiles.
- **Masseter muscle:** Closes the jaw; retrudes it with deep fibers. Myofascial dysfunction of the masseter muscle can lead to temporomandibular joint dysfunction, restricted jaw opening, and unilateral (and occasionally bilateral) tinnitus.[1]

Clinical Relevance: Myofascial restriction in the masseter and lateral pterygoid muscles may respond to local treatment at SI 18. Select SI 18 for facial nerve injury affecting the zygomaticus major muscle. Trigger points in the lateral pterygoid refer pain to SI 18 and SI 19.

Nerves

- **Zygomatic branch of facial nerve (CN VII):** Innervates the muscles inferior part of the orbicularis oculi and other facial muscles inferior to the orbit.
- **Masseteric nerve (CN V_3):** Provides motor output to the masseter muscle.

Clinical Relevance: The proximity of SI 18 to the zygomatic branch of the facial nerve emphasizes this point's relevance in cases of peripheral facial nerve paralysis.[6]

Vessels

- **Transverse facial artery:** Arises from the superficial temporal artery, within the parotid gland. Supplies the parotid gland, the parotid duct, and the skin and muscles of the face.
- **Deep facial vein:** Originates from the pterygoid venous plexus, and drains into the facial vein. It receives blood from the regions supplied by the maxillary artery, including the infratemporal fossa.

Clinical Relevance: Restoration of function in the muscles of facial expression is supported by improvement of local circulation. Moreover, vascular compromise worsens pain and dysfunction in trigger point pathology.

Indications and Potential Point Combinations

- **Facial nerve injury affecting the zygomatic branch:** SI 18; add TH 17 to treat facial nerve trunk.
- **Facial nerve injury affecting multiple branches:** TH 17, SI 18, ST 4, LI 20, Taiyang, GB 14, and Yintang.
- **Maxillary sinus pain:** SI 18, ST 2, ST 3, ST 44, LI 4
- **Tinnitus:** For tinnitus generated by trigger points, find tender areas in the temporalis, masseter, trapezius, sternocleidomastoid, and occipitofrontalis muscles. In addition to SI 18, and myofascial trigger points, consider tender TH and GB points encircling the ear, as well as SI 19.
- **Temporomandibular dysfunction:** Identify myofascial contribution to TMJ dysfunction. In addition to SI 18, consider SI 19, temporal trigger points, and SI, BL, or GB points in the neck and shoulder regions that may refer pain to the TMJ or contribute to myofascial restriction.

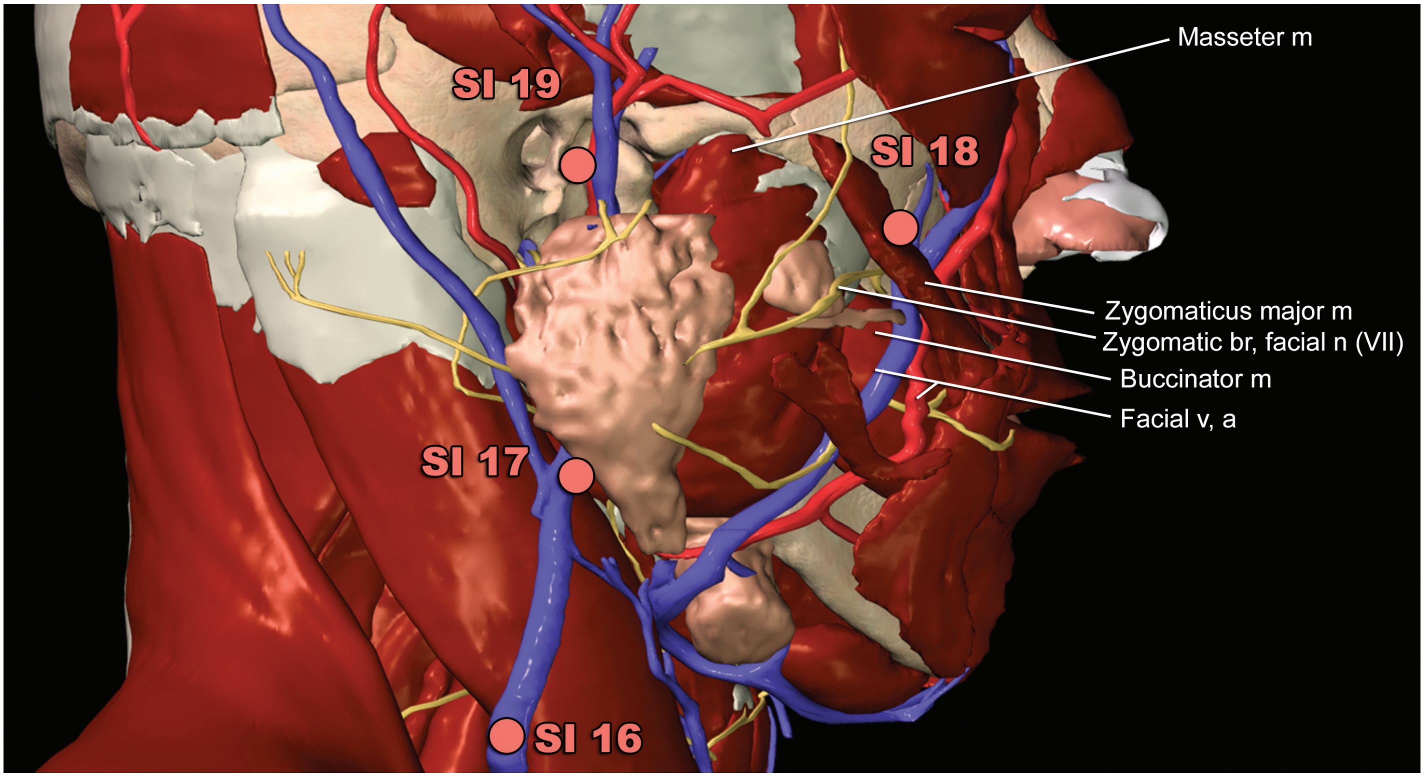


Figure 6-38. SI 18 resides squarely over the muscle belly of the zygomaticus major muscle and on the rim of the masseter.

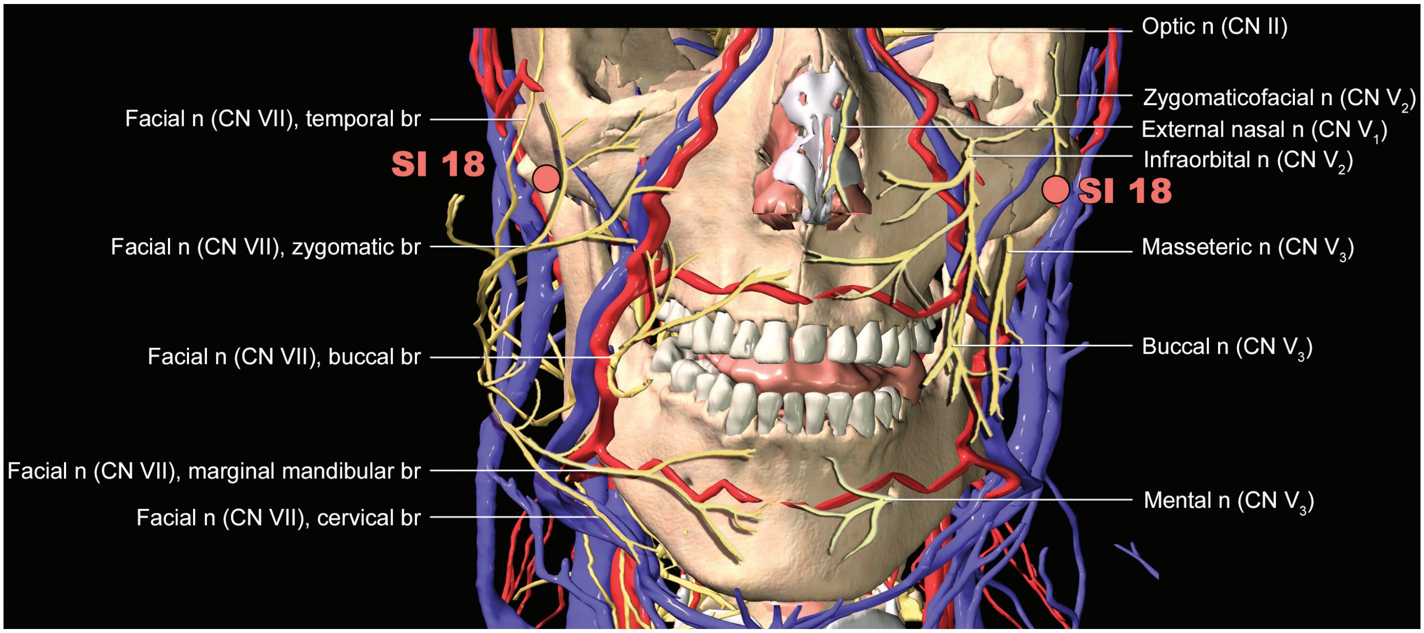

Optic n (CN II)
Facial n (CN VII), temporal br
Zygomaticofacial n (CN V_2)
External nasal n (CN V_1)
Infraorbital n (CN V_2)
SI 18
SI 18
Facial n (CN VII), zygomatic br
Masseteric n (CN V_3)
Facial n (CN VII), buccal br
Buccal n (CN V_3)
Facial n (CN VII), marginal mandibular br
Mental n (CN V_3)
Facial n (CN VII), cervical br

Figure 6-39. The descriptive name for SI 18, "Cheek Bone Hole" refers to the hole found below the zygomatic arch.

- Used in acupuncture analgesia for brain surgery and tooth extraction.[2]

Evidence-Based Applications

- Three out of three RCTs supported the effectiveness of acupuncture for the treatment of **temporomandibular disorders,** prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[3]
- A case series reported that electroacupuncture at GB 14, SI 18, ST 7, GB 20, and LI 4 was effective treatment for **peripheral facial paralysis.**[4]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, SI 18, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, and GB 44.[5]
- **TMJ dysfunction:** ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4, dry needled with deqi achieved, left in situ for 30 minutes.[7]
- **Peripheral facial nerve paralysis:** ST 4, ST 7, ST 6, CV 24, LI 20, SI 18, TH 17, GB 14, ST 2, GB 20, GV 26, Yuyao (in the middle of the eyebrow), and LI 4.[8]

References

1. Simons DG, Travell JG, and Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd Edition*. Baltimore: Williams & Wilkins, 1999. P. 334.
2. Stux G and Pomeranze B. *Acupuncture. Text and Atlas*. Berlin: Springer-Verlag, 1987. P. 126.
3. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases*. 2001;7:109-115.
4. Zhang X. Electric needle therapy for peripheral facial paralysis. *Journal of Traditional Chinese Medicine*. 1997;17(1):47-49.
5. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture*. 2004;15(3):17-18.
6. Zhang D. A method of selecting acupoints for acupuncture treatment of peripheral facial paralysis by thermography. *Am J Chin Med*. 2007;35(6):967-975.
7. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Dis*. 2001;7(2):109-115.
8. Zheng H, Li Y, and Chen M. Evidence based acupuncture practice recommendations for peripheral facial paralysis. *Am J Chin Med*. 2009;37(1):35-43.

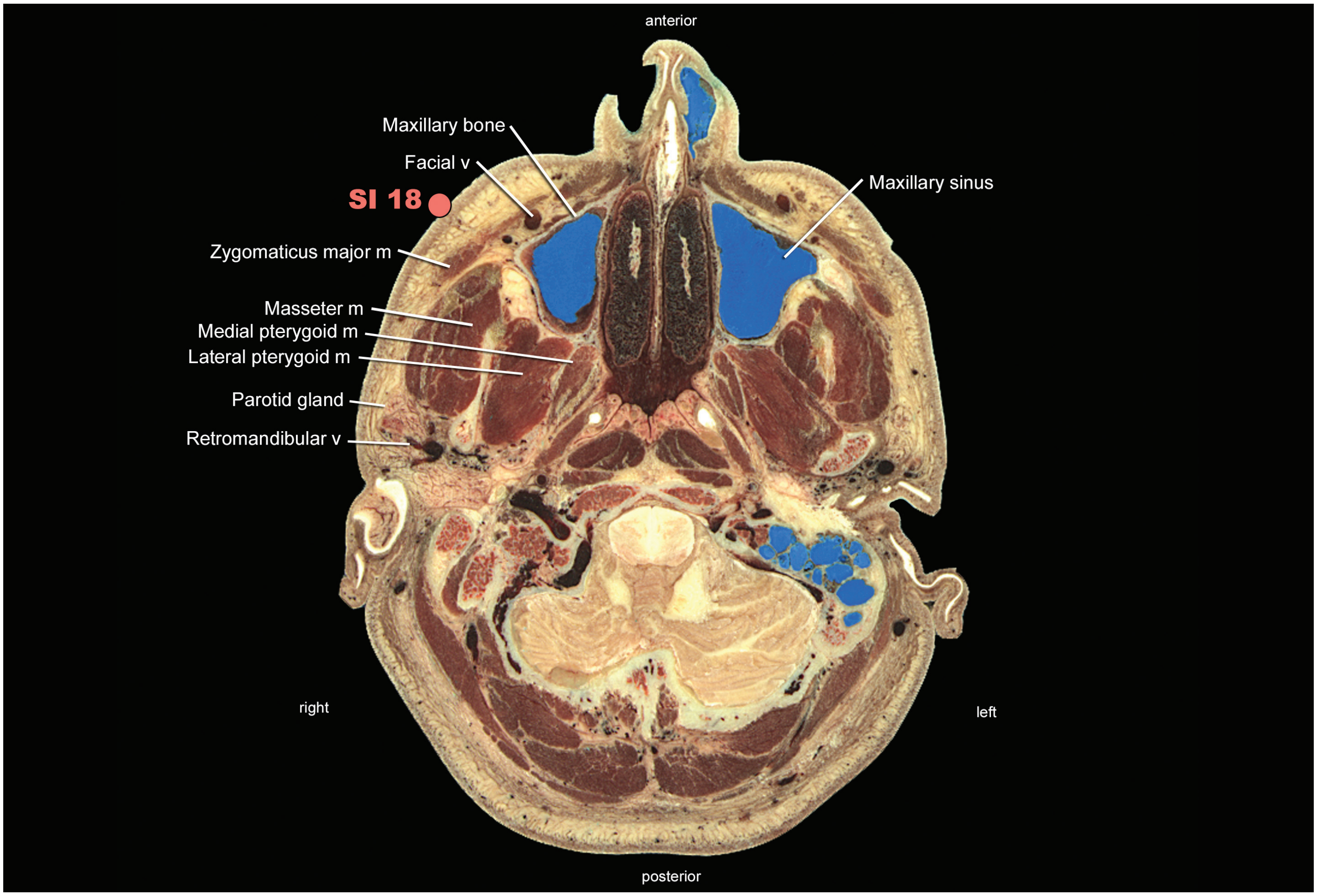

anterior
Maxillary bone
Facial v
SI 18
Maxillary sinus
Zygomaticus major m
Masseter m
Medial pterygoid m
Lateral pterygoid m
Parotid gland
Retromandibular v
right
left
posterior

Figure 6-40. As shown here, a needle entering SI 18 first impacts the zygomaticus major muscle and subsequently the masseter, depending on depth and direction.

SI 19

Ting Gong "Palace of Hearing"

In a depression located between the middle of the tragus and the condylar process of the mandible. Easiest to find with the mouth open.

Connective Tissues

- **Fibrous capsule of the temporomandibular joint (TMJ):** This capsule attaches to the temporal bone's articular area and around the neck of the mandible.
- **Lateral (TMJ) ligament:** This thickening of the articular capsule is an intrinsic ligament which strengthens the TMJ from the lateral direction; works in conjunction with the postglenoid tubercle to prevent posterior dislocation of the TMJ.
- **Articular disc:** The articular disc divides the TMJ cavity into two compartments, an inferior and superior one.

Clinical Relevance: Note the proximity of SI 19 to the TMJ in Figure 6-38. Degeneration of the disk, ligament, capsule, or joint components accentuates dysfunction and pain.[3] TMJ disorders are multifactorial in origin, however, with contribution from myofascial structures of the neck and shoulders. As such, it is customary to add SI points on the neck and shoulders, as well as relevant BL and GB locations.

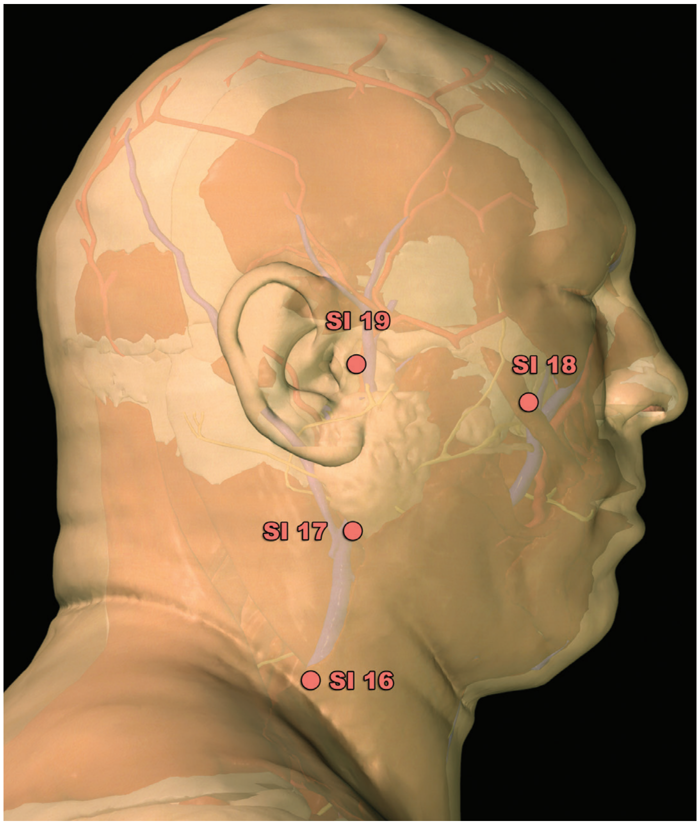


Figure 6-41. The name "Auditory Palace" for SI 19 refers to its proximity to the ear. In addition, alleviating compressive forces on the TMJ contributes to the resolution of tinnitus connected to myofascial dysfunction of the head and neck.

Nerves

- **Auriculotemporal nerve from mandibular nerve (CN V_3):** Carries parasympathetic fibers to the parotid gland and supplies sensation to the gland. Also supplies sensation to the skin in the following regions: tragus, anterosuperior helix and auricle, roof of the external acoustic meatus, upper tympanic membrane, and the regions anterior to the ear and in the posterior temporal region.
- **Sympathetic fibers from the cervical ganglia:** These fibers travel to the parotid gland via the external carotid nerve plexus accompanying the external carotid artery.

Clinical Relevance: Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

Vessels

- **Superficial temporal artery and anterior auricular branches:** The superficial temporal artery is a terminal branch of the external carotid artery, and travels anterior to the ear toward the temporal region, ending in the scalp. It supplies the skin of the frontal and temporal regions as well as the muscles of the face.
- **Superficial temporal vein:** This vein begins on the scalp as a widespread plexus, and also covers the zygomatic arch, draining the scalp, superficial parts of the temporalis muscle, and the external ear. It joins with the maxillary vein posterior to the mandible, forming the retromandibular vein (see below).
- **Retromandibular vein:** The retromandibular vein forms as a result of the union of the maxillary and superficial temporal veins, anterior to the ear. It later joins with the posterior auricular vein to create the external jugular vein. The retromandibular vein drains the parotid gland and masseter muscle.

Clinical Relevance: Direct the acupuncture needle away from vessels and toward, but not into, the joint.

Indications and Potential Point Combinations

- **Tinnitus:** SI 19, trigger points in muscles connecting to the temporal bone, tender TH points encircling the ear, TH 5. GB 20, BL 10, GV 20. Massage to provide gentle traction to the suboccipital region. Deactivate trigger points in the temporalis muscle.
- **Temporomandibular joint (TMJ) dysfunction:** SI 19, SI 18 (sometimes connected to SI 19 with electrical stimulation), and local trigger points in the temporal, cervical, and upper thoracic region.
- **Dental pain:** SI 19, LI 4, LU 7.

Evidence-Based Applications

Electroacupuncture of SI 19 and LI 11 was more effective in **lowering blood pressure** than were other points paired with LI 11.[1] This effect appeared to be related to central opioid and/or noradrenergic mechanisms.[2]

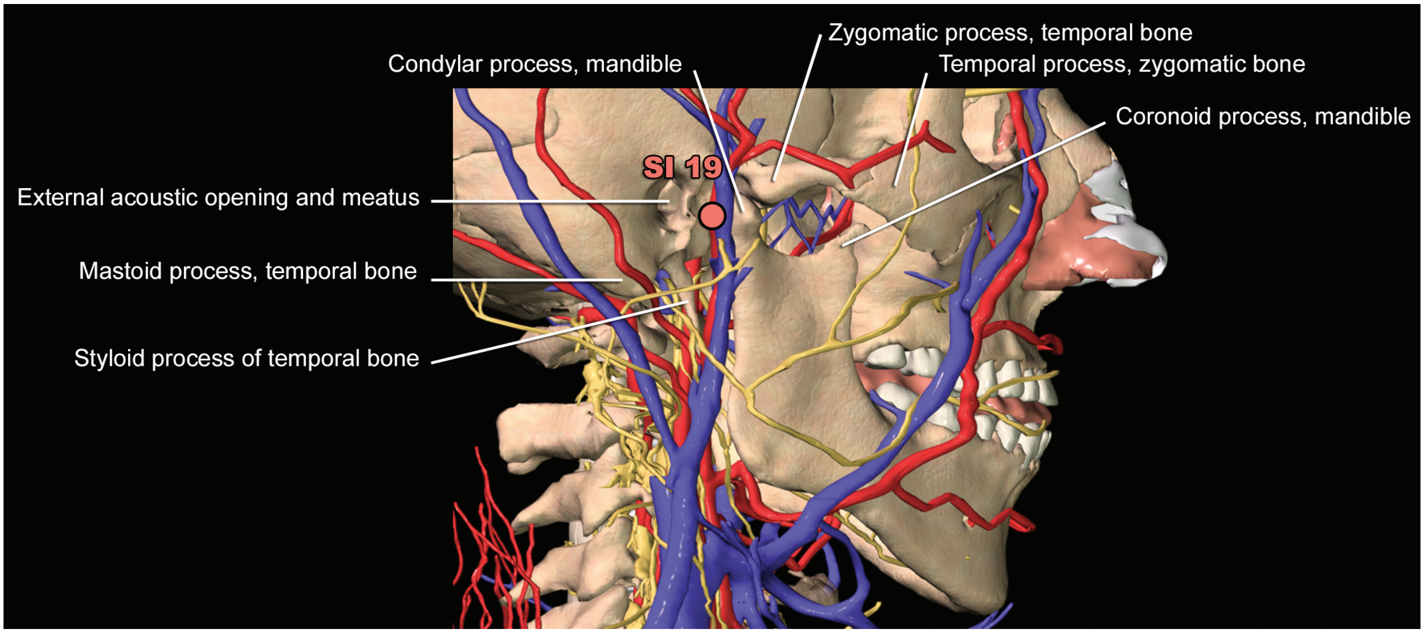

Zygomatic process, temporal bone
Condylar process, mandible
Temporal process, zygomatic bone
Coronoid process, mandible
SI 19
External acoustic opening and meatus
Mastoid process, temporal bone
Styloid process of temporal bone

Figure 6-42. SI 19 falls along a vascular superhighway, as denoted by this neurovascular image. Note, too, the vessels coursing through the pterygoid fossa.

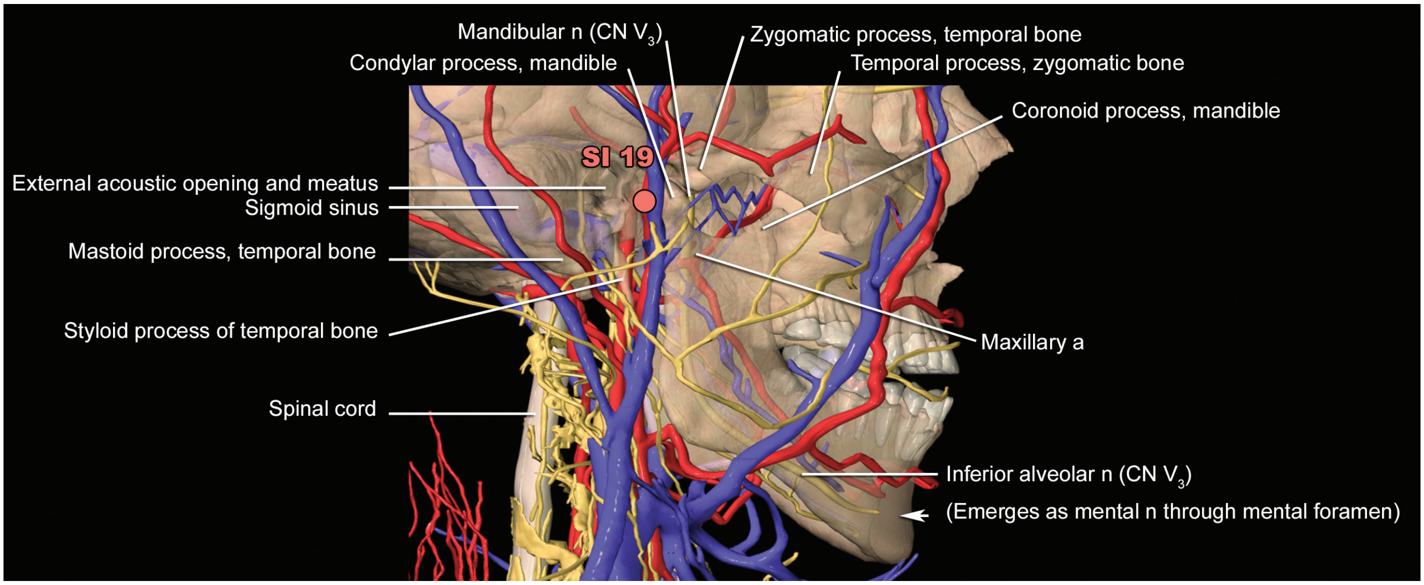

Mandibular n (CN V_3)
Zygomatic process, temporal bone
Condylar process, mandible
Temporal process, zygomatic bone
Coronoid process, mandible
SI 19
External acoustic opening and meatus
Sigmoid sinus
Mastoid process, temporal bone
Styloid process of temporal bone
Maxillary a
Spinal cord
Inferior alveolar n (CN V_3)
(Emerges as mental n through mental foramen)

Figure 6-43. This depiction provides a peek at the vessels inside the cranial bones. Even though they are inaccessible to needling, reflexes from the surface through trigeminosympathetic reflexes will influence intracranial circulation.

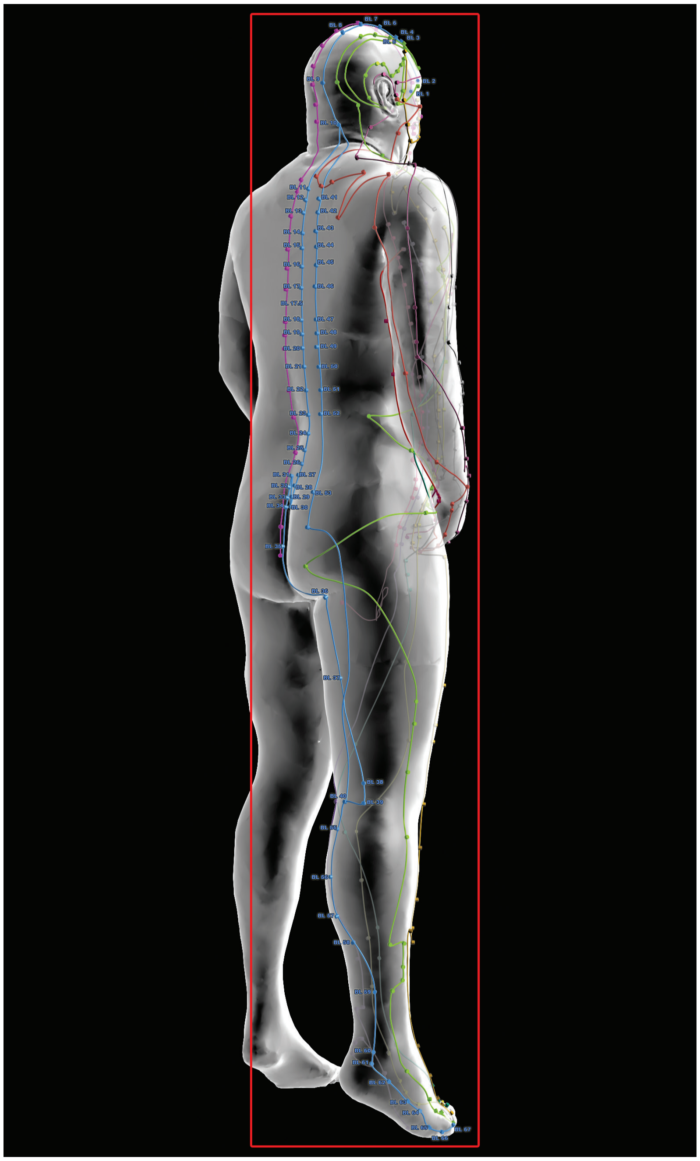
References

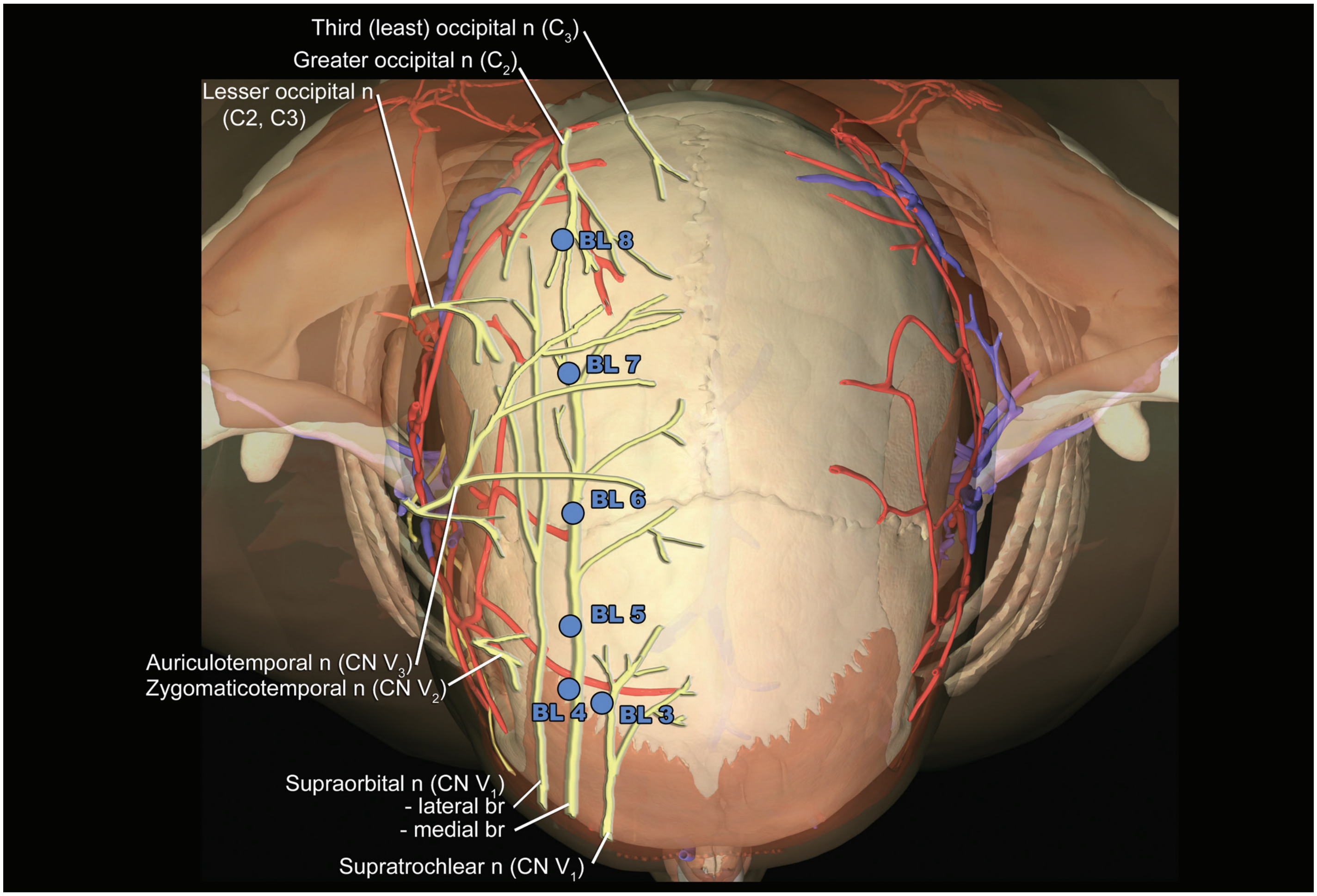
1. Ku Y-H and Zou C-J. Tinggong (SI 19), a novel acupoint for 2Hz electroacupuncture-induced depressor response. *Acupuncture & Electrotherapeutics Res., Int J.* 1993;18:89-96.
2. Zou C-J, Wang H, and Ge L. The central mechanism of the depressor-bradycardia effect of "Tinggong(SI19)-Quchi(LI11)" 2Hz electroacupuncture. *Acupuncture & Electro-therapeutics Res., Int J.* 2000;25:145-153.
3. Sharma S, Gupta DS, Pal US, et al. Etiological factors of temporomandibular joint disorders. *Natl J Maxillofac Surg.* 2011;2(2):116-119.

Channel 7:: The Bladder (BL)

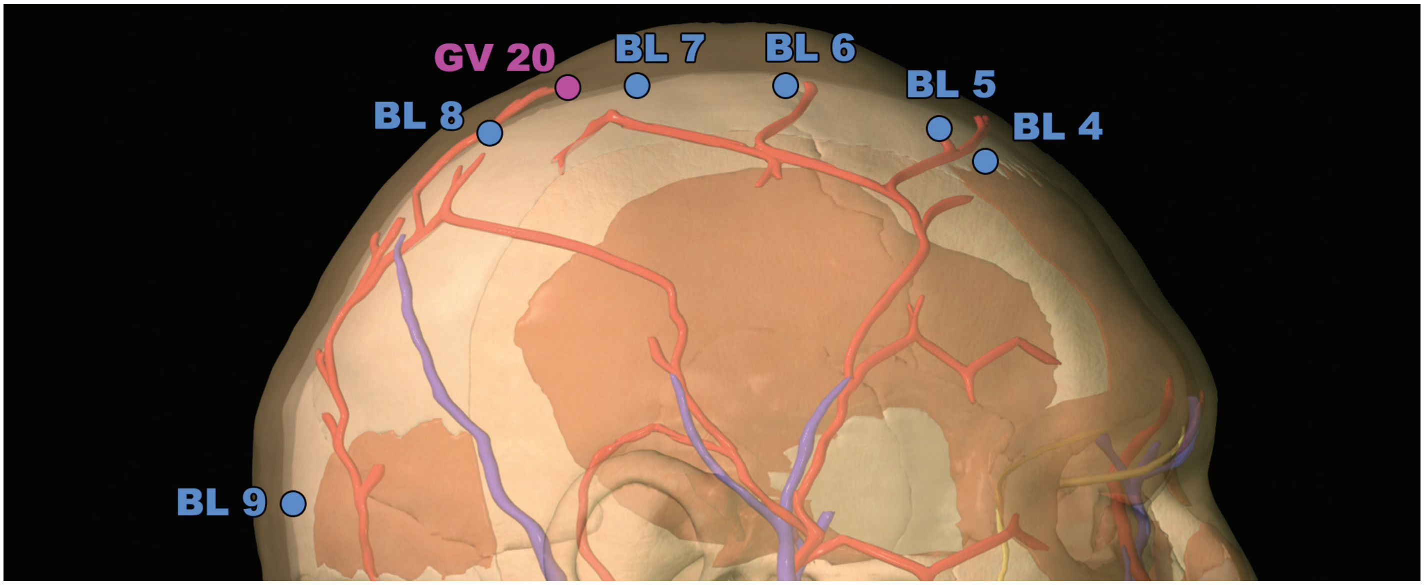
The Bladder channel starts just above the inner canthus of the eye. It ascends the Forehead and descends along the erector spinae in two parallel lines to the sacrum. After crisscrossing the caudal thigh, the BL channel reunites in the popliteal fossa, terminating at BL 67 on the little toe.

Myofascial referred-pain patterns link the BL line from head to toe. Dorsher enumerates the connecting muscles as follows: Occipitalis, splenius capitis, semispinalis capitis, multifidi, rhomboids, trapezius, serratus posterior inferior, longissimus thoracis, iliocostalis lumborum, piriformis, hamstring group, popliteus, gastrocnemius, soleus, tibialis posterior, abductor digiti minimi.[1] The BL channel also closely follows Myers' Superficial Back Line anatomy train.[2]

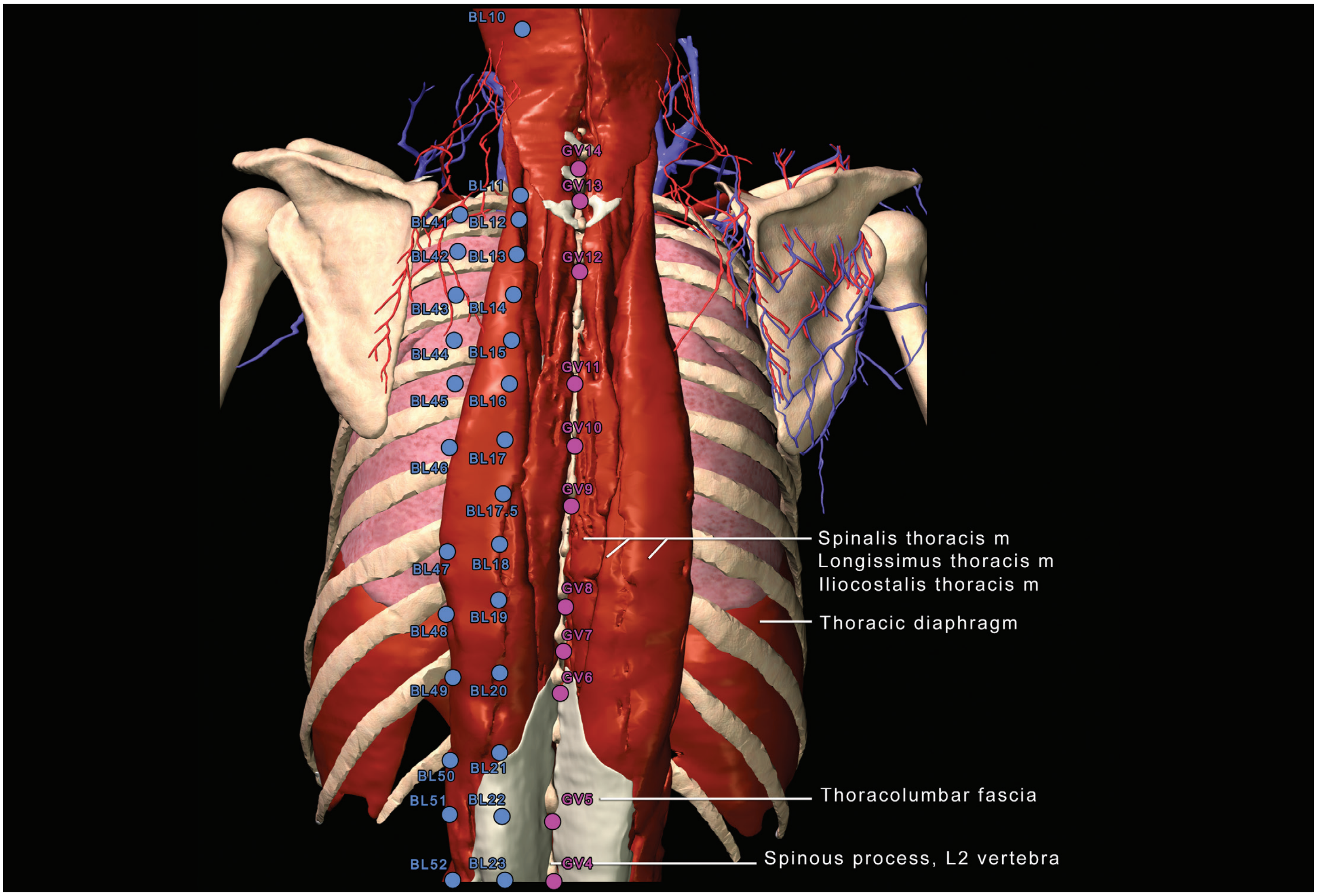

BL 7
BL 8
BL 6
BL 4
BL 3
BL 5
BL 2
BL 9
BL 1
BL 10
BL 11
BL 12
BL 41
BL 13
BL 42
BL 14
BL 43
BL 15
BL 44
BL 16
BL 45
BL 17
BL 46
BL 17.5
BL 18
BL 47
BL 19
BL 48
BL 20
BL 49
BL 21
BL 50
BL 22
BL 51
BL 23
BL 52
BL 24
BL 25
BL 26
BL 31
BL 27
BL 32
BL 28
BL 53
BL 33
BL 29
BL 34
BL 30
BL 35
BL 36
BL 37
BL 38
BL 40
BL 39
BL 55
BL 56
BL 57
BL 58
BL 59
BL 60
BL 61
BL 62
BL 63
BL 64
BL 65
BL 67
BL 66


Third (least) occipital n (C_3)
Greater occipital n (C_2)
Lesser occipital n (C2, C3)
BL 8
BL 7
BL 6
BL 5
BL 4
BL 3
Auriculotemporal n (CN V_3)
Zygomaticotemporal n (CN V_2)
Supraorbital n (CN V_1)
- lateral br
- medial br
Supratrochlear n (CN V_1)

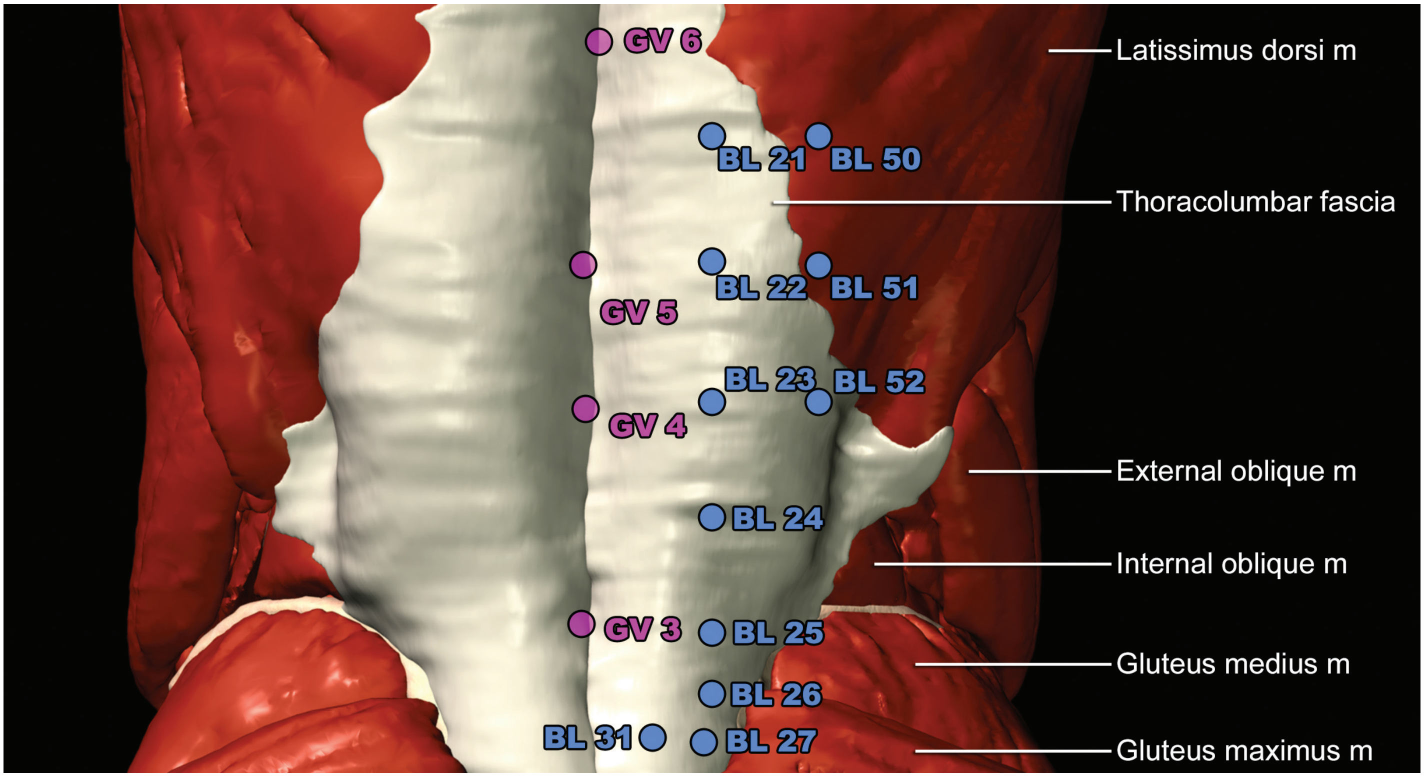
From head to toe, the BL line follows spinal nerves, that is, as long as one includes the spinal nucleus and tract of the trigeminal nerve (V). On the rostral cranium, BL 1-BL 7 associate with the trigeminal nerve. Trigeminal afferents from the face and mouth course to the spinal nucleus of V. The spinal tract and nucleus of V also associate with the facial, glossopharyngeal, and vagus nerves. This allows for crosstalk between the cranial nerves, explaining in part how stimulating points on the face and head lead to autonomic changes in organs and tissues supplied by CN VII, CN IX, and CN X, respectively. BL 2 through BL 10 play prominent roles in headache treatments, especially when palpatory tenderness or referred pain patterns argue for their participation. Whether the headache originates from intracranial or extracranial sites, the extensive communication between trigeminal, vagal, upper cervical, and autonomic nerve pathways allows for stimulation of BL 2 through BL 10 to modulate nervous system activity on various levels.


GV 20
BL 7
BL 6
BL 5
BL 8
BL 4
BL 9

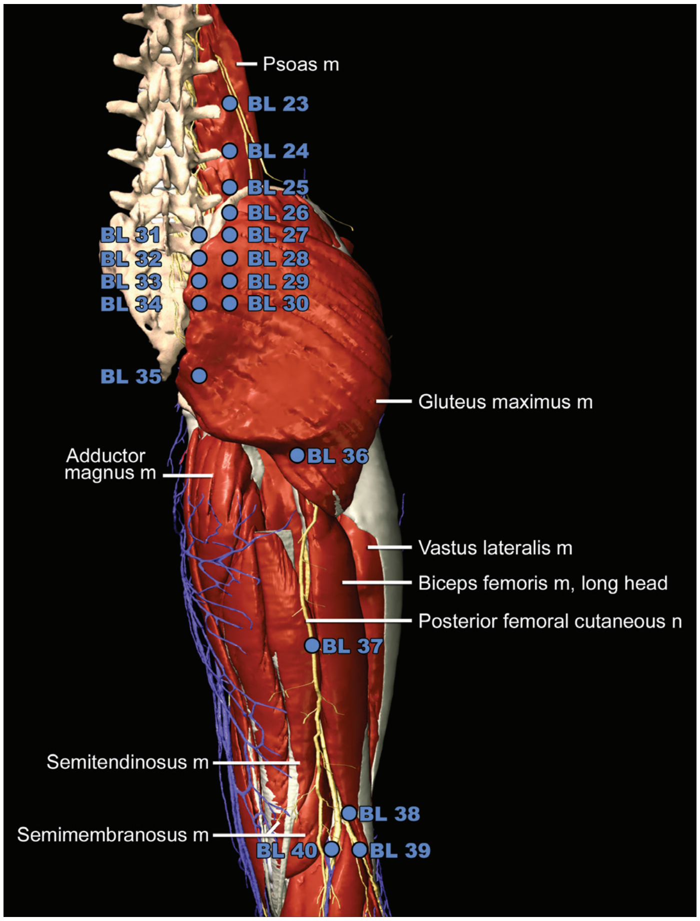
Cranial and cervical myofascial dysfunction often leads to headaches at the vertex and back of the head. Trigger points in the sternocleidomastoid muscle (sternal head) and splenius capitis can cause vertex pain. Pain at the back of the head includes patterns referred from trigger points in the trapezius, sternocleidomastoid (sternal or clavicular heads), semispinalis capitis and cervicis, suboccipital, occipitalis, digastricus, and temporalis muscles.


BL10
GV14
GV13
BL11
BL41
BL12
BL42
BL13
GV12
BL43
BL14
BL44
BL15
GV11
BL45
BL16
GV10
BL46
BL17
GV9
BL17.5
Spinalis thoracis m
Longissimus thoracis m
Iliocostalis thoracis m
BL47
BL18
GV8
Thoracic diaphragm
BL48
BL19
GV7
GV6
BL49
BL20
BL50
BL21
BL51
BL22
GV5
Thoracolumbar fascia
BL52
BL23
GV4
Spinous process, L2 vertebra

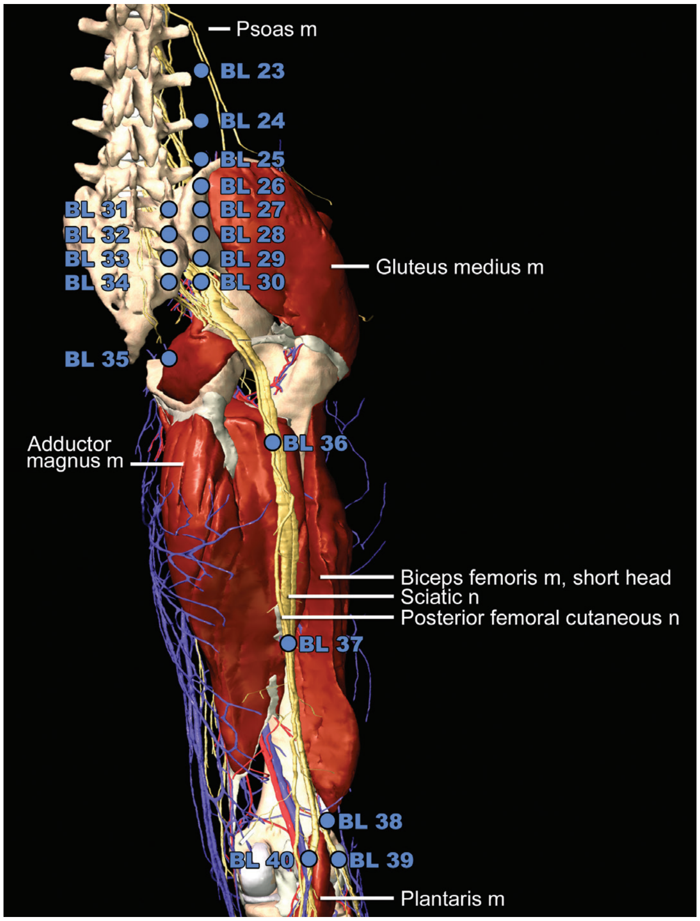
Note the relationship of the parallel trajectories of the inner and outer BL points in blue to the erector spinae muscles.


GV 6
Latissimus dorsi m
BL 21
BL 50
Thoracolumbar fascia
BL 22
BL 51
GV 5
BL 23
BL 52
GV 4
External oblique m
BL 24
Internal oblique m
GV 3
BL 25
Gluteus medius m
BL 26
BL 31
BL 27
Gluteus maximus m

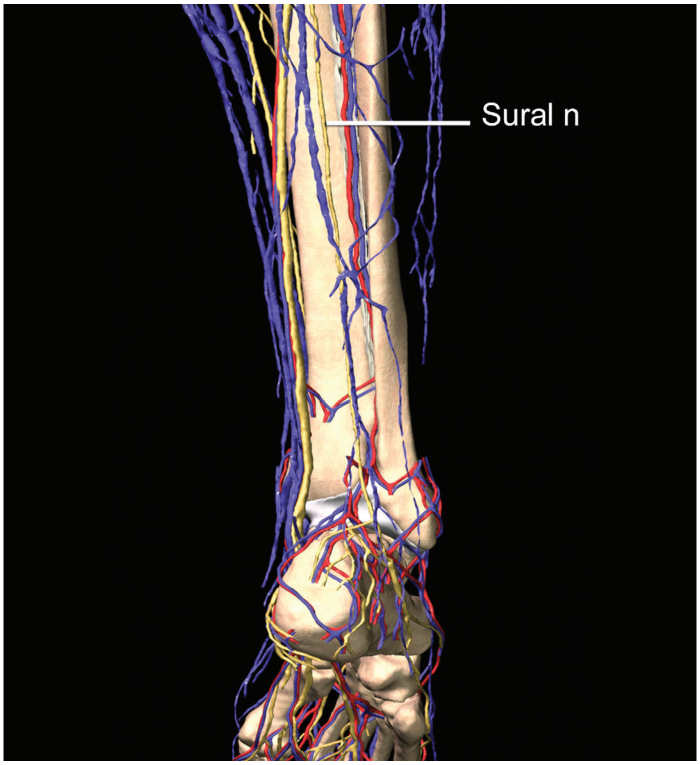
Needles inserted into BL points in the thoracolumbar region benefit low back pain in part by releasing restrictions in the dense and investing thoracolumbar fascia as well as underlying musculature.


Psoas m
BL 23
BL 24
BL 25
BL 26
BL 31
BL 27
BL 32
BL 28
BL 33
BL 29
BL 34
BL 30
BL 35
Gluteus maximus m
Adductor magnus m
BL 36
Vastus lateralis m
Biceps femoris m, long head
Posterior femoral cutaneous n
BL 37
Semitendinosus m
BL 38
Semimembranosus m
BL 40
BL 39

Beyond the back, BL points follow peripheral nerves, including the posterior femoral cutaneous nerve superficially.


Psoas m
BL 23
BL 24
BL 25
BL 26
BL 31
BL 27
BL 32
BL 28
BL 33
BL 29
BL 34
BL 30
Gluteus medius m
BL 35
BL 36
Adductor magnus m
Biceps femoris m, short head
Sciatic n
Posterior femoral cutaneous n
BL 37
BL 38
BL 40
BL 39
Plantaris m

More deeply, BL points overlap the sciatic nerve, separating at BL 38 into the tibial nerve at BL 40 and the common fibular (peroneal) nerve at BL 39.



The sural nerve, comprised of tibial and fibular (peroneal) contributions, follows the BL channel as it courses from the crus to the foot. Note how the nerve issues branches to the caudal heel (BL 61) and calcaneus (BL 62) before it continues on its way to the little toe (BL 63 – BL 67).

BL 1

Jing Ming "Bright Eyes"

With the patient's eye closed, the point is found in the small fossa 0.1 cun dorsolateral to the medial canthus.

CAUTION: Avoid penetrating the globe and area vessels. Some suggest gently pressing the globe in a lateral direction, then inserting the needle near the superior aspect of the lacrimal sac and directing the needle medially. No needle lifting and thrusting or twirling should be done.

Note: The risk of penetrating or injuring the globe and impacting vision exists when needling any periocular acupuncture points, especially BL 1 and ST 1. Ophthalmologists have written, regarding an instance of eye injury and vision loss following periocular acupuncture, "We believe that the use of acupuncture in and around the eye is an extremely risky procedure, with no solid evidence of its benefit, and advise against its use."[3] This emphasizes weighing risks versus benefits of needling sites where injury may occur.

Muscles

- **Orbicularis oculi muscle, palpebral and lacrimal parts:** The orbicularis oculi acts as a sphincter muscle for the eyelids. The palpebral portion shuts the lids, as when one blinks. The lacrimal portion resides deep to the palpebral part, promoting lacrimal fluid flow by compressing the lids onto the globe, and dilating the lacrimal sac by tugging on the lacrimal fascia. The neuroanatomic proximity of the orbicularis oculi and orbicularis oris motoneuronal pool in the brainstem subnuclei may explain why eyelids close during deglutition. That is, the motoneurons connect at the deglutitional center in the brainstem, such as in the nucleus tractus solitarius after intraoral trigeminal afferents activate swallowing centers and, simultaneously, efferent fibers to the orbicularis oculi muscle.[4]

Clinical Relevance: Blepharoplasty (eyelid surgery) poses the risk of causing dry eye and chemosis (edema of the conjunctiva). Facial nerve injury (temporal and zygomatic branches) causes inability to close the eyelid. Horner's syndrome causes ptosis (eyelid drooping), miosis and anhidrosis of the ipsilateral face, and conjunctival redness. Each of these pathologies affecting the eyelid has different etiologies and nerve pathways affected. As such, acupuncture approaches would differ for distal and homeostatic points, though local stimulation sites might overlap.

View the location of BL 1 on the orbicularis oculi muscle in Figure 7-3. The main indication for BL 1 is epiphora, in light of its association with the lacrimal part of the orbicularis oculi muscle that assists in the drainage of tears. Treatment of other eye conditions can more safely be addressed with less risky points.

Nerves

- **Infratrochlear nerve (terminal branch of nasociliary nerve, CN V_1):** Innervates the skin on the medial upper lid, the side and bridge of the nose, and the lacrimal sac.
- **Ophthalmic nerve (from which all other branches of CN V_1 arise):** The smallest of the three divisions of the trigeminal nerve (CN V), the ophthalmic nerve carries only sensory information. After emerging through the superior orbital fissure and entering the orbit, the ophthalmic nerve branches to form the nasociliary nerve, the frontal nerve, and the lacrimal nerve. Further divisions produce five cutaneous branches: the external nasal, infratrochlear, supratrochlear, supraorbital, and lacrimal nerves. The ophthalmic nerve supplies innervation to the dura of the posterior cranial fossa via the tentorial nerve.
- **Temporal branch of the facial nerve, CN VII:** Innervates the orbicularis oculi, upper lid portion.

Clinical Relevance: BL 1's main influence pertains to epiphora through its actions on the lacrimal part of the orbicularis oculi muscle, supplied by the facial nerve. It may also reduce pain for conjunctival disorders afflicting the medial canthus.

Vessels

- **Angular vein:** Drains the upper and lower lids and the conjunctiva; it may receive drainage from the cavernous sinus.
- **Anastomoses of the angular artery and vein with the ophthalmic artery and vein, respectively:** Supply and drain the orbit, including the retina.
- **Dorsal nasal artery:** Supplies the dorsal surface of nose.

Clinical Relevance: Stimulation of BL 1 alters circulation in nearby tissues. Deep within the orbit, the anterior ethmoidal artery branches off of the ophthalmic artery in the medial orbit. An ill-advised deeply inserted needle at BL 1 would traverse the skin, subcutaneous tissue, the medial palpebral ligament, the medial rectus, and the orbital adipose body.[5] If this needle angled dorsad, it could damage the anterior ethmoidal vessels. While a Chinese study recommends that needling depth at BL 1 not exceed 30.36 mm, this far exceeds acceptable depth for safety. Review the anatomy near the globe visible in the cross section of Figure 7-4.

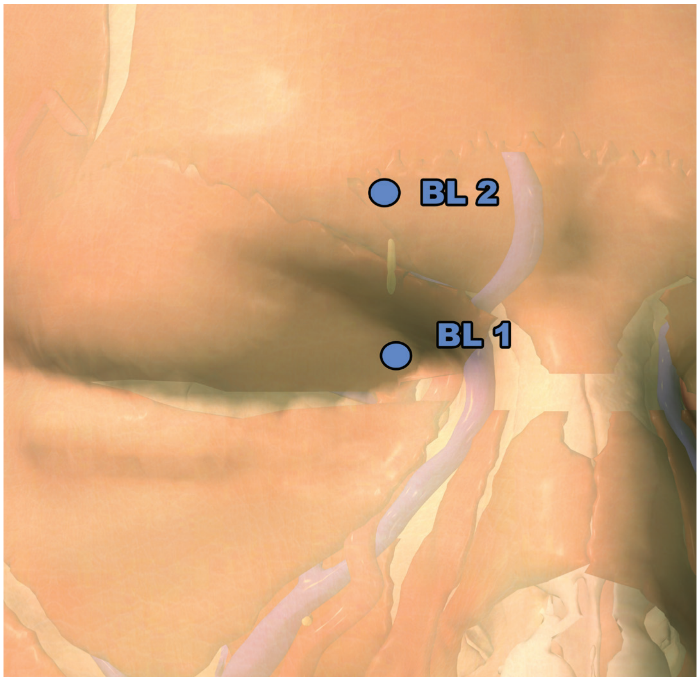


Figure 7-1. BL 1, "Bright Eyes", supposedly improves the health of the eye and clarifies vision. However, the possibility of injuring the globe with deep insertion poses safety hazards. As such, BL 2 frequently stands in for BL 1.

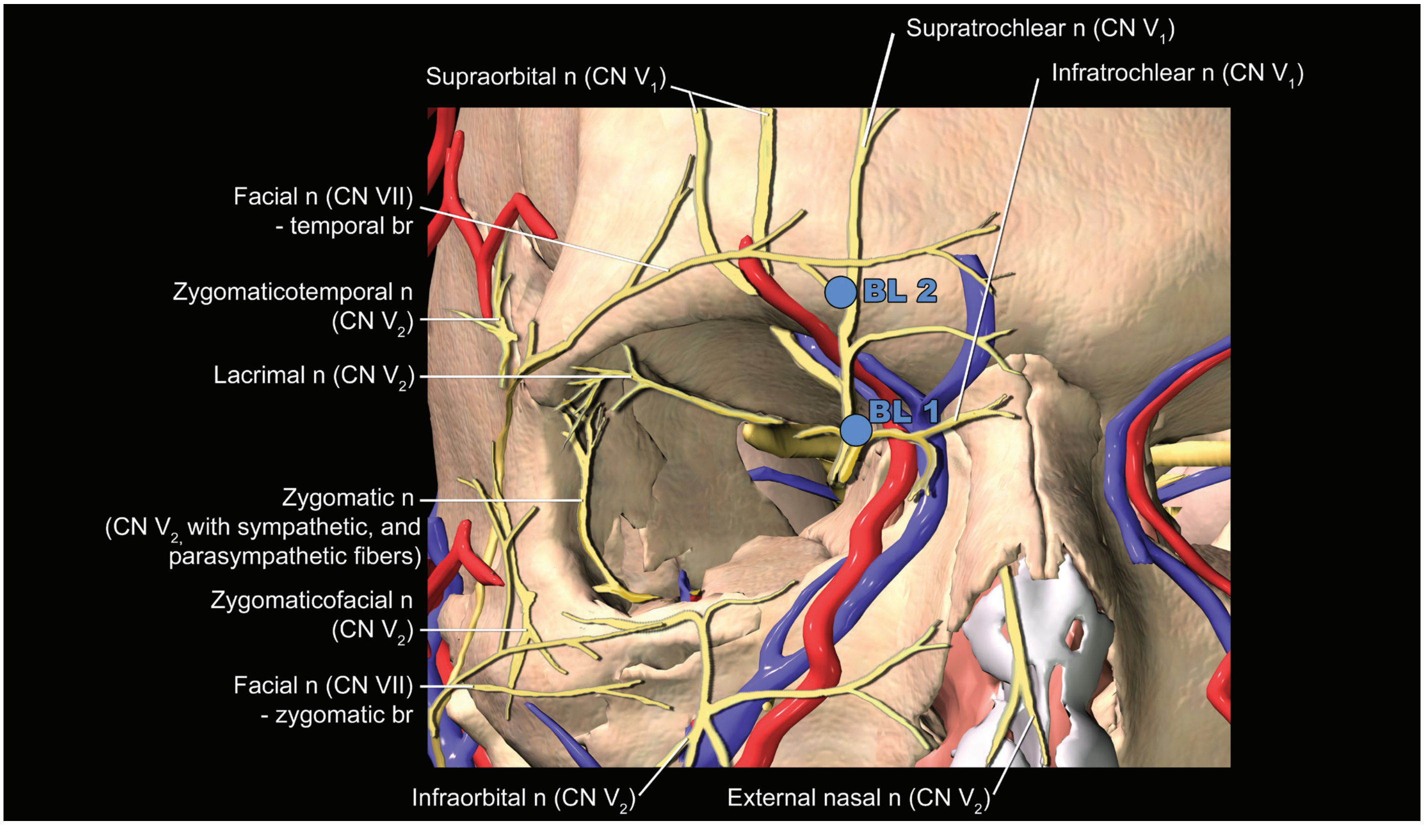

Supratrochlear n (CN V1)
Supraorbital n (CN V1)
Infratrochlear n (CN V1)
Facial n (CN VII) - temporal br
Zygomaticotemporal n (CN V2)
Lacrimal n (CN V2)
Zygomatic n (CN V2, with sympathetic, and parasympathetic fibers)
Zygomaticofacial n (CN V2)
Facial n (CN VII) - zygomatic br
Infraorbital n (CN V2)
External nasal n (CN V2)
BL 2
BL 1

Figure 7-2. The dense and varied nerve supply of acupuncture points surrounding the eye help explain the neurophysiologic effects of acupuncture for eye conditions. Specifically, the indications for BL 1 of epiphora, eye pain, and blepharospasm relate to the local nerve supply from the ophthalmic division of the trigeminal nerve and the temporal branch of the facial nerve.

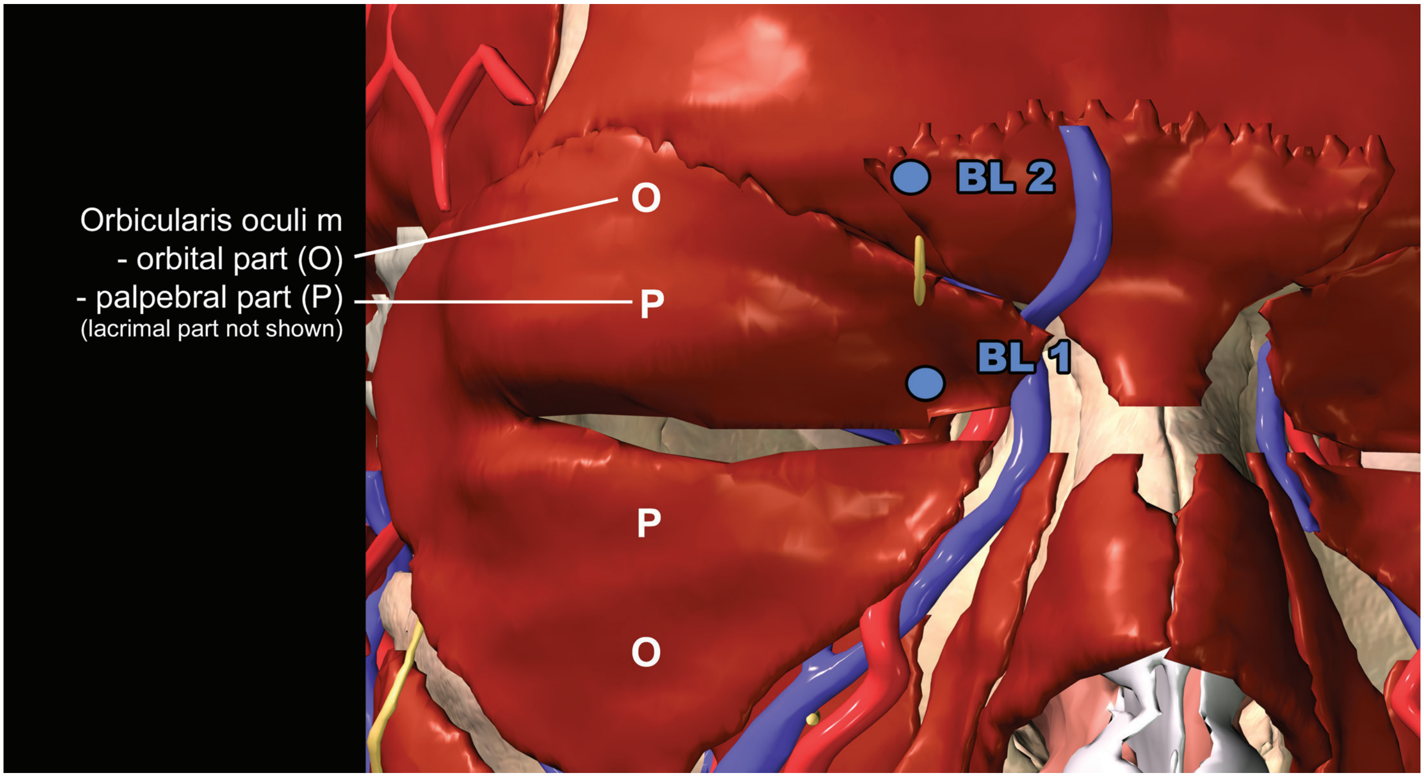

Orbicularis oculi m
- orbital part (O)
- palpebral part (P)
(lacrimal part not shown)
O
P
BL 2
BL 1
P
O

Figure 7-3. The orbicularis oculi muscle actually comprises three parts: an orbital, palpebral, and lacrimal part. The lacrimal portion resides deep to the palpebral part and promotes lacrimal fluid flow by compressing the lids onto the globe. It dilates the lacrimal sac by tugging on the lacrimal fascia.

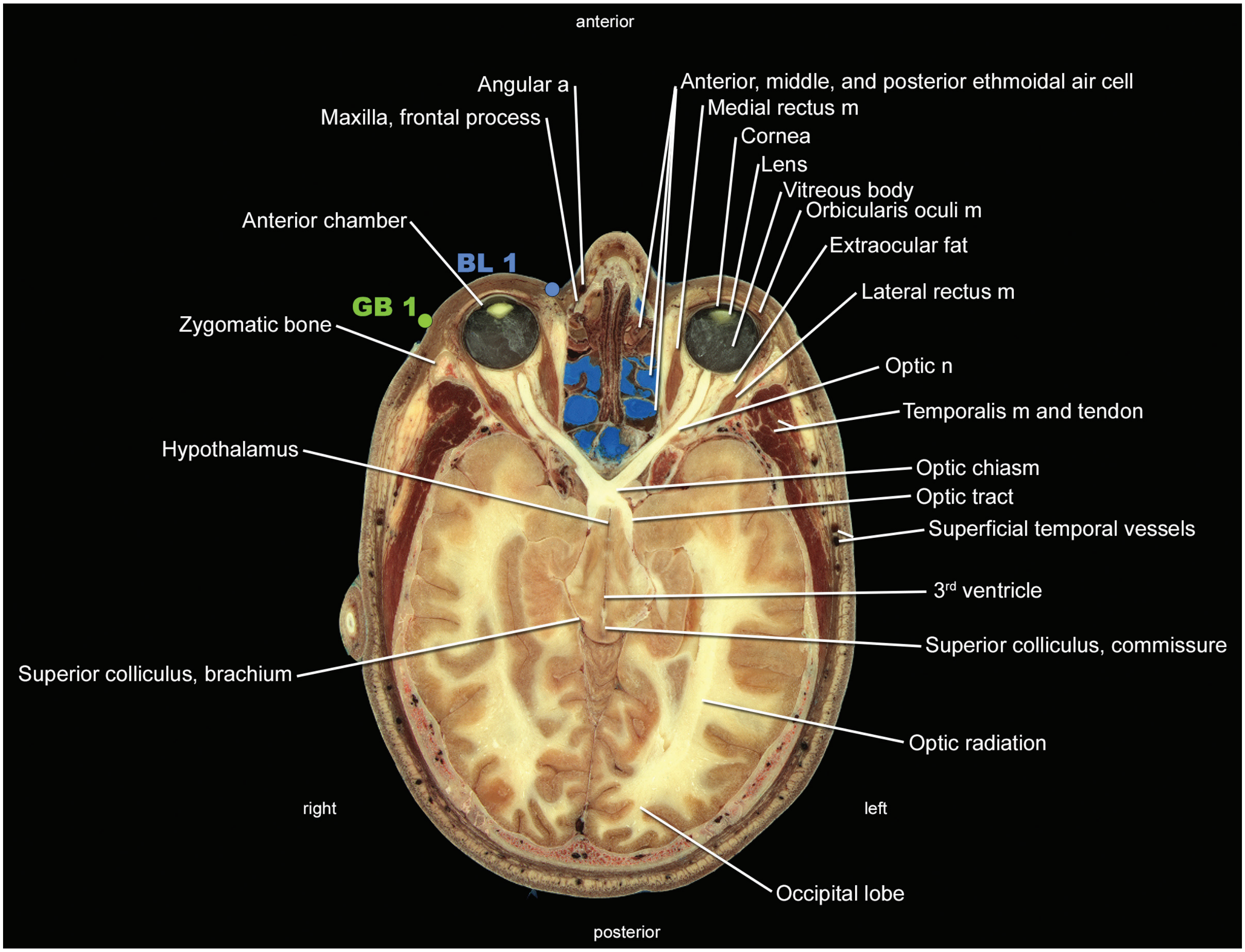

anterior
Angular a
Maxilla, frontal process
Anterior, middle, and posterior ethmoidal air cell
Medial rectus m
Cornea
Lens
Vitreous body
Orbicularis oculi m
Anterior chamber
Extraocular fat
BL 1
GB 1
Lateral rectus m
Zygomatic bone
Optic n
Temporalis m and tendon
Hypothalamus
Optic chiasm
Optic tract
Superficial temporal vessels
3rd ventricle
Superior colliculus, commissure
Superior colliculus, brachium
Optic radiation
right
left
Occipital lobe
posterior

Figure 7-4. BL 1 must be needled cautiously in order to avoid injuring the globe. This cross section illustrates how an acupuncture needle could reach the medial rectus muscle but it fails to show the vessels and nerves at risk, other than the optic nerve. The cross section at the level of BL 1 also displays the neuroanatomy of the visual system from the globe to the optic nerve, optic chiasm, optic tract, superior colliculus, optic radiation, and occipital cortex.

Indications and Potential Point Combinations

- **Eye problems: watery eyes, epiphora, visual disturbances, conjunctivitis, iritis, retinitis, eye pain, blepharospasm:** BL 1 or BL 2, GV 24.5 (Yintang), GB 14, GB 1 or TH 23, GV 20, ST 36.

Evidence-Based Applications

- Two series of cases indicated that BL 1 may be of benefit in cases of **epiphora.**[1,2]
- **Peripheral facial nerve** injury with inability to close the eyelid: BL 1, GB 14, and ST 2.[6]

References

1. Ni Y, Yang J, Wang J, and Xu X. Treatment of epiphora due to insufficiency of lacrimal passage by acupuncture at Jingming. *Journal of Traditional Chinese Medicine.* 1999;19(2):108-110.

2. Ni Y, Shi W, Xu X, and Wang J. Acupuncture treatment of 34 cases of epiphora with dysfunction of lacrimal duct. *Journal of Traditional Chinese Medicine.* 2002;22(1):31-32.

3. Fielden M, Hall R, Kherani F, et al. Ocular perforation by an acupuncture needle. *Can J Ophthalmol.* 2011;46:94-95.

4. Ertekin C, Eryasar G, Gurgor N, et al. Orbicularis oculi muscle activation during swallowing in humans. *Exp Brain Res.* 2012; Oct 13 [Epub ahead of print].

5. Xu XD, Jin LZ, Lou XF, et al. Anatomical study on Jingming (BL 1). *Zhongguo Zhen Jiu.* 2006;26(6):415-416.

6. Tian J. Electroacupuncture combined with flash cupping for treatment of peripheral facial paralysis – a report of 224 cases. *J Tradit Chin Med.* 2007;27(1):14-15.

BL 2

Zan Zhu "Gathered Bamboo"

[The name for BL 2, "Bamboo Gathering", denotes the likeness of the eyebrows to the bamboo leaves apposed on a stem.]

In the shallow depression at the medial end of the eyebrow, in the supraorbital notch or foramen, superior to BL 1. Often tender to palpation.

Muscles

- **Frontal belly of epicranius (occipitofrontalis) muscle:** Wrinkles the forehead, elevates the eyebrow.
- **Corrugator supercilii muscle:** A muscle of facial expression that demonstrates concern. The corrugator supercilii muscles move the eyebrows toward each other and metaphorically "gather bamboo"; hence the name.

Clinical Relevance: Migraines may arise from tension in the forehead muscles such as the corrugator supercilii, deep to the eyebrow. Although some plastic surgeons have noted that elimination of this muscle leads to significant improvement in migraine-associated head pain,[4] nonsurgical trigger point deactivation through acupuncture and related techniques should be tried first. Trigger points in the attachment of the frontalis muscle near BL 2 also produce forehead pain.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V_1):** The supraorbital nerve is the largest of five branches of the ophthalmic division of the trigeminal nerve to reach the skin of the face. Innervates the mucous membrane of the frontal sinus and upper eyelid (palpebral conjunctiva); supplies skin of forehead to the hairline. The supraorbital nerve divides into deep and superficial branches. The deep branch courses between the galea aponeurotica and the periosteum. The superficial branch passes through the rostral frontalis muscle and courses caudally over the muscle to supply the scalp. Branches of both the superficial and deep components of the supraorbital nerve head toward the vertex and GV 20, helping explain that point's name of "Bai Hui" or Hundred Convergences.
- **Supratrochlear nerve (from frontal nerve, CN V_1):** Innervates the mucosal lining of the frontal sinus and the skin in the middle of the forehead. The supratrochlear nerve supplies the skin near the midline (GV channel) of the rostral scalp while the supraorbital nerve's medial and lateral branches follow the BL line.
- **Temporal branch of the facial nerve, CN VII:** Innervates the corrugator supercilii muscle and the frontal belly of the occipitofrontalis muscle.

Clinical Relevance: BL 2 coincides with the site of supraorbital nerve block.[5] Pain in the eye or head associated with the supraorbital nerve or, more broadly, the ophthalmic division of the trigeminal nerve, often responds to neuromodulation at this and other relevant sites. This includes not only pain in the head but also the sinuses.

Vessels

- **Supratrochlear artery:** Supplies the muscles and skin of the scalp.
- **Supratrochlear vein:** Drains the anterior part of scalp and forehead.

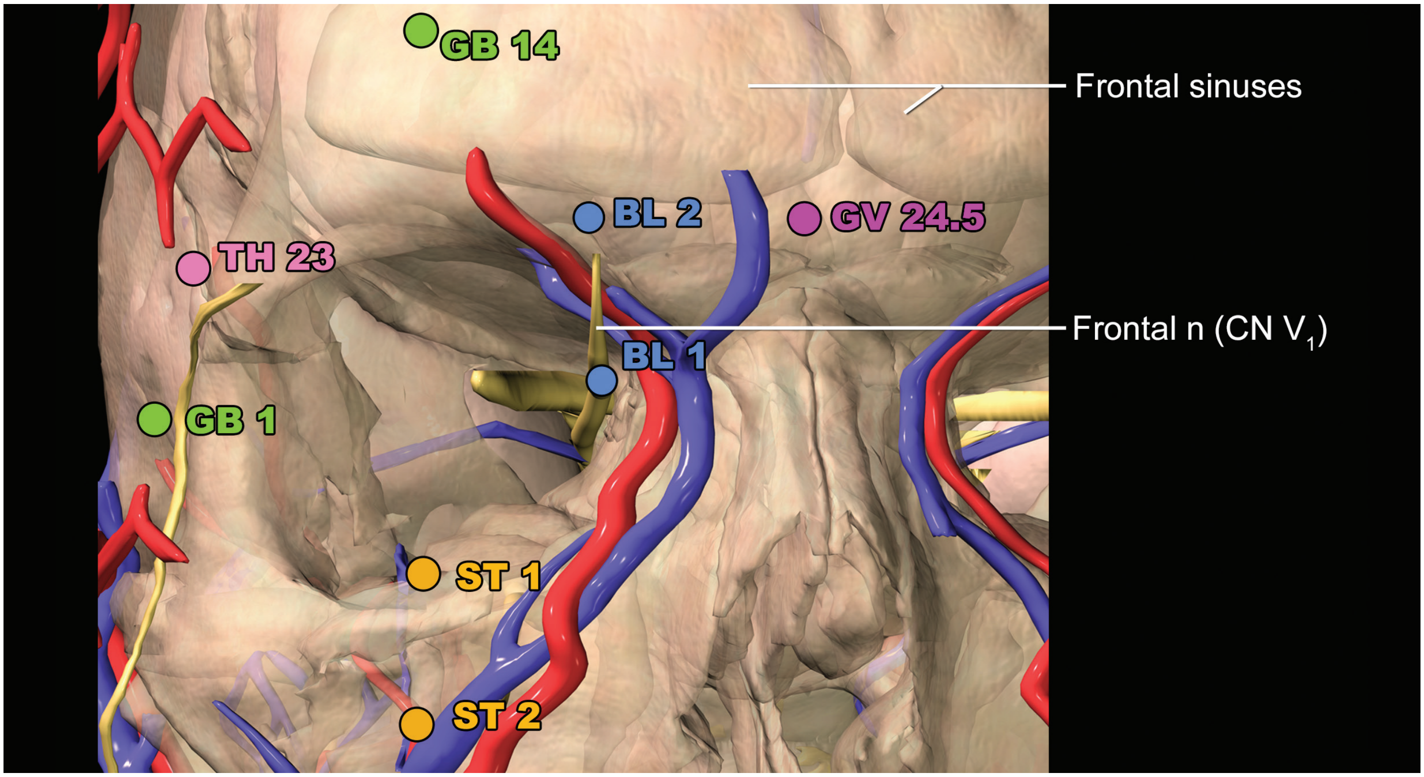


Figure 7-5. In addition to its effects on the eyes, BL 2 affects frontal sinus pain via the supratrochlear nerve, a trigeminal nerve branch that supplies the mucosal lining of the sinus. The semitransparent skull shown here depicts the relationship of BL 2 to the sinuses.

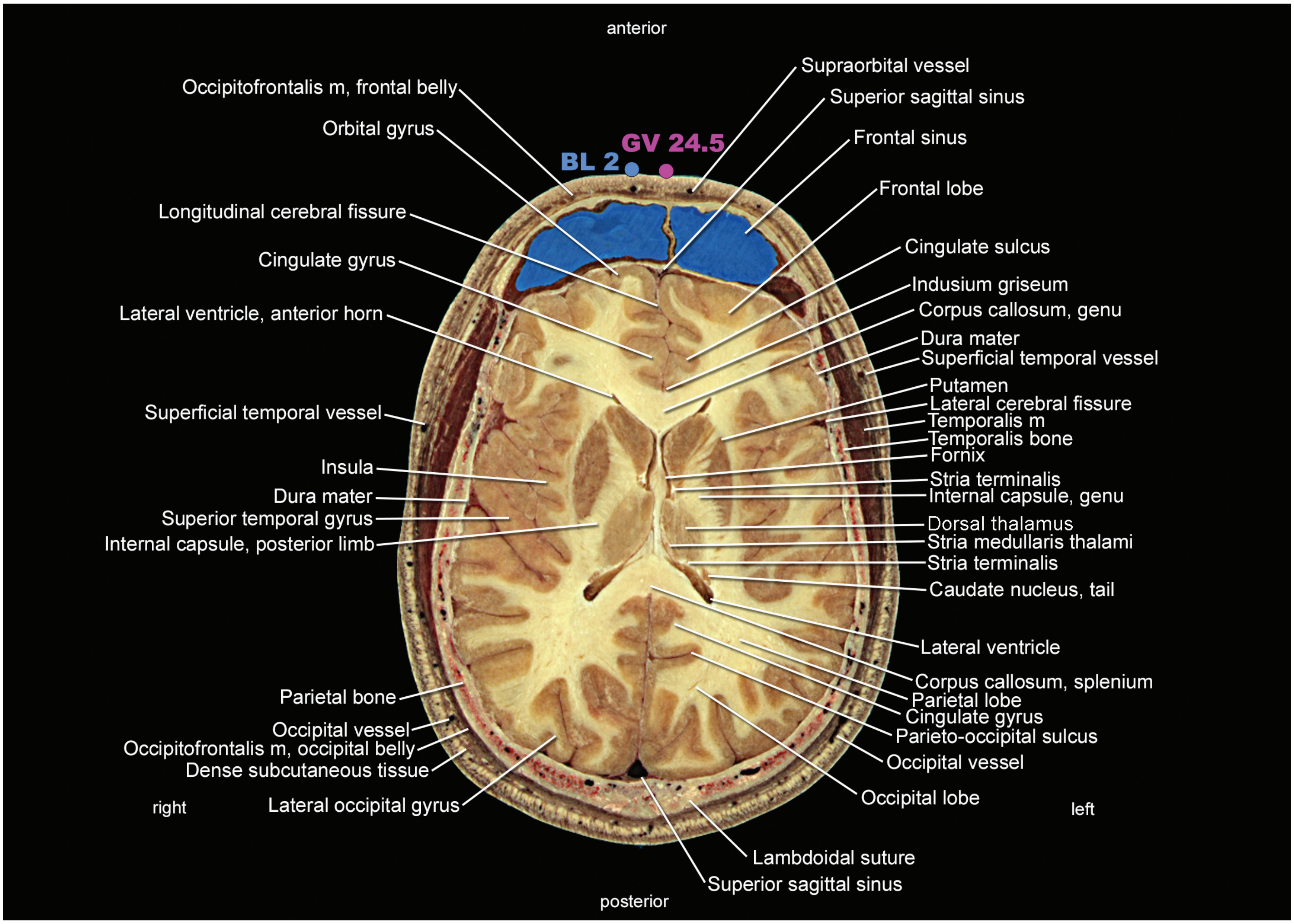

anterior
Occipitofrontalis m, frontal belly
Orbital gyrus
BL 2
GV 24.5
Longitudinal cerebral fissure
Cingulate gyrus
Lateral ventricle, anterior horn
Superficial temporal vessel
Insula
Dura mater
Superior temporal gyrus
Internal capsule, posterior limb
Parietal bone
Occipital vessel
Occipitofrontalis m, occipital belly
Dense subcutaneous tissue
right
Lateral occipital gyrus
Supraorbital vessel
Superior sagittal sinus
Frontal sinus
Frontal lobe
Cingulate sulcus
Indusium griseum
Corpus callosum, genu
Dura mater
Superficial temporal vessel
Putamen
Lateral cerebral fissure
Temporalis m
Temporalis bone
Fornix
Stria terminalis
Internal capsule, genu
Dorsal thalamus
Stria medullaris thalami
Stria terminalis
Caudate nucleus, tail
Lateral ventricle
Corpus callosum, splenium
Parietal lobe
Cingulate gyrus
Parieto-occipital sulcus
Occipital vessel
Occipital lobe
left
Lambdoidal suture
Superior sagittal sinus
posterior

Figure 7-6. The relationship between the frontal sinus (denoted in blue) and BL 2 can be seen in this cross section. Trigeminal sensory fibers supply both, which helps justify the indication of frontal sinusitis for BL 2. In addition, the dura mater can be seen between the brain and calvarium. The rostral dura receives trigeminal sensory supply, suggesting an avenue for trigeminal neuromodulation through points on the head that influence the ophthalmic division.

- **Supraorbital artery:** Supplies the muscles and skin of the forehead and scalp. The supraorbital artery often issues a branch to the diploë at the foramen. See Figure 7-11 to view a supraorbital vessel in cross section.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.

Clinical Relevance: The supratrochlear, infraorbital, and branches of the facial arteries form an anastomotic relationship within the paranasal and medial canthal region.[6] Thus, improving circulation through stimulation of BL 2 can benefit blood flow in other portions of the orbit. See Figure 7-5 to note the vascular continuity exhibited at the medial canthus. Also note in Figure 7-5 the oblique branch of the supraorbital artery coursing toward GB 14. A study evaluating the vascular anatomy of the forehead found this branch frequently anastomoses with either the transverse frontal artery or the frontal branch of the superficial temporal artery.[7] Figure 7-5 shows this frontal branch above TH 23 reaching toward BL 2, reinforcing that circulatory stimulation at one site may have more widespread effects than previously considered.

Indications and Potential Point Combinations

- **Frontal sinus congestion and/or headache:** BL 2, BL 10, GV 24.5 (Yintang), LI 4, ST 36.
- **Dry eye:** BL 2, TH 23, GB 14, GV 20, GB 20, ST 36, LR 3.
- **Migraine:** BL 2, LI 4, LR 3, BL 10, GV 20.

Evidence-Based Applications

- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **keratoconjunctivitis sicca (KCS, or dry eye).**[1]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **KCS**.[2]
- Case report indicated that **hiccoughs** were successfully treated with digital pressure on BL 2, followed by moxibustion.[3]
- Dry eye, with BL 2, GB 14, TH 23, ST 1, GB 20, LI 4, LI 11, GV 23, Sishencong (EX-HN-1); tear film break-up time significantly improved after acupuncture, as did **ocular surface disease** index.[8]

References

1. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand*. 2004;82:283-290.

2. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2*. New York: Plenum Press, 1998. pp. 1011-1016.

3. Lu R, Liu M. Clinical application of single acupoint for treatment. *Journal of Traditional Chinese Medicine*. 1991;11(4):284-285.

4. Guyuron B, Varghai A, Michelow BJ, et al. Corrugator supercilii muscle resection and migraine headaches. *Plastic and Reconstructive Surgery*. 2000; 106(2):429-434.

5. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery*. 1995;96(3):564-569.

6. Kelly CP, Yavuzer R, Keskin M, et al. Functional anastomotic relationship between the supratrochlear and facial arteries: an anatomical study. *Plast Reconstr Surg*. 2008;121(2):458-465.

7. Kleinties WG. Forehead anatomy: arterial variations and venous link of the midline forehead flap. *J Plast Reconstr Aesthet Surg*. 2007;60(6):593-606.

8. Kim T-H, Kang JW, Kim KH, et al. Acupuncture for the treatment of dry eye: a multicenter randomised controlled trial with active comparison intervention (artificial teardrops). *PLoS ONE*. 2012;7(5):e36638.

BL 3

Mei Chong "Eyebrow's Pouring" (or "Eyebrow Ascension")

Directly above BL 2, .5 cun caudal to the rostral hairline, level with GV 24 and BL 4.

If unsure of the location of the anterior hairline (i.e., it is either indistinct or absent), measure the distance between the glabella (at point GV 24.5, or Yintang) and the caudal hairline, which equals 15 cun. The rostral hairline occurs one-fifth (=3 cun) the distance from the glabella to the caudal hairline. If the caudal hairline is indistinct as well, that line can be taken 1 cun caudal to GV 16, or Fengfu, immediately below the external occipital protuberance.

Muscles

- **Frontal belly of epicranius (occipitofrontalis) muscle:** Wrinkles the forehead and elevates the eyebrow.

Clinical Relevance: The occipitofrontalis muscle comprises two physiologically and anatomically distinct muscles.[2] The rostral limit of the galea aponeurotica in the vicinity of BL 3 and BL 4 creates a unique layering system that raises the possibility of nerve entrapment. That is, the superficial fascia over the occipital belly turns into the temporoparietal fascia that attaches to the superior, or upper, border of the frontalis muscle. This superficial musculoaponeurotic complex lifts the eyebrow and pulls the scalp rostrad. In contrast, the occipital belly of the occipitofrontalis muscle joins with the galea aponeurotica and inserts on the deeper aspect, or underside, of the frontalis muscle, forming the deep musculoaponeurotic system. The occipital muscle attachment gives this layer the capacity to pull the scalp, including the superficial musculoaponeurotic system, caudad. Clinically, this layering system poses opportunities for nerve entrapment as branches travel between layers. Compression or traction of the cranial and upper cervical spinal nerves that supply the scalp, muscle, fascia, and aponeurotica leads to headache and, potentially, visual disturbances. After giving off branches that supply the upper eyelid and mucosal lining of the frontal sinus, the supraorbital nerve pierces the frontalis muscle at variable levels from the orbital rim to the mid-forehead. It also courses through the galea aponeurotica to supply sensation to the skin, subcutaneous tissue, and periosteum of the scalp as far as the vertex of the skull.[3] The superficial branch of the supraorbital nerve travels along the BL channel and covers BL 3 and BL 4. Palpate the rostral cranium and forehead to determine the loci of tender sites and trigger points. Deactivate accordingly.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V_1):** Innervates the mucous membrane of the frontal sinus and upper eyelid (palpebral conjunctiva); supplies skin of forehead to the vertex.
- **Supratrochlear nerve (from frontal nerve, CN V_1):** Innervates the mucosal lining of the frontal sinus and the skin in the middle of the forehead.
- **Ophthalmic division (CN V_1):** Both the supraorbital and supratrochlear nerves arise from the frontal nerve, derived from the ophthalmic division of the trigeminal nerve. The ophthalmic division provides substantial numbers of pain-sensitive afferents for large portions of the supratentorial dura and its associated venous structures.[1] The ophthalmic division also appears to provide afferent sensory fibers to the main arterial trunks on the

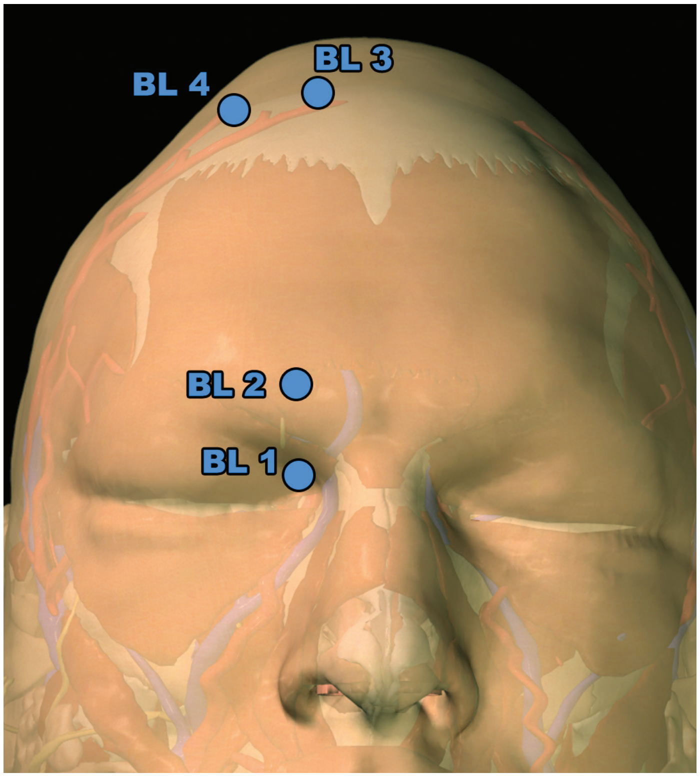


Figure 7-7. BL 2 and BL 3 trace the course of the supratrochlear and medial supraorbital nerves.

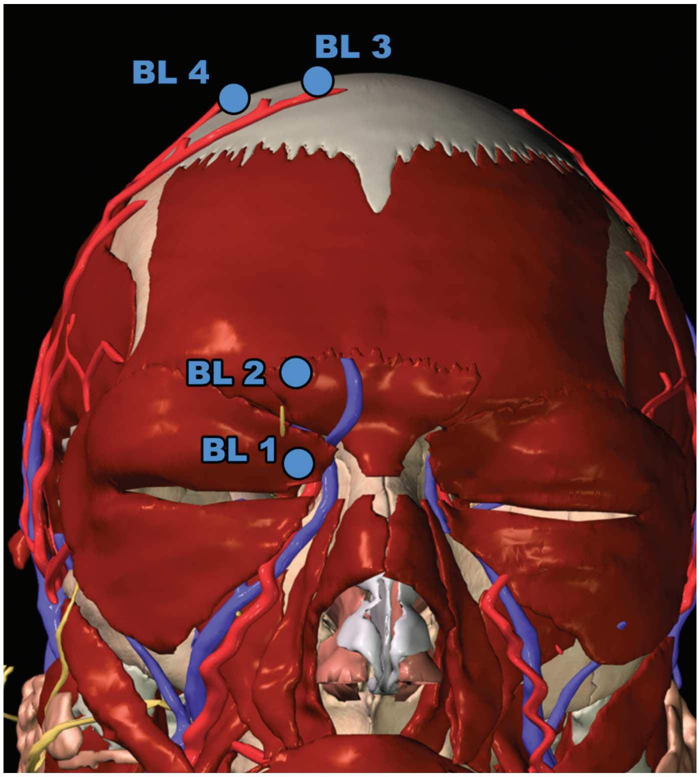


Figure 7-8. The frontalis muscle on the forehead, anchored at BL 3 and BL 4, elevates the eyebrows. Hence the name "Eyebrow Ascension".

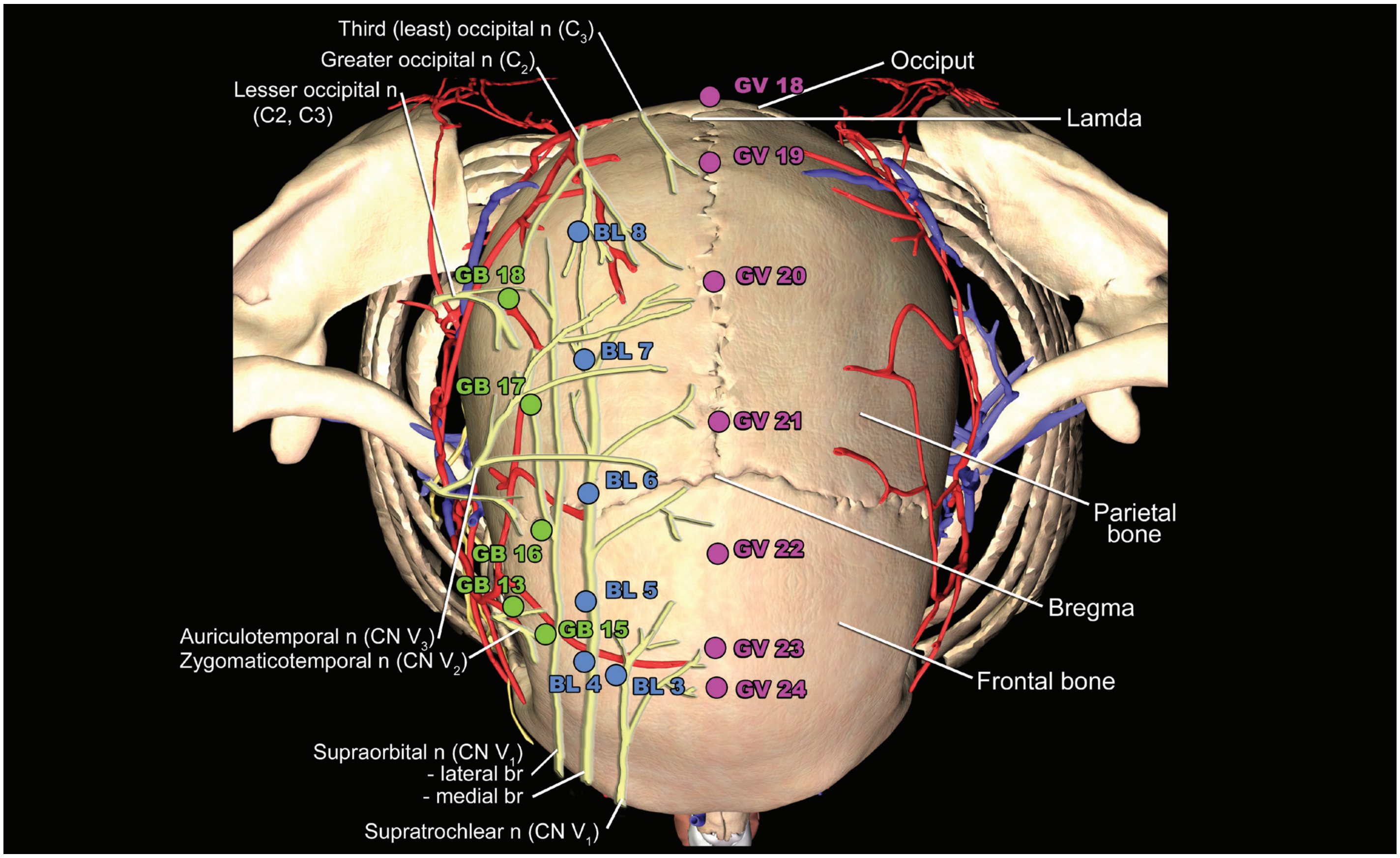

Third (least) occipital n (C_3)
Greater occipital n (C_2)
Lesser occipital n (C2, C3)
Occiput
GV 18
Lamda
GV 19
BL 8
GB 18
GV 20
BL 7
GB 17
GV 21
BL 6
Parietal bone
GB 16
GV 22
GB 13
BL 5
Bregma
GB 15
Auriculotemporal n (CN V_3)
Zygomaticotemporal n (CN V_2)
GV 23
BL 4
BL 3
GV 24
Frontal bone
Supraorbital n (CN V_1)
- lateral br
- medial br
Supratrochlear n (CN V_1)

Figure 7-9. BL 3 associates with the supratrochlear nerve whereas BL 4 follows the supraorbital nerve more closely.

base of the brain; i.e., the circle of Willis. Small branches from both the ophthalmic and maxillary divisions joint sympathetic fibers from the internal carotid artery to supply the vessels making up the circle of Willis. These connections provide an anatomic basis for headache-related indications of BL, GV, and other points in the trigeminal nerve distribution.

- **Temporal branch of the facial nerve, CN VII:** Innervates the superior part of the orbicularis oculi muscle and frontal belly of occipitofrontalis muscle.

Clinical Relevance: As becomes clear in Figure 7-9, the supratrochlear nerve peters out near BL 3. Consequently, the BL channel steps in a lateral direction to follow the supraorbital nerve to the vertex. Acupuncture at or near BL 3 addresses trigger point pathology and nerve entrapments involving the aforementioned nerves. Neuromodulation of the trigeminal nerve branches at BL 3 assists in clearing science congestion.

Vessels

- **Supraorbital artery:** Supplies the muscles and skin of forehead and scalp.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis structures. Figure 7-7 indicates the trajectory of the superficial temporal artery headed toward the midline. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

Indications and Potential Point Combinations

- **Nose and frontal sinus disorders, including rhinitis, sneezing, and sinusitis:** BL 3 or BL 4 (whichever is more tender), BL 2, GV 20, GV 24.5 (Yintang), LI 4, ST 36.
- **Frontal headache:** BL 3 or BL 4 if either is tender. Consider also BL 2, GV 20, GV 24.5 (Yintang), GB 14, LI 4.

References

1. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am.* 2003;36:1041-1053.

2. Kushima H, Matsuo K, Yuzuriha S, et al. The occipitofrontalis muscle is composed of two physiologically and anatomically different muscles separately affecting the positions of the eyebrow and hairline. *British Journal of Plastic Surgery.* 2005;58:681-687.

3. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery.* 1995;96(3):564-569.

BL 4

Qu Chai "Crooked Curve" or "Deviating Turn"

Located 1.5 cun lateral to the midline (at GV24), 1/2 cun posterior to the anterior hairline, level with BL 3 and GV 24. Lands 1/3 the distance from GV 24 to ST 8.

Muscles

- **Frontal belly of epicranius (occipitofrontalis) muscle:** Wrinkles the forehead, elevates the eyebrow.

Clinical Relevance: The occipitofrontalis muscle comprises two physiologically and anatomically distinct muscles.[1] The rostral limit of the galea aponeurotica in the vicinity of BL 3 and BL 4 creates a unique layering system that raises the possibility of nerve entrapment. That is, the superficial fascia over the occipital belly turns into the temporoparietal fascia that attaches to the superior, or upper, border of the frontalis muscle. This superficial musculoaponeurotic complex lifts the eyebrow and pulls the scalp rostrad. In contrast, the occipital belly of the occipitofrontalis muscle joins with the galea aponeurotica and inserts on the deeper aspect, or underside, of the frontalis muscle, forming the deep musculoaponeurotic system. The occipital muscle attachment gives this layer the capacity to pull the scalp, including the superficial musculoaponeurotic system, caudad. Clinically, this layering system poses opportunities for nerve entrapment as branches travel between layers. Compression or traction of the cranial and upper cervical spinal nerves that supply the scalp, muscle, fascia, and aponeurotica leads to headache and, potentially, visual disturbances. After giving off branches that supply the upper eyelid and mucosal lining of the frontal sinus, the supraorbital nerve pierces the frontalis muscle at variable levels from the orbital rim to the mid-forehead. It also courses through the galea aponeurotica to supply sensation to the skin, subcutaneous tissue, and periosteum of the scalp as far as the vertex of the skull.[2] The superficial branch of the supraorbital nerve travels along the BL channel and covers BL 3 and BL 4. Palpate the rostral cranium and forehead to determine the loci of tender sites and trigger points. Deactivate accordingly.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V$_1$):** Innervates the mucous membrane of the frontal sinus and the palpebral conjunctiva of the upper eyelid. Supplies the skin of the eyelid and forehead to the vertex. A sensory branch of the ophthalmic division of the trigeminal nerve.
- **Temporal branch of the facial nerve, CN VII:** Innervates the superior part of the orbicularis oculi muscle and the frontal belly of the occipitofrontalis muscle.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[3] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of BL 2, BL 4, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Supraorbital artery:** Supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis structures. Figure 7-7 indicates the trajectory of the superficial temporal artery headed toward the midline. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

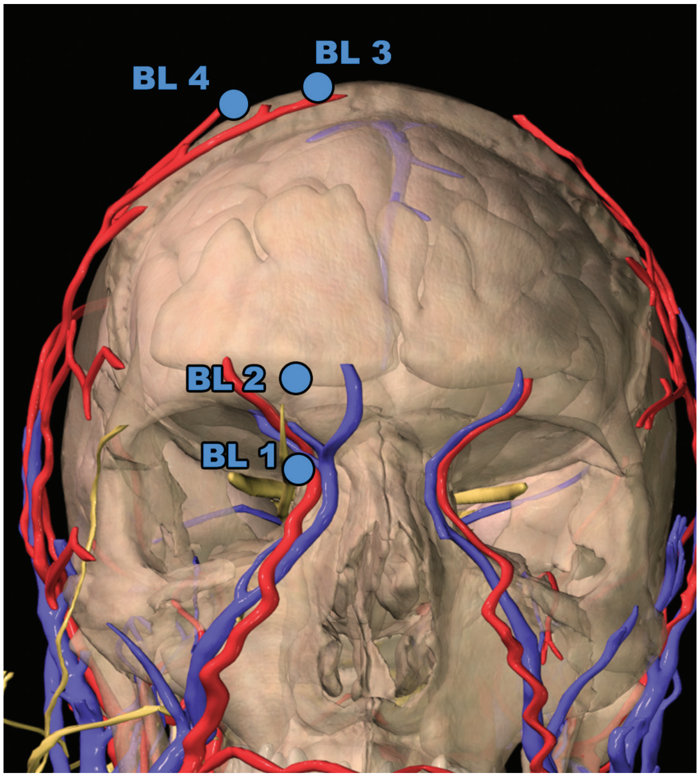


Figure 7-10. The BL channel turns a corner at BL 4, accounting for its name, "Deviating Turn". Its closest neural companion changes from the supratrochlear nerve at BL 3 to the supraorbital nerve from BL 4 to BL 7. See also Figure 7-9.

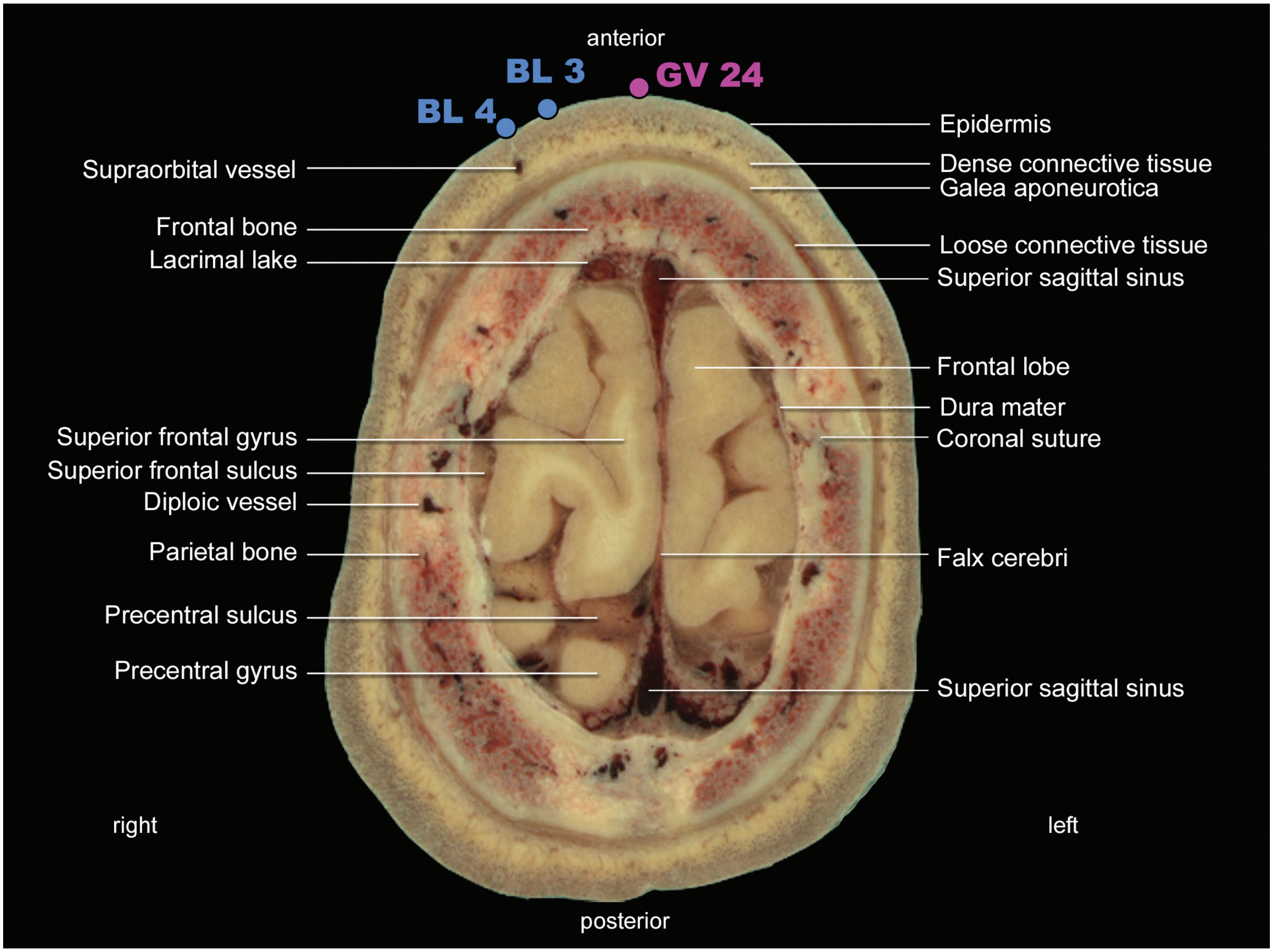

anterior
BL 3
GV 24
BL 4
Supraorbital vessel
Frontal bone
Lacrimal lake
Epidermis
Dense connective tissue
Galea aponeurotica
Loose connective tissue
Superior sagittal sinus
Frontal lobe
Dura mater
Coronal suture
Superior frontal gyrus
Superior frontal sulcus
Diploic vessel
Parietal bone
Falx cerebri
Precentral sulcus
Precentral gyrus
Superior sagittal sinus
right
left
posterior

Figure 7-11. BL 4, BL 3, and GV 24 reside just inside the hairline. They affect nerve branches making their way above, through, and below various tissue layers at risk of entrapment.

Indications and Potential Point Combinations

- **Nose and frontal sinus disorders, including rhinitis, sneezing, and sinusitis:** BL 3 or BL 4 (whichever is more tender), BL 2, GV 20, GV 24.5 (Yintang), LI 4, ST 36.
- **Frontal headache:** BL 3 or BL 4 if either is tender. Consider also BL 2, GV 20, GV 24.5 (Yintang), GB 14, LI 4.
- **Cognitive dysfunction:**[4] BL 4, GV 20, GV 24, LI 4, ST 36.

References

1. Kushima H, Matsuo K, Yuzuriha S, et al. The occipitofrontalis muscle is composed of two physiologically and anatomically different muscles separately affecting the positions of the eyebrow and hairline. *British Journal of Plastic Surgery.* 2005;58:681-687.
2. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery.* 1995;96(3):564-569.
3. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
4. Li W, Cheng YH, and Yu XG. Observation on therapeutic effect of acupuncture combined with medicine on mild cognition disorders in patients with post-stroke. *Zhongguo Zhen Jiu.* 2012;32(1):3-7.

BL 5

Wu Chu "Fifth Place"

Located 1.5 cun lateral to the midline (at GV 23), .5 cun posterior to BL 4, and 1 cun behind the anterior hairline.

Muscles

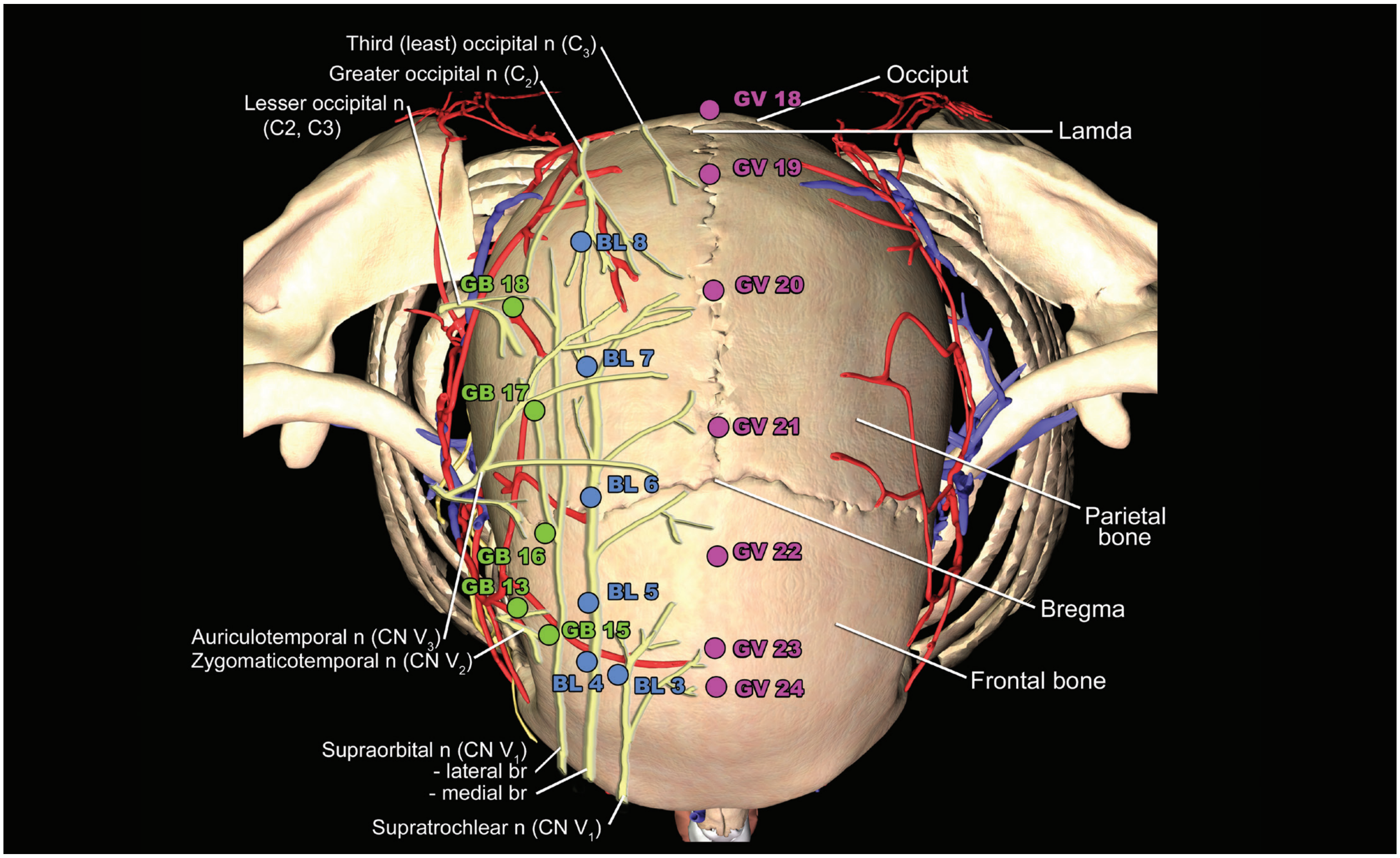
- **Frontal belly of epicranius (occipitofrontalis) muscle:** Wrinkles the forehead and elevates the eyebrow.

Clinical Relevance: The occipitofrontalis muscle comprises two physiologically and anatomically distinct muscles.[1] The rostral limit of the galea aponeurotica in the vicinity of BL 3 and BL 4 creates a unique layering system that raises the possibility of nerve entrapment. That is, the superficial fascia over the occipital belly turns into the temporoparietal fascia that attaches to the superior, or upper, border of the frontalis muscle. This superficial musculoaponeurotic complex lifts the eyebrow and pulls the scalp rostrad. In contrast, the occipital belly of the occipitofrontalis muscle joins with the galea aponeurotica and inserts on the deeper aspect, or underside, of the frontalis muscle, forming the deep musculoaponeurotic system. The occipital muscle attachment gives this layer the capacity to pull the scalp, including the superficial musculoaponeurotic system, caudad. Clinically, this layering system poses opportunities for nerve entrapment as branches travel between layers. Compression or traction of the cranial and upper cervical spinal nerves that supply the scalp, muscle, fascia, and aponeurotica leads to headache and, potentially, visual disturbances. After giving off branches that supply the upper eyelid and mucosal lining of the frontal sinus, the supraorbital nerve pierces the frontalis muscle at variable levels from the orbital rim to the mid-forehead. It also courses through the galea aponeurotica to supply sensation to the skin, subcutaneous tissue, and periosteum of the scalp as far as the vertex of the skull.[2] The superficial branch of the supraorbital nerve travels along the BL channel and traverses BL 5. Palpate the rostral cranium and forehead to determine the loci of tender sites and trigger points. Deactivate accordingly.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V_1):** Innervates the mucous membrane of the frontal sinus and the palpebral conjunctiva of the upper eyelid. Supplies the skin of the eyelid and forehead to the vertex. A sensory branch of the ophthalmic division of the trigeminal nerve.
- **Temporal branch of the facial nerve, CN VII:** Innervates the superior part of the orbicularis oculi muscle and the frontal belly of the occipitofrontalis muscle.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[3] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger



Third (least) occipital n (C_3)
Greater occipital n (C_2)
Lesser occipital n (C2, C3)
Occiput
GV 18
Lamda
GV 19
BL 8
GB 18
GV 20
BL 7
GB 17
GV 21
BL 6
Parietal bone
GB 16
GB 13
GV 22
BL 5
Bregma
Auriculotemporal n (CN V_3)
Zygomaticotemporal n (CN V_2)
GB 15
GV 23
BL 4
BL 3
GV 24
Frontal bone
Supraorbital n (CN V_1)
- lateral br
- medial br
Supratrochlear n (CN V_1)

Figure 7-12. This view of the vertex, with the nose pointing down, illustrates the neurovascular correspondences to the BL and GB channels. As the fifth point on the BL line, BL 5 becomes the "Fifth Place".

point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of BL 2, BL 5, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Supraorbital artery:** Supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.
- **Deep temporal veins (tributaries of the pterygoid venous plexus):** Drain the deep parts of the scalp.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis structures. Figure 7-12 indicates the trajectory of the superficial temporal artery headed toward the midline. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves. The proximity of BL 5 to nearby deep temporal veins at the 10 o'clock and 11 o'clock positions (between the epicranial aponeurosis and dense connective tissue layers) is evident in Figure 7-13.

Indications and Potential Point Combinations

- **Frontal sinusitis, respiratory allergy symptomatology such as sneezing, rhinitis, and frontal headache:** BL 5 if tender; other tender points on the frontal region, BL 2, BL 10, GV 20, GV 24.5 (Yintang), LU 7, ST 36.

References

1. Kushima H, Matsuo K, Yuzuriha S, et al. The occipitofrontalis muscle is composed of two physiologically and anatomically different muscles separately affecting the positions of the eyebrow and hairline. *British Journal of Plastic Surgery.* 2005;58:681-687.
2. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery.* 1995;96(3):564-569.
3. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575

BL 6

Cheng Guang "Receiving Light"

Located 1.5 cun lateral to the midline, 2.5 cun behind the anterior hairline, and 1.5 cun posterior to BL 5.

Connective Tissues

- **Galea aponeuotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 7-13, labeled at the bottom right area of the image.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipialis (e.g., BL 9) muscles. Figure 7-14 depicts the relationship of BL 9 to the occipitalis muscle. Lateral pulls from the temporalis fascia accentuate tension in the epicranial aponeurosis and predisposes patients to headache syndromes.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V$_1$):** Innervates the mucous membrane of the frontal sinus and the palpebral conjunctiva of the upper eyelid. Supplies the skin of the forehead to the vertex.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[1] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of BL 2, BL 6, and other points along the course of the supraorbital nerve alleviate neuropathic

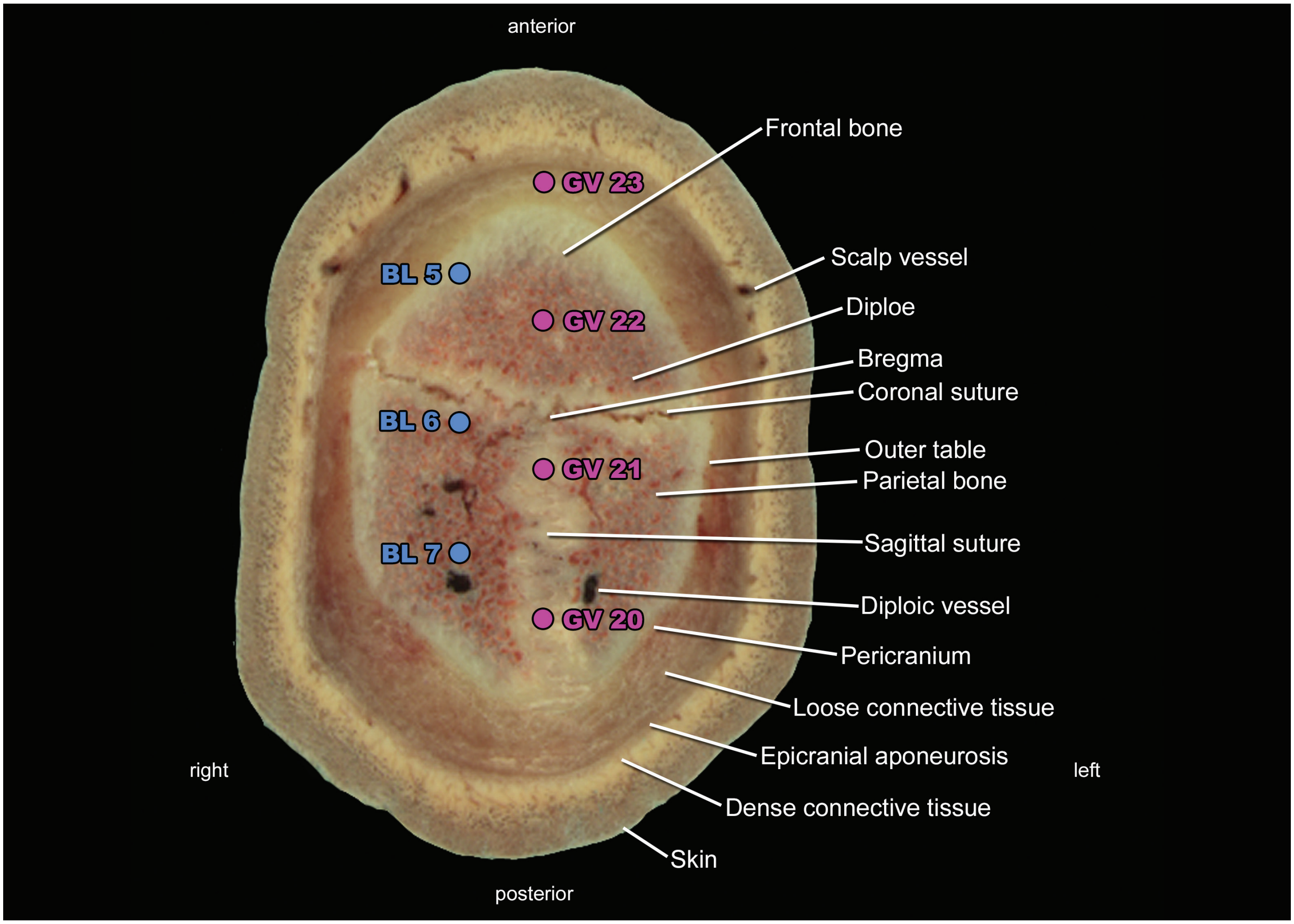


Figure 7-13. Light from the sun shines on BL 6, where "Receiving Light" exists (see also Figure 7-12 which highlights BL 6). Tenderness to palpation at BL 6 may arise from supraorbital neuropathy and/or restrictions in the coronal suture.

pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Supraorbital artery:** Supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.
- **Superficial temporal artery (terminal branch of external carotid artery):** Supplies the skin and facial muscles of the frontal and temporal regions.
- **Superficial temporal vein (part of a widespread plexus of veins on the side of the scalp):** Drains the scalp, the superficial aspect of the temporal muscle, and the external ear.
- **Deep temporal veins (tributaries of the pterygoid venous plexus):** Drain deep parts of the scalp.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis vasculatre. Figure 7-12 indicates the trajectory of the superficial temporal artery headed toward the midline. Figure 7-14 echoes this phenomenon and reveals branches traveling to BL 7, BL 6, BL 5, and BL 4. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves. Figure 7-13 exposes the layout of deep vessels (“scalp vessel”) around the rostral cranium, between the epicranial aponeurosis and dense connective tissue.

Indications and Potential Point Combinations

- **Headache:** BL 6, other local points, GV 20, BL 10, LI 4.
- **Rhinitis:** BL 6, LI 4, LI 20, GV 24.5 (Yintang)

References

1. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575

BL 7

Tong Tian "Celestial Connection"

Located 4 cun behind the anterior hairline, 1.5 cun lateral to the midline, 1.5 caudal to BL 6, and 1 cun anterior to the level of GV 20. Because the distance between the glabella (and GV 24.5 or Yintang) and the lower border of the occipital protuberance (GV 16) equals 14 cun, BL 7 can be found at the midpoint of this line, 1.5 from the midline.

Connective Tissues

- **Galea aponeuotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 7-13, labeled at the bottom right area of the image.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipialis (e.g., BL 9) muscles. Figure 7-14 depicts the relationship of BL 9 to the occipitalis muscle. Lateral pulls from the temporalis fascia accentuate tension in the epicranial aponeurosis and predisposes patients to headache syndromes.

Nerves

- **Supraorbital nerve (from frontal nerve, CN V$_1$):** Innervates the mucous membrane of the frontal sinus and upper eyelid (i.e., the palpebral conjunctiva). Supplies the skin of the forehead to the vertex.
- **Spinal nerves C2 and C3:** Innervate the scalp caudal to the auricles; the dorsal roots of C2 and C3 innervate the caudal cranial fossa.
- **Greater occipital nerve (C2):** Supplies cutaneous sensation to the caudal scalp. Stimulation of the greater occipital nerve (GON) can reduce pain from headaches that arise in trigeminal nerve territory, possibly through mechanisms involving trigeminocervical convergence.[1]

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[2] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of BL 2, BL 7, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

BL 7 may receive innervation from rostral filaments of the greater occipital nerve (as illustrated in Figure 7-12). As such, a compressed or otherwise irritated greater occipital nerve secondary to cervical spinal arthritis or head trauma could derive benefit from neuromodulation through acupuncture and related techniques at this site.

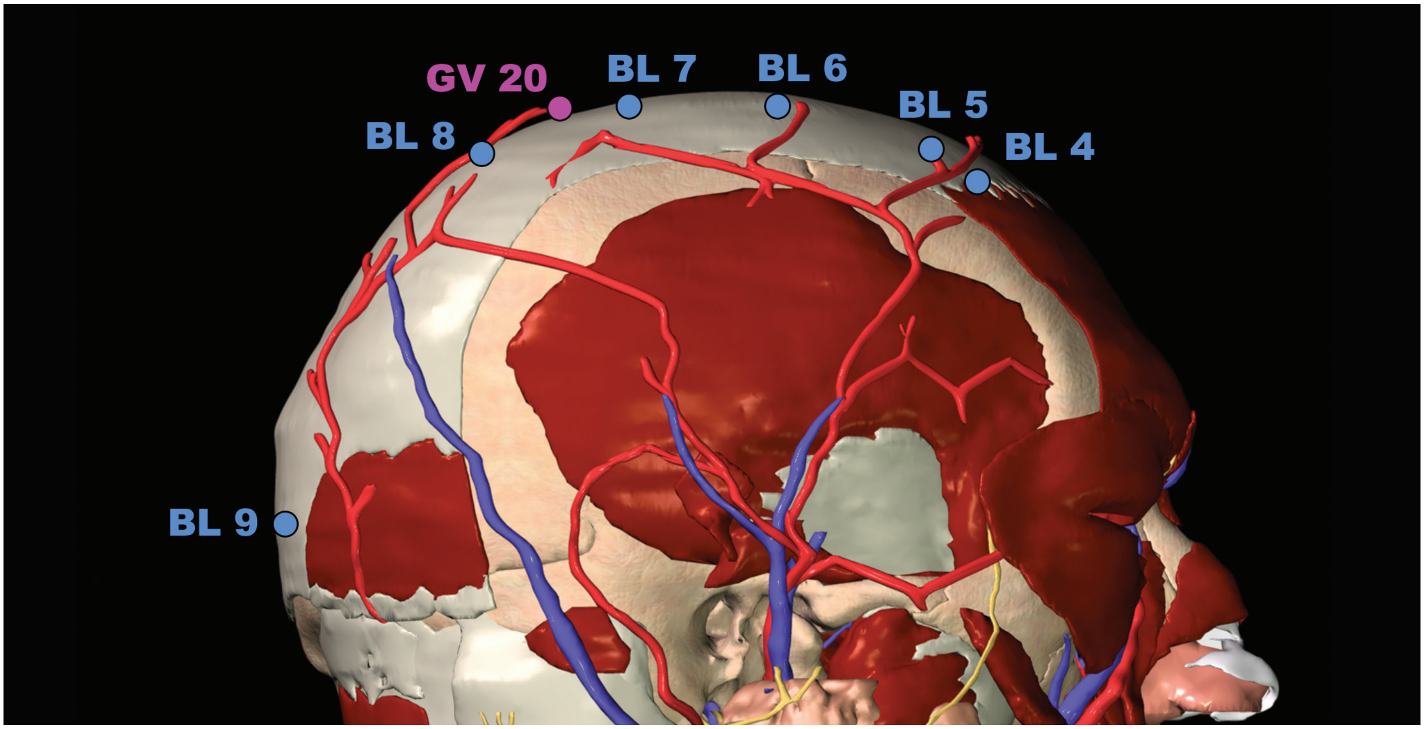


Figure 7-14. BL 7, the "Celestial Connection", is so named because of its relative proximity to the sky compared to other BL line points.

Functional connectivity between trigeminal and cervical afferents exists in the brain stem where afferent fibers from the three most cranial cervical spinal nerve roots converge onto neurons in the spinal nucleus of the trigeminal nerve.[3] This explains the widespread sensory, motor, and autonomic phenomena that arise in various headache states, including migraine and occipital neuralgia.

From a trigger point perspective, although muscles are largely absent from the vertex, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head, from BL 6 to BL 8. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature.

Vessels

- **Supraorbital artery:** Supplies the muscles and skin of forehead and scalp.
- **Supraorbital vein:** Drains the anterior part of the scalp and forehead.
- **Superficial temporal artery (terminal branch of external carotid artery):** Supplies the skin and facial muscles of the frontal and temporal regions.
- **Superficial temporal vein (part of a widespread plexus of veins on the side of the scalp):** Drains the scalp, the superficial aspect of the temporal muscle, and the external ear.
- **Deep temporal veins (tributaries of the pterygoid venous plexus):** Drain deep parts of the scalp.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis vasculature. Figure 7-14 shows branches of the superficial temporal artery headed toward BL 7, BL 6, BL 5, and BL 4. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

Indications and Potential Point Combinations

- **Nasal congestion:** BL 7, BL 6, GV 20, GV 24.5 (Yintang), LI 4, LI 20.
- **Headache:** BL 7 if tender, GV 20, BL 10, add BL 2 if frontal sinusitis, LI 4, LR 3.
- **Psychological disturbance:** agitation, attention deficit, insomnia, depression: BL 7, BL 8, GV 20. Alternate: Sishencong.
- **Vertigo:** BL 7 and/or BL 8, GV 20, BL 10, GB 20.
- **Seizures:** BL 7, BL 8, GV 20, ST 36.
- **Post-stroke hemiplegia:** BL 7, BL 6, GV 20, LI 4, ST 36, LR 3, Baxie (points located at the web spaces between the fingers), Bafeng (points in the web spaces between the toes).
- **Neck stiffness:** BL 7, BL 10, GB 21, GV 14.

References

1. Piovesan EJ, Di Stani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attacks: evidence for inhibitory trigemino-cervical convergence mechanisms. *Arq Neuropsiquiatr* 2007;65(3-A):599-604.
2. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
3. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1): S179-S180.

BL 8

Luo Que "Declining Connection"

On the parietal region, 5.5 cun within the anterior hairline, 1.5 cun posterior to BL 7, and 1.5 cun lateral to the midline. Falls 1/2 cun posterior to the level of GV 20. Note that the distance between the midpoint of the anterior hairline and GV 20 equals 5 cun.

Connective Tissues

- **Galea aponeuotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 7-13, labeled at the bottom right area of the image.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipialis (e.g., BL 9) muscles. Figure 7-16 depicts the relationship of BL 8 to the galea aponeurotica. Lateral pulls from the temporalis fascia accentuate tension in the epicranial aponeurosis and predisposes patients to headache syndromes.

Nerves

- **Spinal nerves C2 and C3:** Innervate the scalp caudal to the auricles; the dorsal roots of C2 and C3 innervate the caudal cranial fossa.
- **Greater occipital nerve (C2):** Supplies cutaneous sensation to the caudal scalp. Stimulation of the greater occipital nerve (GON) can reduce pain from headaches that arise in trigeminal nerve territory, possibly through mechanisms involving trigeminocervical convergence.[1]

Clinical Relevance: The greater occipital nerve has been identified as a contributor to several types of headaches, including cluster, cervicogenic, migraine, medication-overuse, tension, and hemicrania continua.[2]

Functional connectivity between trigeminal and cervical afferents exists in the brain stem where afferent fibers from the three most cranial cervical spinal nerve roots converge onto neurons in the spinal nucleus of the trigeminal nerve.[3] This explains the widespread sensory, motor, and autonomic phenomena that arise in various headache states, including migraine and occipital neuralgia.

BL 8 receives innervation from the greater occipital nerve, as shown in Figure 7-15. As such, a compressed or otherwise irritated greater occipital nerve secondary to cervical spinal arthritis or head trauma could derive benefit from neuromodulation through acupuncture and related techniques at this site.

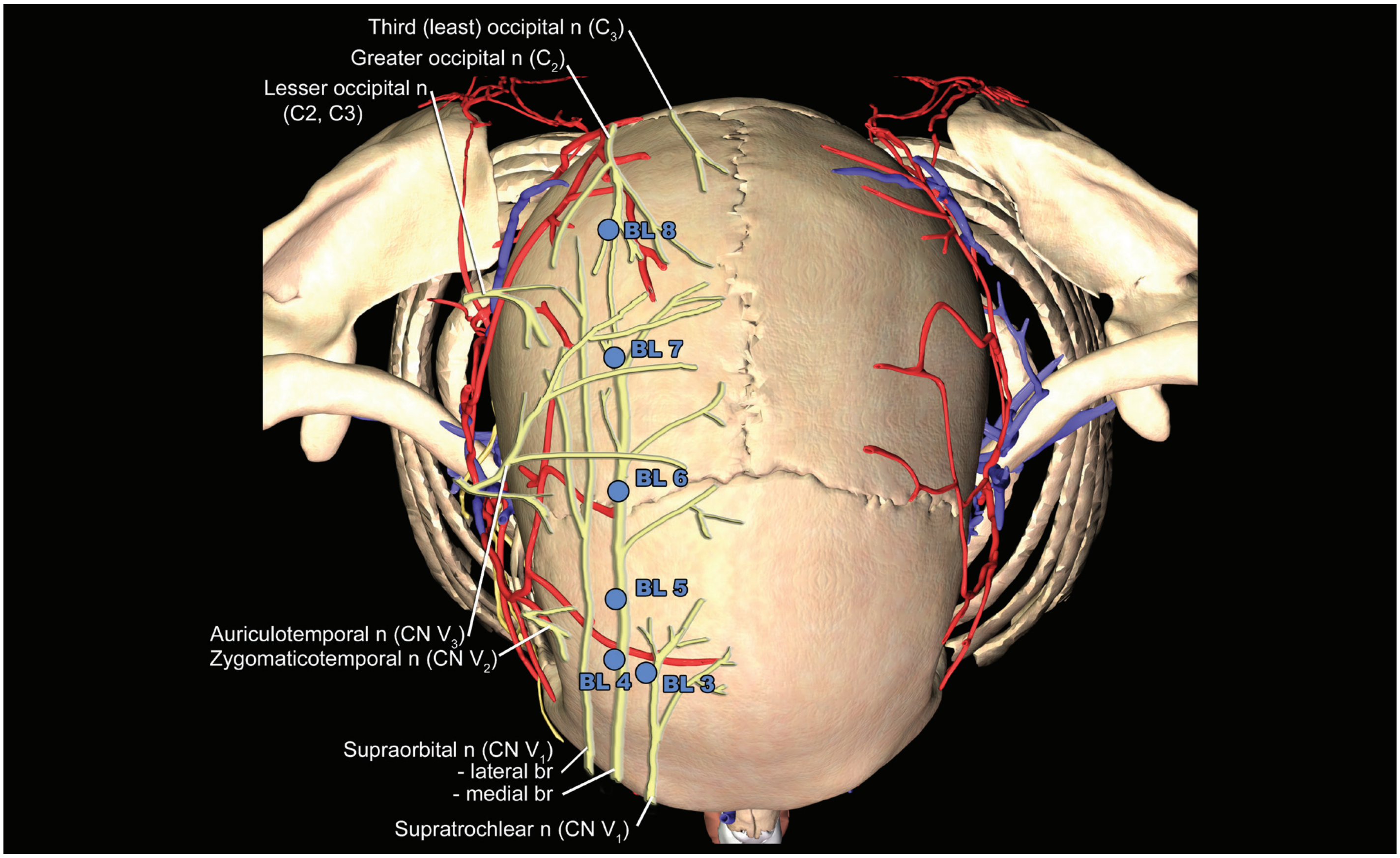

Third (least) occipital n (C_3)
Greater occipital n (C_2)
Lesser occipital n (C2, C3)
BL 8
BL 7
BL 6
BL 5
BL 4
BL 3
Auriculotemporal n (CN V_3)
Zygomaticotemporal n (CN V_2)
Supraorbital n (CN V_1)
- lateral br
- medial br
Supratrochlear n (CN V_1)

Figure 7-15. The innervation of the BL line shifts from predominantly trigeminal nerve-based (BL 1- BL 7) to the greater occipital nerve (BL 8 – BL 10), better addressing cervicogenic headaches than trigeminal-sourced discomfort. However, considering the convergence of upper cervical spinal nerve afferents onto the spinal nucleus of the trigeminal nerve, an anatomical basis exists for crosstalk occurring between nerves supplying both the rostral and caudal cranium. Furthermore, tension in the occipitofrontalis muscle worsens nerve irritation; relaxing both the occipitalis and frontalis with dry needling suggests treatment of rostral and caudal BL points.

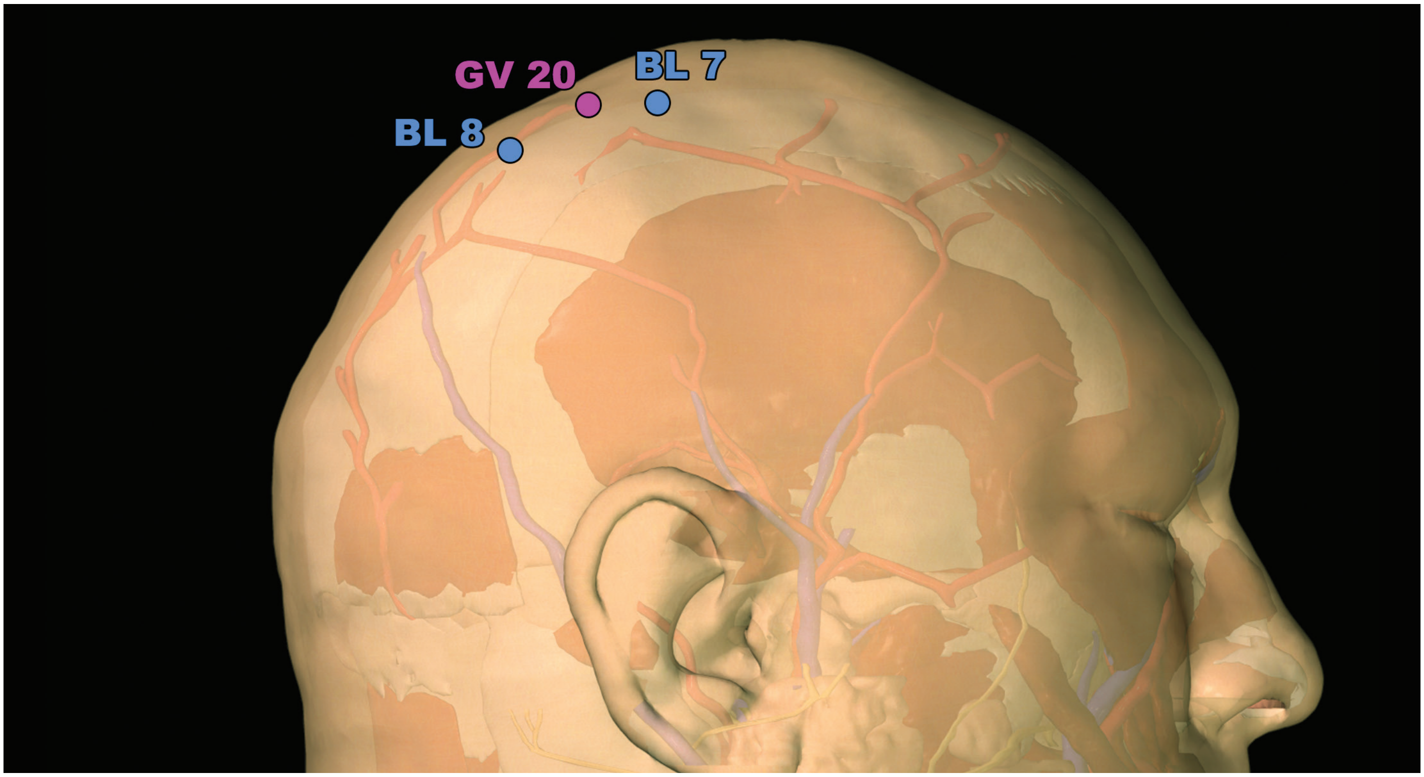


Figure 7-16. The descriptive name for BL 8, "Declining Connection" indicates its position below, BL 7, "Celestial Connection".

From a trigger point perspective, although muscles are largely absent from the vertex, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head, from BL 6 to BL 8. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature.

Vessels

- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Drains the occipital portion of the scalp, and usually drains into the suboccipital venous plexus or the internal jugular vein.
- **Superficial temporal artery (terminal branch of external carotid artery):** Supplies the skin and facial muscles of the frontal and temporal regions. The arteries of the scalp, from both the external and internal carotid arteries, anastomose freely with one another in the dense, subcutaneous connective tissue layer of the scalp. This layer contains a rich innervation from the overlying cutaneous nerves. To review, branches of the external carotid artery that supply the scalp include the superficial temporal artery, the occipital artery, and the posterior auricular artery. Scalp arteries arising from the internal carotid artery include the supratrochlear and supraorbital arteries.
- **Superficial temporal vein (part of a widespread plexus of veins on the side of the scalp):** Drains the scalp, superficial aspect of the temporal muscle, and the external ear.
- **Deep temporal veins (tributaries of the pterygoid venous plexus):** Drain deep parts of the scalp.

Clinical Relevance: In addition to supplying the occipital scalp, the occipital arteries also contribute to the vascularization of the cervical paraspinal muscles.[4] Reduced blood supply due to myofascial restriction compressing vasculature predisposes the muscles served by those vessels to further pain and dysfunction.

Indications and Potential Point Combinations

- **Seizures**
- **Vertigo, dizziness**
- **Nasal congestion**
- **Migraine**
- **Vomiting**

References

1. Piovesan EJ, Di Stani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attacks: evidence for inhibitory trigeminocervical convergence mechanisms. *Arq Neuropsiquiatr* 2007;65(3-A):599-604.
2. Guerrero AL, Herrero-Velazquez S, Penas ML, et al. Peripheral nerve blocks: a therapeutic alternative for hemicrania continua. *Cephalalgia.* 2012;32(6):505-508.
3. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1): S179-S180.
4. Yue BYT, Le Roux CM, Corlett R, et al. The arterial supply of the cervical and thoracic spinal muscles and overlying skin: anatomical study with implications for surgical wound complications. *Clinical Anatomy.* 2012; doi: 10.1002/ca.22139.

BL 9

Yu Zhen "Jade Pillow"

On the occiput, in a depression approximately 1.5 cun lateral to the superior border of the external occipital protuberance. Located 1.3 cun lateral to GV 17, which lies in the depression superior to the external occipital protuberance, and 1.5 cun superior to GV 16. See Figure 7-17 to examine the relationship between BL 9, GV 17, and GV 16.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipitalis (e.g., BL 9) muscles. Figure 7-16 depicts the relationship of BL 8 to the galea aponeurotica. Lateral pulls from the temporalis fascia accentuate tension in the epicranial aponeurosis and predisposes patients to headache syndromes.

Clinical Relevance: BL 9 can become tender to palpation with occipitofrontalis tension (e.g., in cases of tension headache) that results in traction on the epicranial aponeurosis. BL 9 also becomes tender in some patients suffering from migraine and chronic neck pain. In addition, many muscles refer pain to the occipital region when they harbor trigger points. These muscles include the trapezius, sternocleidomastoid, semispinalis, splenius, suboccipital group, occipitalis, digastric and temporalis, according to Travell and Simon's *Myofascial Pain and Dysfunction – The Trigger Point Manual,* 2nd edition, p. 238.

Nerves

- **Spinal nerves C2 and C3:** Innervate the scalp posterior to the auricles; the dorsal roots of C2 and C3 innervate the posterior cranial fossa.
- **Greater occipital nerve (C2):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[4] (The occipital artery appears in Figure 7-17 lateral to BL 9.) As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

Clinical Relevance: This region receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of BL 9 in point protocols addressing intracranial and extracranial sources of discomfort.

Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigeminocervical convergence at the level of the trigeminal nucleus caudalis.[1,5]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[6] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[7] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[8,9]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[10] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts

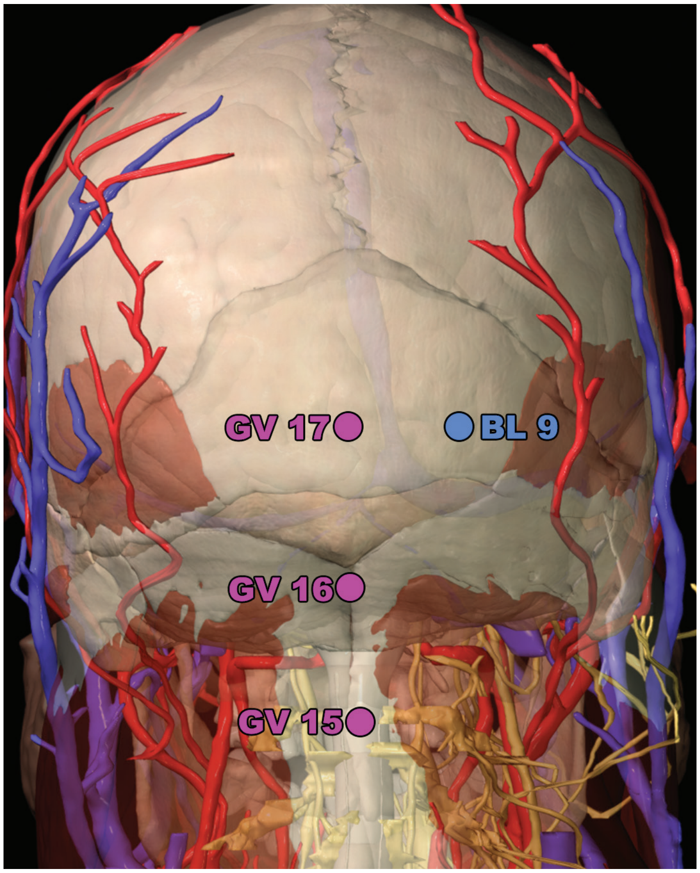


Figure 7-17. The Chinese word for the occipital bone, *zhen gu*, translates as "pillow bone",[2] referring to where the head contacts a pillow when lying recumbent, also thought of as "precious jade lying on a pillow".[3] This explains the name "Jade Pillow" for BL 9. It resides adjacent to GV 17 ("Brain's Door"), shown on the midline, level with BL 9. The semi-transparent skull affords the opportunity to visualize the sagittal sinus veering toward the right, away from midline. BL 9 relates closely to the greater occipital nerve (GON), not shown in this image but which courses medial to the greater occipital artery which is visible lateral to "Jade Pillow".

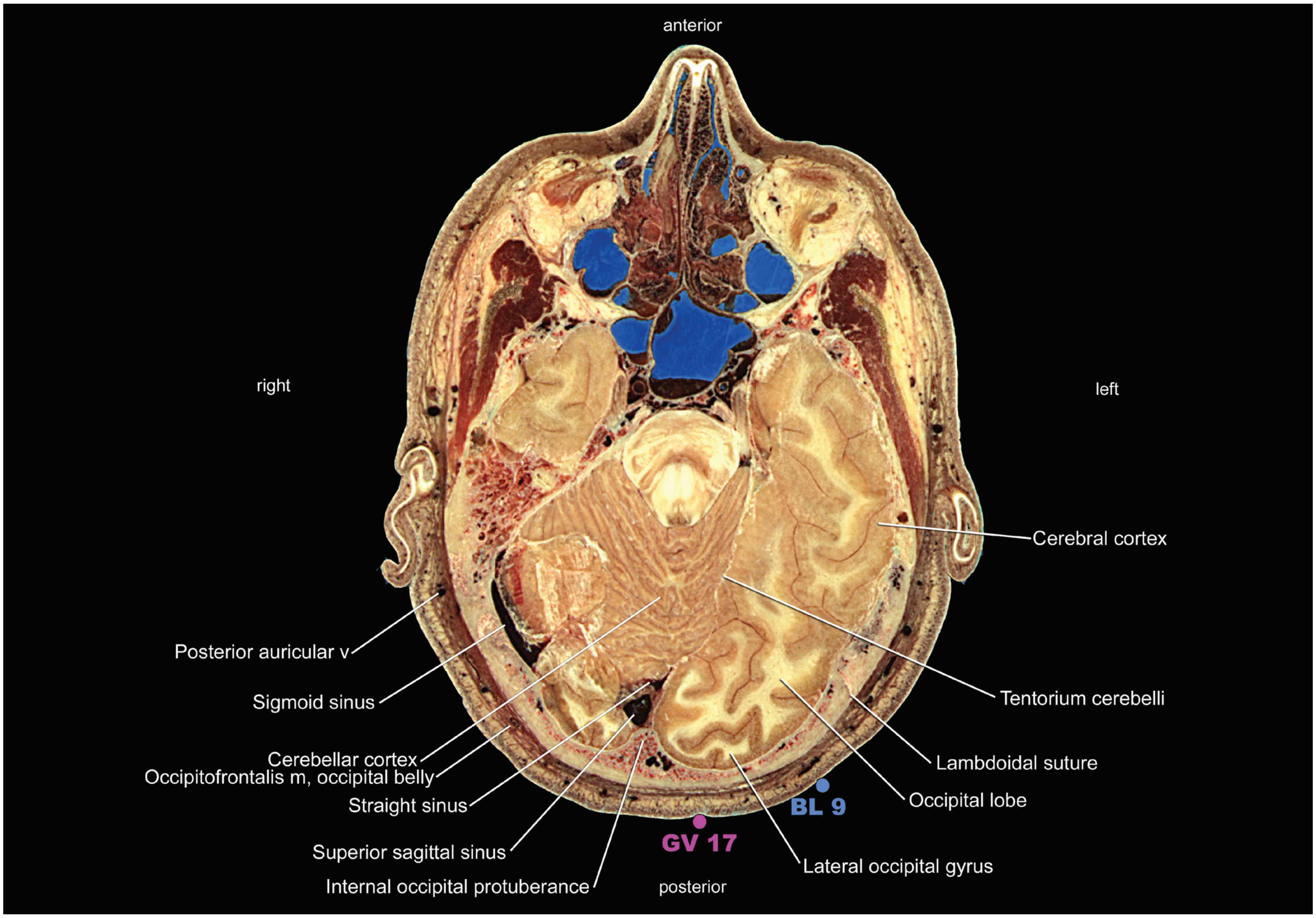

anterior
right
left
Cerebral cortex
Posterior auricular v
Sigmoid sinus
Tentorium cerebelli
Cerebellar cortex
Occipitofrontalis m, occipital belly
Lambdoidal suture
Straight sinus
BL 9
Occipital lobe
GV 17
Superior sagittal sinus
Lateral occipital gyrus
Internal occipital protuberance
posterior

Figure 7-18. The occipital lobe of the brain lies deep to "Jade Pillow", serving as the main visual processing center of the cerebrum. Note, as well, the subcutaneous vessel deep to BL 9, not represented in Figure 7-18, as not all structures in the human specimen were transferred to the computer-regenerated image.

the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[11] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[12]

Vessels

- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Usually drains into the suboccipital venous plexus or the internal jugular vein.

Clinical Relevance: The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[13] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[14] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Tension headache, neck pain and myofascial restriction:** BL 9, BL 10, GV 20, GV 24.5, GB 21.
- **Migraine:** BL 9, BL 10, GV 20, GB 21, LI 4, ST 36, LR 3, appropriate trigger points.
- **Occipital neuralgia:** BL 9, BL 10, GB 14, GV 20. Myofascial release to the neck. Deactivation of relevant trigger points, especially in the cervical paraspinal and upper back region, including the trapezius.[15]
- **Vertigo, dizziness due to cervicogenic causes:** BL 9, BL 10, GB 20, LI 4, cervical and upper back trigger points.
- **Vertigo due to vertebrobasilar artery insufficiency:** BL 9, GV 20 directed toward GV 21, GB 8, and GB 7.[16]
- **Visual problems:** BL 9, BL 10, BL 2, GB 1.
- **Nasal congestion:** BL 9, BL 10, GV 20, LI 20.

Evidence-Based Applications

- A Chinese study reports benefit for the treatment of spasticity in infants with **cerebral palsy** by needling BL 9 and BL 10, designed to influence the “superficial projection region of the pyramidal decussation”.[17]

References

1. Piovesan EJ, Di Stani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attacks: evidence for inhibitory trigemino-cervical convergence mechanisms. *Arq Neuropsiquiatr* 2007;65(3-A):599-604.
2. Ellis A, Wiseman N, and Boss K. *Grasping the Wind.* Brookline, MA: Paradigm Publications, 1989, p. 150.
3. Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications.* Stuttgart: Thieme, 2008, p. 74.
4. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
5. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
6. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.
7. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.
8. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.
9. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.
10. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
11. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
12. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.
13. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.
14. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.
15. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
16. Qi XJ and Wang S. Penetrating needling on head points for vertigo caused by vertebral-basilar arterial blood-supply insufficiency. *Zhongguo Zhen Jiu.* 2011;31(6):503-507.
17. Wang SQ, Liang WX, Huang GH, et al. Randomized controlled clinical trials for acupuncture treatment of spastic cerebral palsy children by bilateral horizontal puncturing from Yuzhen (BL 9) to Tianzhu (BL 10). *Zhen Ci Yan Jiu.* 2011; 36(3):215-219.

BL 10

Tian Zhu "Celestial Pillar"

In a depression on the lateral border of the trapezius muscle, level with the caudal border of the spinous process of C2. Figure 7-19 illustrates how BL 10 falls along the border of the trapezius while Figure 7-20 presents its proximity to C2. While some authors place BL 10 more cranial (superior), the risk of damage to the vertebral artery increases in a suboccipital location.

Muscles

- **Trapezius muscle:** Fibers of the cranial, or superior, part of the trapezius elevate the scapula (i.e., when shrugging the shoulders).
- **Splenius capitis muscle:** Acting unilaterally, this muscle rotates the head at the atlantoaxial joint; it laterally flexes the head and neck to the same side. Acting bilaterally, these muscles extend the head and neck. Myofascial
- **Semispinalis capitis muscle (a transversospinal muscle):** Extends the head.
- **Longissimus capitis muscle:** Medial to the longissimus cervicis and lateral to the semispinalis capitis muscle, the longissimus capitis arises from tendons attached to the transverse processes of the 4-5 most cranial thoracic vertebrae and articular processes of the 3-4 most caudal cervical vertebrae. It inserts onto the caudal margin of the mastoid process of the temporal bone, caudal to the splenius capitis and sternocleidomastoid insertion. Extends the neck and head when active bilaterally; rotates and laterally flexes the head and neck when contracted unilaterally.

Clinical Relevance: Myofascial trigger points in any of these muscles can produce head and neck pain. In addition, pain at the back of the head can arise from trigger points in the multifidi, levator scapulae, splenius cervicis, and infraspinatus muscles. Restriction in the soft tissues in the neck elevates pressure on large, vital neural, vascular, and glandular components, raising the potential for pain and suboptimal endocrine regulation.

Nerves

- **Third ("Least") occipital nerve (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[11]

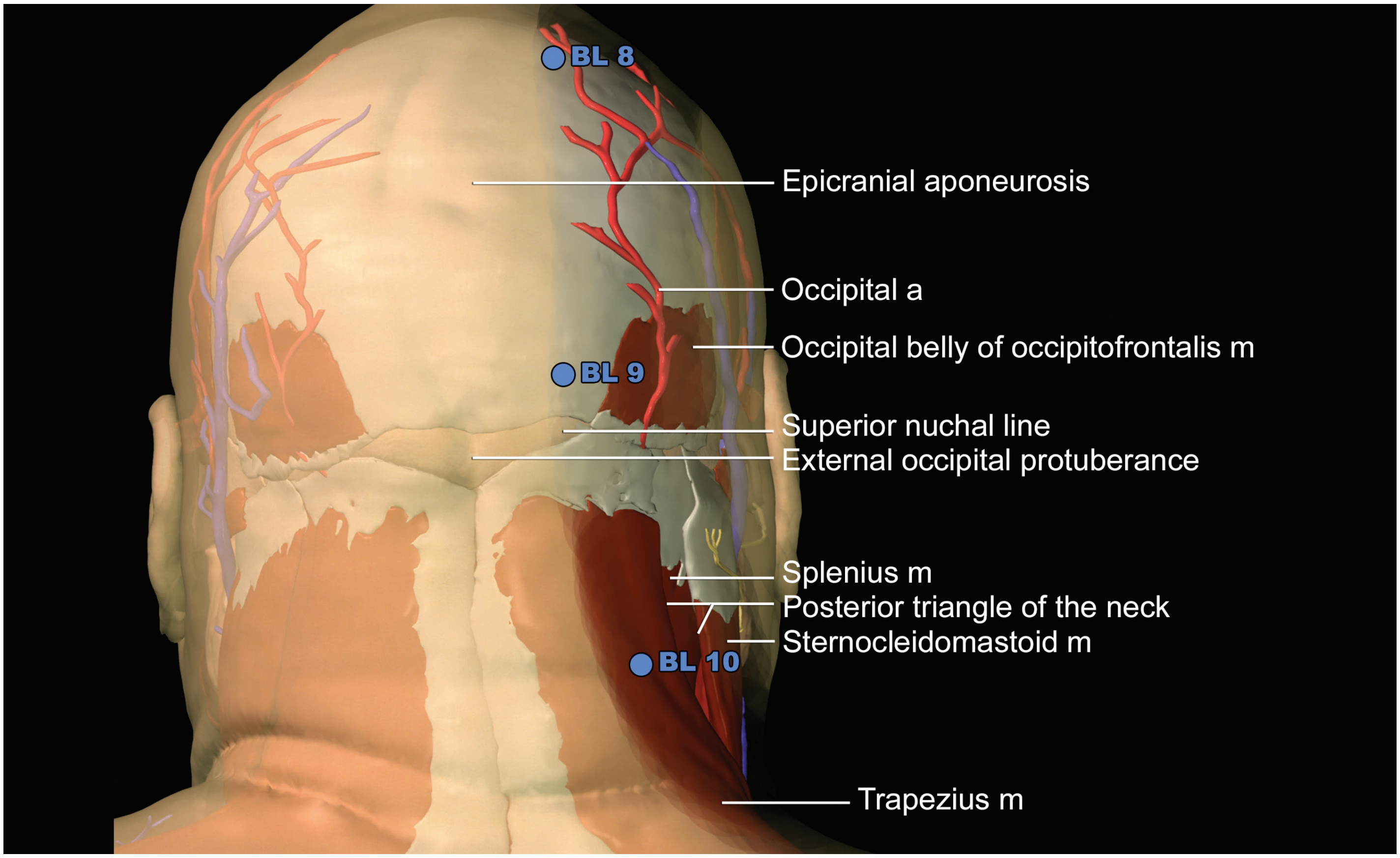


Figure 7-19. As the BL channel descends the neck and back, it begins to interface more closely with spinal nerves influence or initiate neck and back pain when neuromodulated or irritated, respectively. BL 10, "Celestial Pillar" sits at a fulcrum between the head and back and as such addresses all three: head, neck, and back pain. It does so by impacting cervical spinal nerves that form the GON, leading to headache and by myofascial components that produce both neck and head pain, such as the trapezius muscle. The cranial extent of the erector spinae, or epaxial, muscles, inserts onto the occiput. When tense, this column of myofascial bands connecting the occiput to sacrum entraps a host of spinal nerve branches, leading not only to pain but to restricted motion and altered supporting function. This image takes away the skin layer to expose the structures beneath the BL pathway from BL 8 to BL 10.

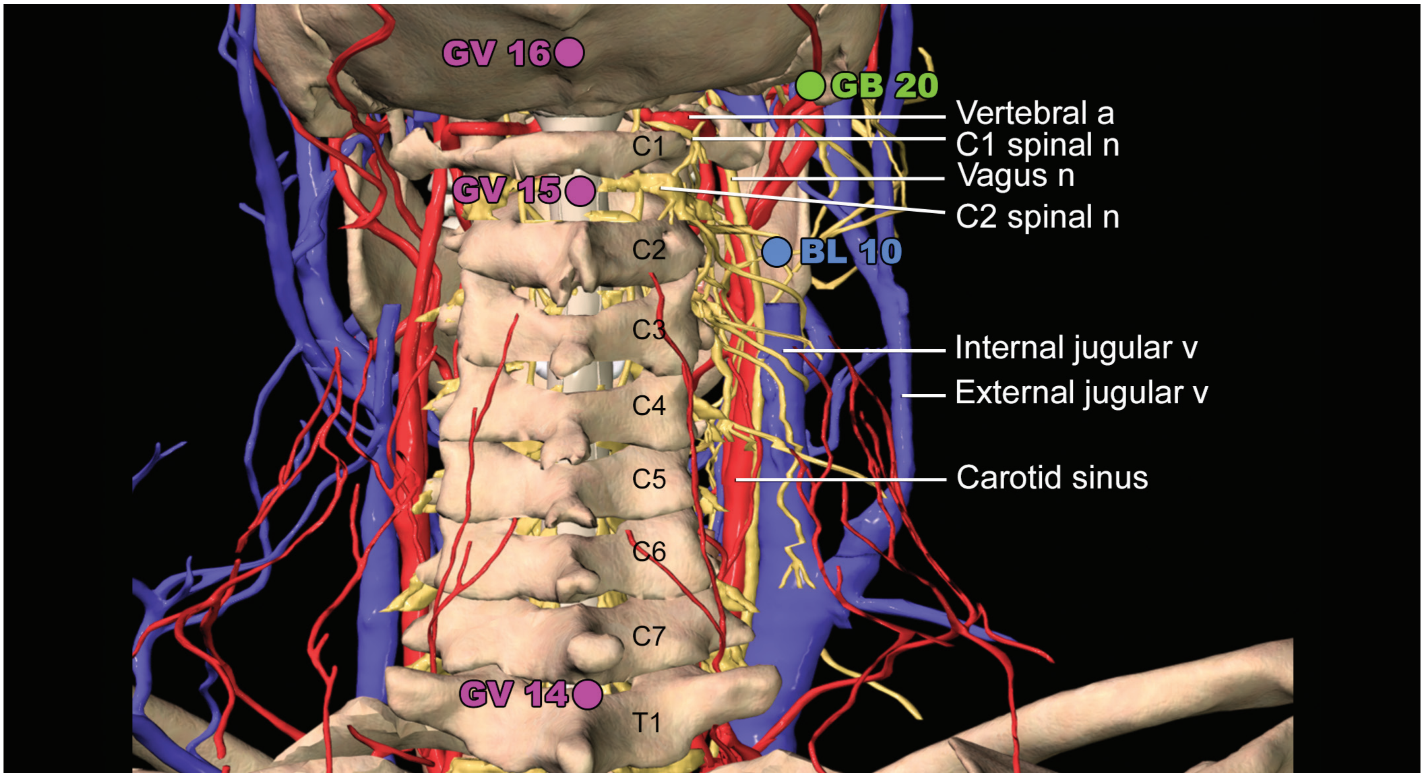


Figure 7-20A. BL 10, "Celestial Pillar", stands at the top of the pillar (neck) that supports the heavens (head).

- **Greater occipital nerve, or GON (C2, C3):** Innervates skin of the upper neck and occipital regions, lateral to the 3rd (least) occipital nerve.
- **Spinal nerve C2-C3, dorsal rami:** Innervate the posterior cranial fossa.
- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **Spinal nerves C2 – C5, dorsal rami:** Innervate splenius capitis muscle.
- **Spinal nerves C2 – C4, dorsal rami:** Innervate semispinalis capitis muscle.
- **Spinal nerves C4 – C7, dorsal rami:** Innervate longissimus capitis muscle.

Clinical Relevance: Any of the nerves supplying structures within reach of a needle entering BL 10 may become entrapped in the series of layers involved in cervical anatomy, apparent in Figure 7-22. Nerve entrapment leads to pain and myofascial dysfunction. The GON headed from BL 10 toward GV 20, has received the most intensive attention based on its contribution to headaches of all sorts, including migraine (see below).

GON: Convergence between the cervical nerves and trigeminal inputs provides a strong neuroanatomic context supporting the inclusion of points within the upper cervical and trigeminal nerve distribution for head and face pain.[1] This trigemino-cervical convergence can work in a nociceptive excitatory or inhibitory manner, depending on the nature of the stimulation entering the central nervous system. The trigemino-cervical complex forms the anatomic and physiologic basis for this convergence.[2] The complex spans from the trigeminal nucleus caudalis to the C2 and C3 spinal cord segments. The GON provides afferent information from the posterior head to the complex, mainly through the C2 nerve root. Nociceptive input supplied by upper cervical nerves flowing into this neural intersection include afferent stimuli from blood vessels, the dura mater of the posterior cranial fossa, cervical spinal ligaments, joints, and muscles. Furthermore, a direct coupling takes place in the dorsal horn of the spinal cord between cervical afferents and input from the meninges, arguing again for targeting cervical acupuncture points (in addition to points innervated by the trigeminal nerve) in cases of head pain and dural irritation. Chronic pain states that induce neuroplastic changes and central sensitization accentuate the excitability of the synaptic meetings, leading to mutual changes and upregulation in the firing patterns of structures in the trigeminocervical distribution. Neck muscles may tense as a result of the sensorimotor integration facilitated by the

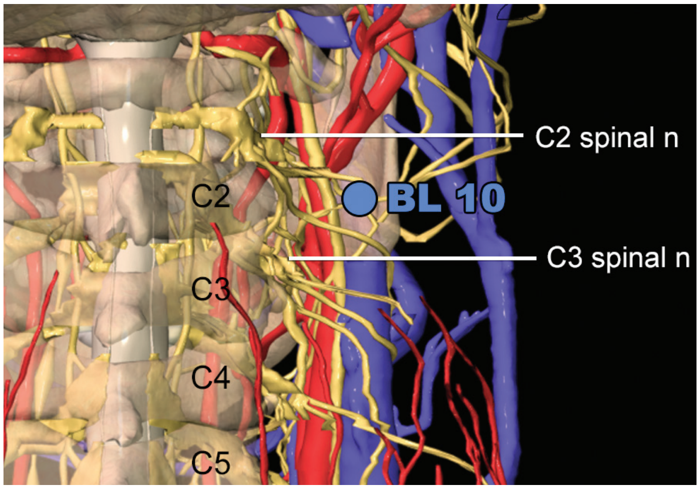


Figure 7-20B. This enlargement of the C2 and C3 spinal nerve branches exiting the intervertebral foramina illustrates the complex branching pattern of the C2 and C3 spinal nerves, including fibers supplying the cervical facet joints.

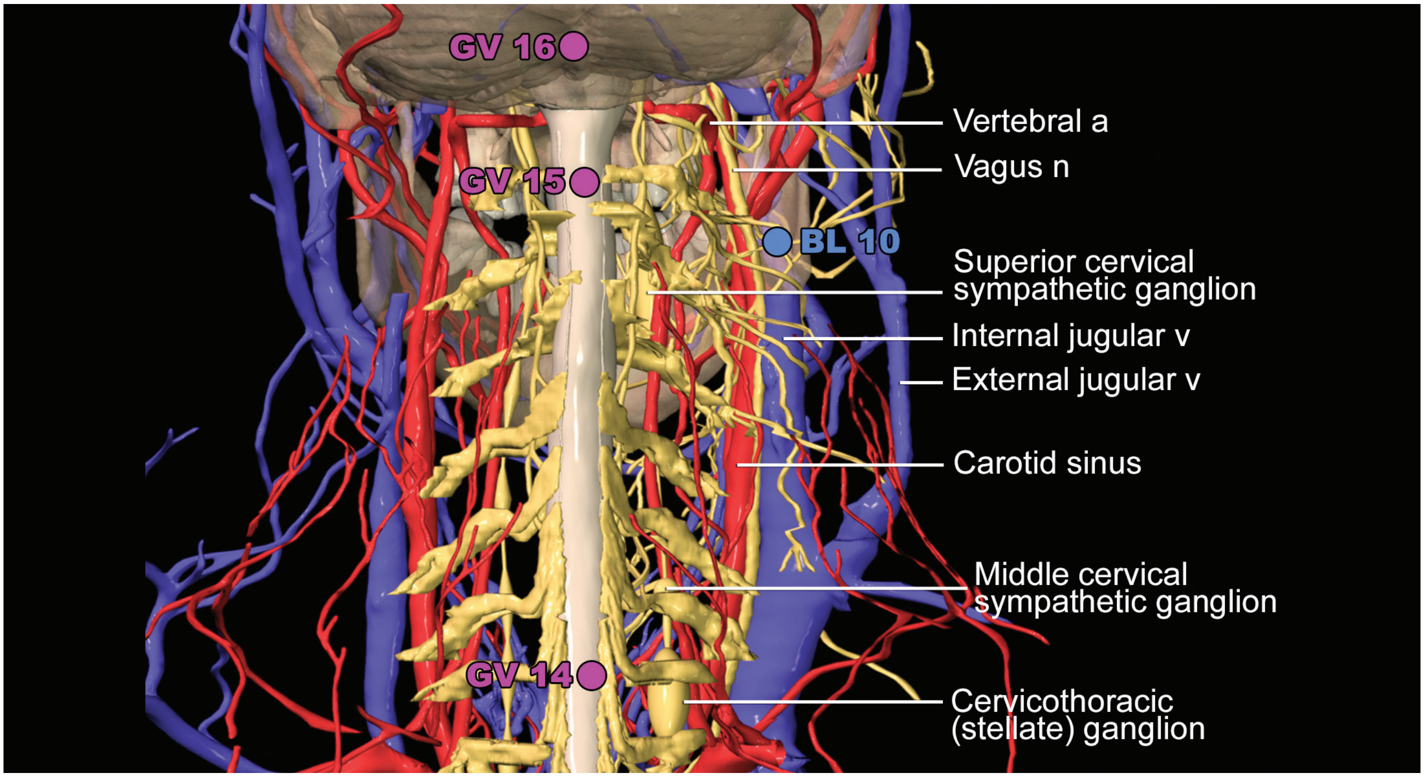

GV 16
Vertebral a
Vagus n
GV 15
BL 10
Superior cervical sympathetic ganglion
Internal jugular v
External jugular v
Carotid sinus
Middle cervical sympathetic ganglion
GV 14
Cervicothoracic (stellate) ganglion

Figure 7-21. The high volume of neural traffic entering and exiting from the upper cervical nerve roots becomes clear in this image focusing on the spinal cord, nerves, and autonomic routes. Note the proximity of BL 10 to the vagus nerve, vertebral artery, and superior cervical sympathetic ganglion.

central sensitization resulting from chronic nociceptive afferent aggravation of pain pathways. Heightened motor output through alpha- and gamma-motoneurons secondarily activates Ia and II muscle spindle afferents, producing even more motor tone through spinal reflex mechanisms. Irritated dural nociceptors further push the motoneurons to fire, contracting the suboccipital paraspinal muscles. Neuromodulation with acupuncture affects local and central pain modulation circuits and interrupts these reflexes. It reduces central sensitization and muscle tension and improves circulation to the local musculature, thereby reducing nociceptive afferent irritability.

Trigeminocervical neural crosstalk can cause patients to feel pain driven by nociceptive information from structures supplied by upper cervical nerve roots and trigeminal territories. This may confuse where the pain originated in cases of posterior fossa tumor, infratentorial dura mater, neuropathic cervical nerve roots, disturbances in the subcutaneous tissue supplied by the GON, and dissection of the vertebral artery.[3]

Cervical spinal nerves: Cervical zygopophysial joints cause chronic neck pain and headache in up to half of patients. Facet joints receive innervation from the medial branches of the spinal nerves C3 to C7; each nerve supplies the joint above and below. BL 10 lives near the location of a third (least) occipital nerve block.[12]

Although percutaneous radiofrequency ablation (RFA) has become an accepted nonsurgical modality for chronic neck pain, serious advents may occur. RFA of the least (3rd) occipital nerve and the C2-C4 facet joints has led to “dropped head syndrome” in which the patient became unable of extending her neck, inducing a debilitating complication.[13] While acupuncture and related techniques may not be able to repair nerves completely destroyed by RFA, the risk of permanent disability emphasizes the need to address pain and functional compromise with safe and effective approaches such as acupuncture and related techniques before pursuing modalities that can cause irreversible damage.

Third occipital nerve (TON): This dorsal branch of the 3rd cervical spinal nerve must make its way through several layers of deep nuchal musculature, raising the potential for nerve entrapment and irritation. Thus, this nerve likely produces occipital neuralgia more than has been previously recognized.[14] Neuralgia originating from TON disorders mimics GON neuralgia. The superficial medial branch of the C3 spinal nerve, also called the 3rd or least occipital nerve, travels around the dorsolateral surface of the C2-3 zygopophysial (facet) joint that it supplies. The site of this nerve branching is at BL 10. While facet joints caudal to C2-3 receive innervation by the dorsal rami above and below the joint, the C2-3 facets only receive TON innervation. After supplying the facet joint, the TON continues on to supply the semispinalis capitis muscle, traveling deeply along this muscle until it sends a communicating branch to the greater occipital nerve. The risk of third occipital neuralgia increases as a result of its vulnerability to entrapment at the level of the intervertebral disk behind the intervertebral joints. Osteophytes in these joints can produce nerve compression and chronic headache that may remain undiagnosed as a result of clinicians’ unfamiliarity with this nerve entrapment syndrome. Review the proximity of BL 10 to the anatomy just discussed in Figure 7-20.

Craniotomies with midline approaches may also damage or irritate the TON and cause occipital neuralgia after suboccipital approaches. Scar tissue envelops the nerve, compressing its branches; pain sometimes worsens with cervical motion and mounting myofascial restriction. Intraoperative traction applied to deeper facet branches of the TON during midline craniotomy

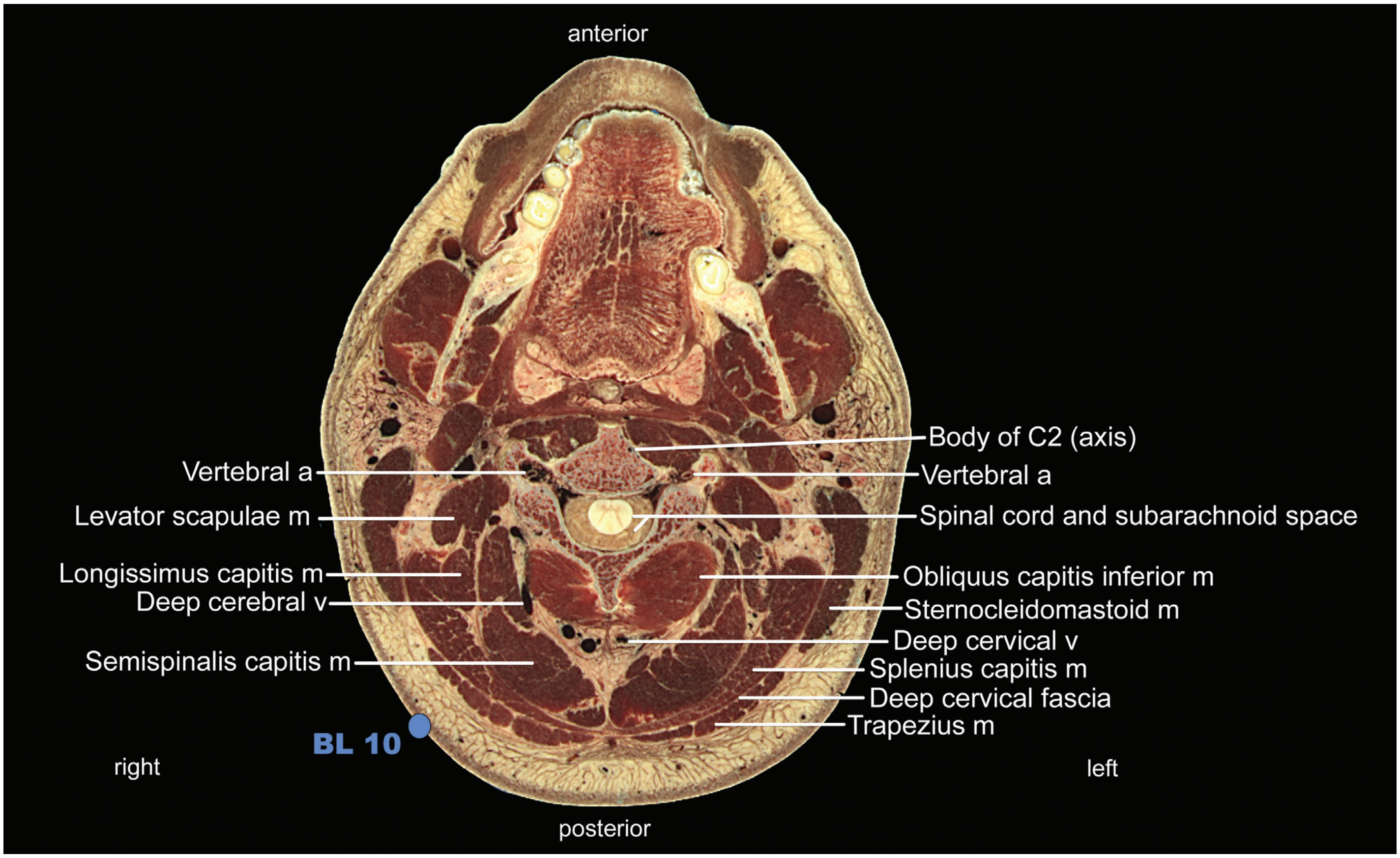


Figure 7-22. This cross section at the level of C2 gives a good perspective of the multilayered musculature where numerous trigger points may entrap nerves and cause local and/or referred neck pain. It also reveals the notable vascular structures which deep needling could damage; i.e., the deep cervical veins and the vertebral artery.

damages its deeper facet branches. Acupuncture and related techniques carefully at BL 10, GV 15, and GV 16 can release tension in this region and neuromodulate the TON.

Vessels

- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Usually drains into the suboccipital venous plexus or the internal jugular vein.
- **Deep cervical artery (from the costocervical trunk, which arises from the subclavian artery):** Supplies the deep cervical muscles.
- **Deep cervical vein:** Receives tributaries from the plexuses around the spinous processes of the cervical vertebrae, and terminates in the lower part of the vertebral vein.

Clinical Relevance: Deep cervical vessels, seen in Figure 7-20 ascending the dorsal surface of the vertebral bodies, are vulnerable to damage with dorsal approaches to cervical spinal surgery.[15] Acupuncture and related techniques such as laser therapy can restore blood supply to the tissues whose perfusion was compromised by invasive procedures to the spine.

Indications and Potential Point Combinations

- **Neck pain, restricted motion, and muscular tension:** BL 10, BL 9, GB 21, other pertinent myofascial trigger points (check on anterior, lateral, and posterior surfaces of the head and neck), GV 20.
- **Occipital headaches:** BL 10, BL 9, GV 14, GV 20.
- **Acute lumbar strain:**[16] BL 10, BL 23, BL 40, BL 60.
- **Post-craniotomy occipital neuralgia:** Laser therapy to BL 10, GV 15, GV 16, GB 20.
- **Shoulder and back pain:** BL 10, GB 20, GB 21, local myofascial trigger points and BL points associated with the vertebral levels of somatic dysfunction, accounting for the divergent input entering the cord a few levels above and below the dysfunction.
- **Vertigo, dizziness, heavy feeling in the head:** BL 10, GB 20, GB 21, check TMJ for myofascial trigger points, LI 4.
- **Memory and concentration problems:** BL 10, BL 7, BL 8, GV 20.
- **Problems with visual acuity:** BL 10, BL 2, BL 9, GV 16, GV 20, GV 24.5 (Yintang). Also check for trigger point in the splenius muscle, because myofascial trigger points here can produce blurry vision, headache, and eye pain that feels "bursting".[4] Eye pain often occurs on the ipsilateral side of the trigger point.[5]
- **Trigeminal neuralgia, post-herpetic neuralgia, and other causes of neurogenic facial pain:**[6] BL 10, points associated with trigeminal nerve branch transmitting pain, myofascial trigger points in the region, GV 14, GV 20.

Evidence-Based Applications

- Prophylactic use of bilateral noninvasive acuplaster on BL 10, BL 11, and GB 34 significantly reduces **vomiting** in children after strabismus correction.[7]

- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders,** prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[8]
- A case series indicated that needling and point injection at BL 10 relieved **acute lumbar sprain.**[9]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[10]
- **Transient cerebral ischemic attack:** A Chinese study reported the success of acupuncture at BL 10, GB 12, and GB 20 to reduce symptoms from TIA and improve blood rheology and coagulation with the help of leech and centipede capsules.[17]
- **"Mind-refreshing acupuncture" to treat facial spasm, trigeminal neuralgia, and facial paralysis:** BL 10, GB 12, and GB 20, along with GB 23 and Yintang to improve blood flow in the vertebrobasilar artery and increase cerebral blood flow by reducing tension in the vascular smooth muscle.[18]
- **Balance disorders after whiplash injury:** Dry needling of BL 10 and GB 20 led to significant improvements in patients experiencing balance disorders following cervical torsion/whiplash injury.[19]

References

1. Piovesan EJ, Di Stani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attackes. *Arq Neuropsiquiatr.* 2007;65(3-A):599-604.
2. Bartsch T. Migraine and the neck: new insights from basic data. *Current Pain and Headache Reports.* 2005;9:191-196.
3. Goadsby PJ and Bartsch T. On the functional neuroanatomy of neck pain. *Cephalalgia.* 2008;28 (Suppl. 1):1-7.
4. Dorsher PT. Myofascial referred-pain data provide physiologic evidence of acupuncture meridians. *The Journal of Pain.* 2009;10(7):723-731.
5. Simons DG, Travell JG, and Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body. 2nd edition.* Baltimore: Williams & Wilkins, 1999. P. 436.
6. Schott GD. Neurogenic facial pain. *Trans Ophthal Soc UK.* 1980;100:253-256.
7. Chu Y-C, Lin S-M, Hsieh Y-C, Peng G-C, Lin Y-H, Tsai S-K, and Lee T-Y. Effect of BL-10 (Tianzhu), BL-11 (Dazhu) and GB-34 (Yanglinquan) acuplaster for prevention of vomiting after strabismus surgery in children. *Acta Anaesthesiol Sin.* 1998;36:11-16.
8. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases.* 2001;7:109-115.
9. Zhou S and Liu M. Thirty cases of acute lumbar sprain treated by acupuncture combined with point-injection at Tianzhu. *Journal of Traditional Chinese Medicine.* 2003;23(3):203-204.
10. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1-6.
11. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.
12. Siegenthaler A, Miekusch S, Trelle S, et al. Accuracy of ultrasound-guided nerve blocks of the cervical zygapophysial joints. *Anesthesiology.* 2012;117:347-352.
13. Stoker GE, Buchowski JM, and Kelly MP. Dropped head syndrome following multilevel cervical radiofrequency ablation: a case report. *J Spinal Disord Tech.* 2013;26(8):444-448.
14. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.
15. Yue BYT, Le Roux CM, Corlett R, et al. The arterial supply of the cervical and thoracic spinal muscles and overlying skin: anatomical study with implications for surgical wound complications. *Clinical Anatomy.* 2013;26(5):584-591.
16. Zhou S and Liu M. Thirty cases of acute lumbar sprain treated by acupuncture combined with point-injection at tianzhu. *J Tradit Chin Med.* 2003;23(3):203-204.
17. Feng L, Zhang J, Wei C, et al. Clinical observation on 30 cases of transient cerebral ischemic attack treated with acupuncture and medication. *J Tradit Chin Med.* 2007;27(2):100-102.
18. Liu Z and Fang G. Mind-refreshing acupuncture therapy for facial spasm, trigeminal neuralgia and stubborn facial paralysis. *J Tradit Chin Med.* 2004;24(3):191-192.
19. Fattori B, Borsari C, Vannucci G, et al. Acupuncture treatment for balance disorders following whiplash injury. *Acupunct Electrother Res.* 1996;21(3-4):207-217.

BL 11

Da Zhu "Great Shuttle"

On the upper thorax, about 1.5 cun lateral to the caudal border of the T1 spinous process.

CAUTION: Needle carefully to avoid pneumothorax. Note the presence of lung tissue near BL 11 in Figure 7-23A. Figure 7-24, in contrast, reveals the thick musculature beneath BL 11 in this individual. Needling BL 11 poses a higher risk of pneumothorax in thin, poorly muscled, and/or geriatric patients, especially when the direction of insertion places the tip between the ribs and away from midline.

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a posterior direction).
- **Rhomboideus major and minor muscles:** Retract and rotate the scapula; assist the serratus anterior muscle in holding the scapula against the thoracic wall; hold the scapula in place the scapula while the thoracic limb is moving.
- **Serratus posterior superior muscle:** Elevates the upper four ribs, thereby raising the sternum and increasing the anteroposterior diameter of the thorax.
- **Erector spinae muscles (transversospinalis, longissimus thoracis, and iliocostalis thoracis muscles):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Trigger points in the vicinity of BL 11 include: splenius cervicis, radiating to the junction between the neck and shoulder; levator scapulae, producing pain locally and radiating to the medial scapula and dorsal shoulder; and rhomboids sending pain along the entire medial border of the scapula. Note the differences in appearance between the axial and appendicular musculature in Figure 7-24, where the musculature attaching to the spine has a much different appearance than those attached to the appendicular skeleton that are less condensed and lighter in color. Figure 7-23B also lends insight into the structural disparity between the broad, more superficial muscular layers (consisting mainly of the trapezius muscle in this presentation) as opposed to the column of erector spinae following and defining the BL channel.

Acupuncture, massage, and laser therapy loosen restrictions that collect here, improving perfusion and reducing peripheral sensitization.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C4, C5, T1 and T2 spinal nerves:** The dorsal rami innervate skin, bones, joints, muscles of the back. The ventral rami form intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **Dorsal s capular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5

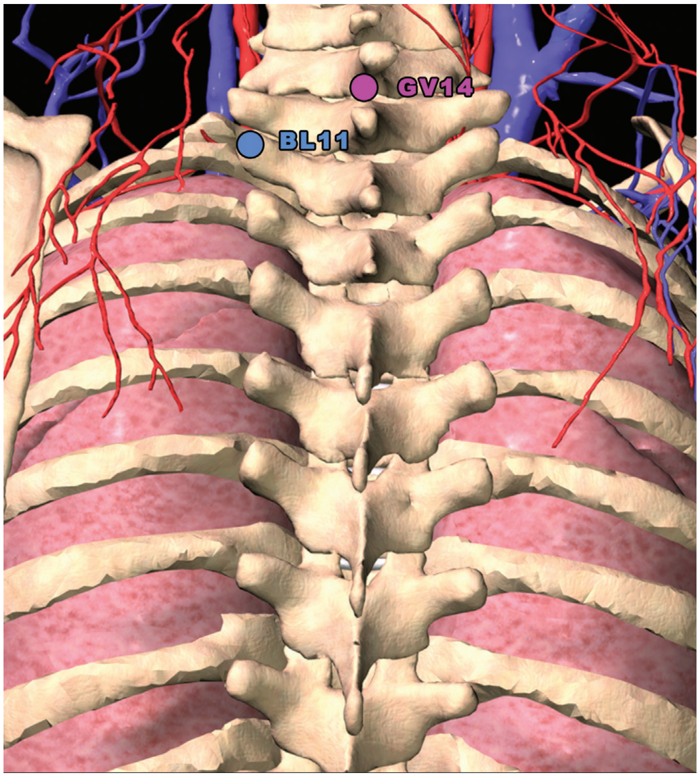


Figure 7-23A. The term "Great Shuttle" applies to the way in which the vertebrae resemble a weaver's shuttle coursing to and fro between the ribs. The spinous process of T1 outsizes that of the other thoracic vertebrae, earning it the "great" shuttle status. Not surprisingly, the nearby point GV 14 goes by the name "Great Hammer" for similar reasons.

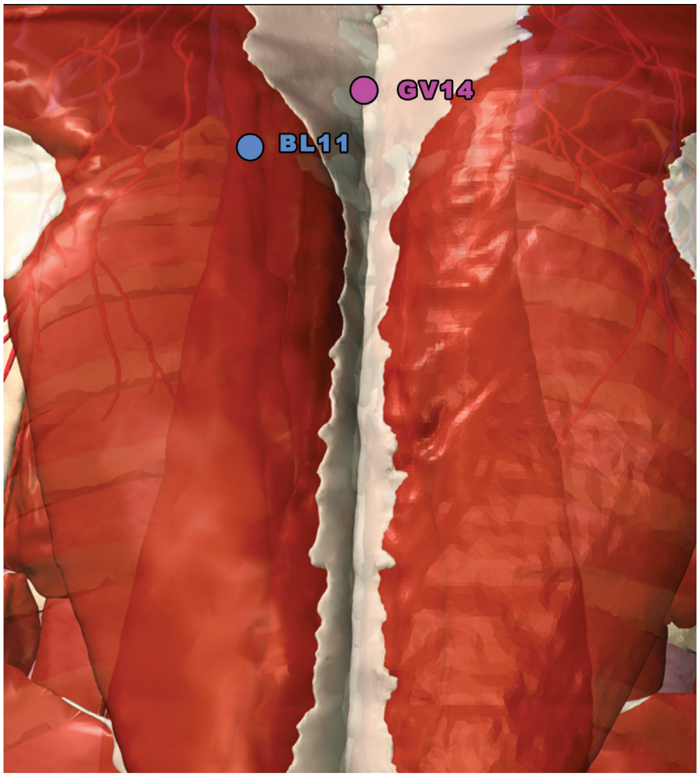


Figure 7-23B. This multilayered image discloses the position of BL 11 atop the paraspinal muscles and well within the "Bermuda Triangle" of trigger points between the medial angle of the scapula and the neck.

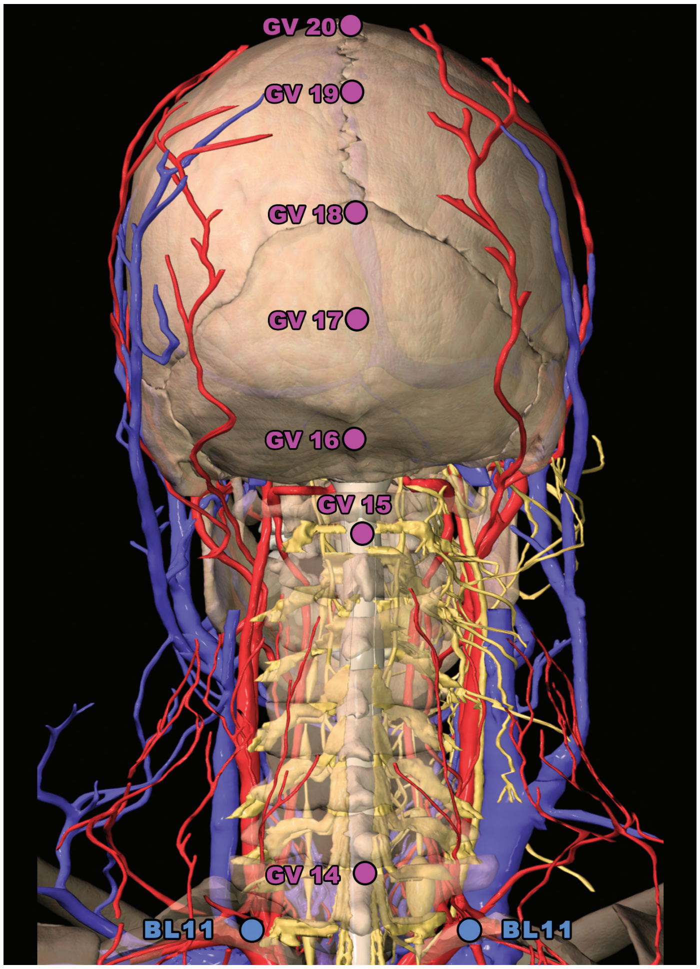


Figure 7-23C. BL 11 begins the BL point series spanning the thorax, lumbar region, and sacrum. Each BL point impacts the adjacent spinal nerve, inducing direct effects on erector spinae tension, pain, and perfusion in the paraspinal musculature. When afferent input reaches the spinal cord communication between somatic and visceral pathways may modulate activity in organs and other structures innervated by that same or nearby spinal cord segments. This forms the basis of diagnostic and treatment approaches through the Shu – Mu subsystem of points, with the twelve Shu points derived from locations on the BL channel between BL 13 and BL 28.

and often receives contribution from C4. May provide fibers to the levator scapulae muscle.

- **T2-T5 spinal nerves, ventral rami (2nd to 5th intercostal nerves):** Innervate the serratus posterior superior muscle.
- **Cervicothoracic (stellate, inferior cervical sympathetic, or caudal cervical sympathetic) ganglion:** A sympathetic ganglion formed by the fusion of the caudal cervical and first thoracic sympathetic ganglia. The cervicothoracic ganglion sits at the level of C7, ventral to the C7 transverse process and neck of the first rib, dorsal to the subclavian artery. See Figure 7-23C to view these neurovascular structures as they relate to the semitransparent C7 vertebra and ribs.

Clinical Relevance: Nerves traversing this well-muscled region run the risk of entrapment and irritation, producing neck, shoulder, and upper thoracic pain.

Note the significant autonomic structures living level with BL 11, apparent in Figure 7-23C, including the cervicothoracic (stellate) sympathetic ganglion, vagus nerve, and nervi vasorum of local major vessels. While Figure 7-24 indicates that abundant muscle tissue separates BL 11 from this neurovasculature, somatoautonomic reflexes reverberate from afferents that supply this point and cervicothoracic spinal cord segments. Acupuncture stimulation that affects the stellate ganglion neuromodulates sympathetic function, affecting associated autonomic disorders such Raynaud's phenomenon, hyperhidrosis (extreme sweating) of the hands, complex regional pain syndrome type 1 (reflex sympathetic dystrophy), and hot flashes/nigh awakenings experienced by menopausal women and some breast cancer survivors. Acupuncture and related techniques performed in this region may aid recovery of complications from stellate ganglion block including Horner's syndrome, dysphagia, and local pain, though ventral cervical points allow more direct access to the sympathetic ganglia in the neck.

BL 11 has historically been called an "influential" point for bone. If BL 11 does, in fact, support bone mass, growth, and repair, it is likely due to the influence of BL 11 on sympathetic nervous system activity in terms of modulating (reducing) hyperactivity in this limb of the autonomic nervous system. Research demonstrates that increased sympathetic activity reduces bone formation and mass. It also likely increases postmenopausal bone loss in women.[2]

Afferent input from BL points on the back travels through the dorsal rami of the spinal nerves to reach the spinal cord. Abundant interneuronal connections between somatic and autonomic pathways produce reverberating effects, including somatovisceral and somatosomatic reflexes. Organs or body regions influenced by BL points depend on their location within the trunk. The classical Shu-Mu subsystem of points pairs twelve BL points with twelve discrete organs or structures. However, the neuroanatomical reality does not justify this one-to-one assignment. That is, nerves from internal organs diverge to join the spinal cord over several segments. What the point-pairing system does provide is a starting point from which an acupuncturist can begin examining and palpating for tenderness, tissue, or texture changes that may indicate either abnormalities in the local musculature, reflexes from dysfunctional viscera, or both. Viewing the organ linkages as regions instead of specific levels, one can associate BL 11 through BL 15 with the cardiopulmonary system; BL 17 through BL 19 to hepatobiliary activities, and BL 20 and BL 21 to digestion in the cranial abdomen. Coursing caudally, BL 22 and BL 23 correspond to the adrenal gland and kidney while BL 25-BL 27 connect with intestinal activity. BL 28 has been assigned to the urinary bladder, but treating bladder dysfunction may call for stimulation of several dorsal sacral spinal nerves to neuromodulate micturition and bladder sensation.

Vessels

- **First posterior intercostal artery:** Arises from the supreme intercostal artery, a branch of the costocervical artery of the subclavian artery. Provides branches that supply the dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and the skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and the parietal pleura.
- **First posterior intercostal vein:** Posterior intercostal veins anastomose with the anterior intercostal veins, which are tributaries of the internal thoracic veins. The 1st through the 3rd

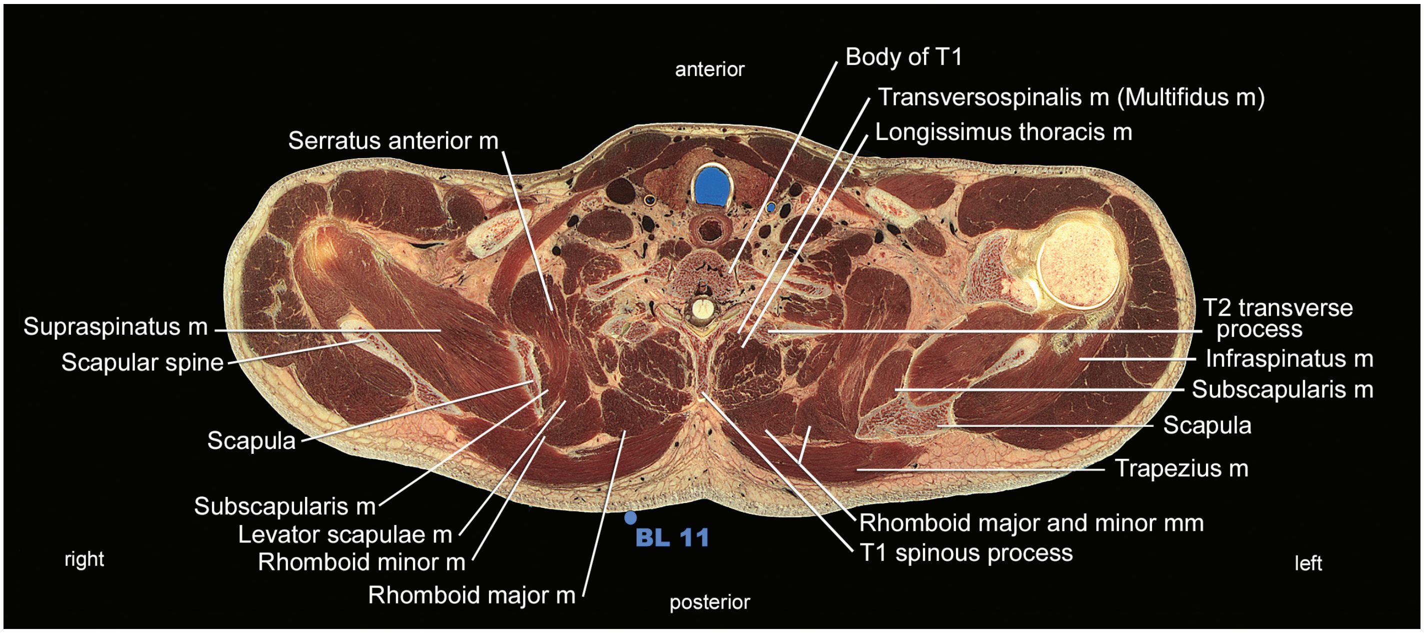

anterior
Body of T1
Transversospinalis m (Multifidus m)
Longissimus thoracis m
Serratus anterior m
Supraspinatus m
Scapular spine
T2 transverse process
Infraspinatus m
Subscapularis m
Scapula
Scapula
Trapezius m
Subscapularis m
Levator scapulae m
Rhomboid minor m
Rhomboid major m
BL 11
Rhomboid major and minor mm
T1 spinous process
right
left
posterior

Figure 7-24. Cross-sections supply information important for trigger point therapists to know regarding the depth and direction of needling necessary to deactivate key sites. As indicated here, a needle entering BL 11 first encounters the robust trapezius, followed by the rhomboids and erector spinae column.

intercostal veins either empty into the brachiocephalic vein or superior vena cava. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Large vessels, exhibiting diameters greater than 1 mm, travel caudal to the thoracic vertebrae and pierce the superficial fascia to supply cutaneous levels.[3] Certain vessels accompany a nerve and perforate slips of semispinalis muscle over along one or more vertebral segments. Other vessels inhabit deep vertebral regions and reside near the rotator muscles. Obviously, tension in the paraspinal muscle bundles impacts not only nerves but also partner vessels by reducing oxygen perfusion and eliminating metabolic waste products. This then precipitates further myofascial trigger point generation.

The azygous and vertebral venous systems comprise part of the venous network comprising the GV channel. In that most of the intercostal veins drain into the azygous system, the BL and GV channels exhibit similarities and connections in their vascular and neural compositions.

Indications and Potential Point Combinations

- **Fever:** BL 11, LI4, LI 11, GV 14, ST 36
- **Headache:** BL 11 if tender. Other local tender myofascial trigger points, as well as BL 10, GV 20, LI 4.
- **Shoulder pain:** BL 11 as a local tender trigger point or others in the vicinity; check SI 11, SI 12. For joint pain, add LI 15, TH 14.
- **Paresthesias of thoracic limb:** BL 11, GV 14, LI 4, other pertinent points related neuroanatomically.
- **Neck pain:** BL 11, local trigger points, distal point such as LI 4 or SI 3.

Evidence-Based Applications

- Prophylactic use of bilateral noninvasive acuplaster on BL 10, BL 11, and GB 34 significantly reduces **vomiting in children after strabismus correction.**[1]

References

1. Chu Y-C, Lin S-M, Hsieh Y-C, Peng G-C, Lin Y-H, Tsai S-K, and Lee T-Y. Effect of BL-10 (Tianzhu), BL-11 (Dazhu) and GB-34 (Yanglinquan) acuplaster for prevention of vomiting after strabismus surgery in children. *Acta Anaesthesiol Sin.* 1998;36:11-16.
2. Farr JN, Charkoudian N, Barnes JN, et al. Relationship of sympathetic activity to bone microstructure, turnover, and plasma osteopontin levels in women. *J Clin Endocrinol Metab.* 2012;97(11):4219-4227.
3. Saito T and Murakami G. Arteries and veins behind the thoracic vertebrae with special reference to the cutaneous blood supply. *Okajimas Folia Anat Jpn.* 1998;74(6):243-257.

BL 12

Feng Men "Wind Gate"

On the upper thorax, about 1.5 cun lateral to the caudal border of the T2 spinous process.

CAUTION: Needle carefully to avoid pneumothorax. Compare the cross section of BL 12 (Figure 7-26) with that of BL 11 (Figure 7-24). The upper lobes of the lungs have now come into play. As with BL 11, needling BL 12 poses a greater risk of causing pneumothorax in thin, poorly muscled, and/or geriatric patients when the direction of needling faces away from the midline.

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles (transversospinalis, longissimus thoracis, and iliocostalis thoracis muscles):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.
- **Splenius cervicis muscle:** Bilateral action extends the neck and head; unilateral action laterally flexes and rotates the head and neck to the ipsilateral side.

Clinical Relevance: Trigger points lurking beneath BL 12 may be housed in the trapezius, rhomboid major, splenius cervicis, and erector spinae group, as becomes apparent in the cross section seen in Figure 7-26. Referred pain from these sites travels to the neck and shoulder. Note the differences in texture between the superficial and deep layers of muscle beneath BL 12. This can translate into changes in resistance encountered by a needle, as perceived by the acupuncturist, thereby announcing the muscles reached with the needle tip.

Acupuncture, massage, and laser therapy address restrictions in this well-muscled region to improve circulation, reduce pain, and counter nerve irritation and entrapment.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C5, C8, T1, T2 and T3 spinal nerves:** Dorsal rami innervate skin, bones, joints, muscles of the back. Ventral rami form intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **C5, C6 dorsal primary rami:** Supplies the splenius cervicis muscle.
- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5

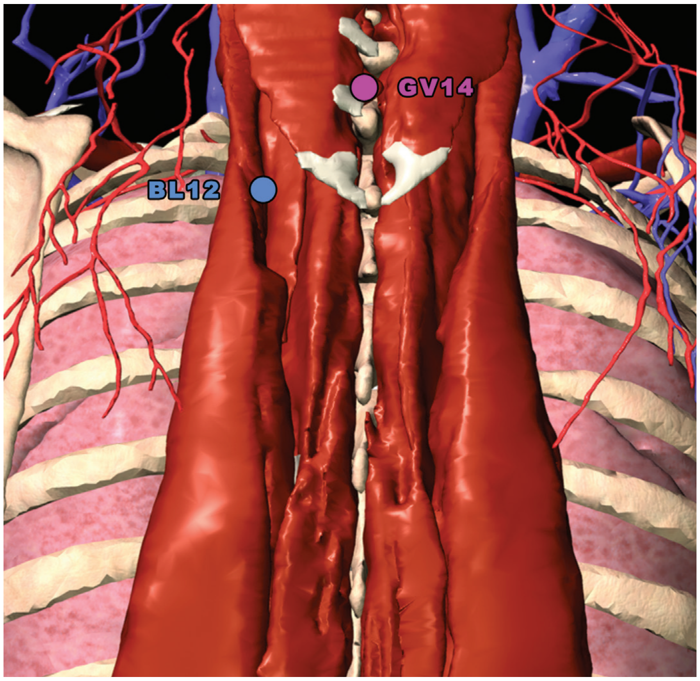


Figure 7-25A. BL 12, "Wind Gate" refers to where early Chinese acupuncturists believed that wind from cold, gusty weather entered the body, causing "cold wind invasion". We now call this "early viral illness." Neuroanatomically, BL 12 neuromodulates cranial thoracic spinal segments that send sympathetic nerve fibers to the bronchi, trachea, lungs, and the upper respiratory airways. BL 12 has also been called the influential point for wind and the trachea. Evidence suggests that acupuncture at BL 12, BL 13, and GV 14 inhibited airway remodeling in a rodent model of asthma, possibly related to the inhibition of T-type calcium channel protein in airway smooth muscle.[6]

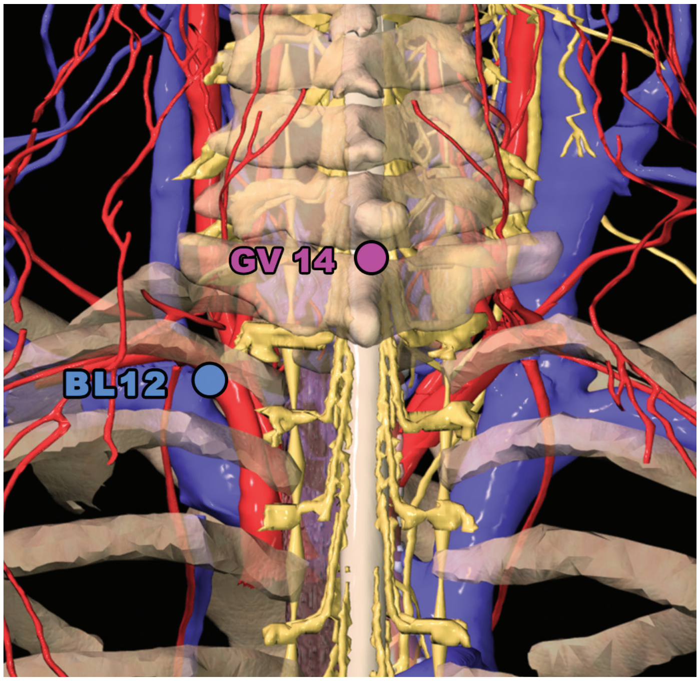


Figure 7-25B. Although the lungs span many vertebral segments, their sympathetic and sensory nerves arise from the nearby sympathetic chain ganglia and cranial spinal cord segments (shown here) near the key points for respiratory conditions: BL 12, BL 13, and GV 14.

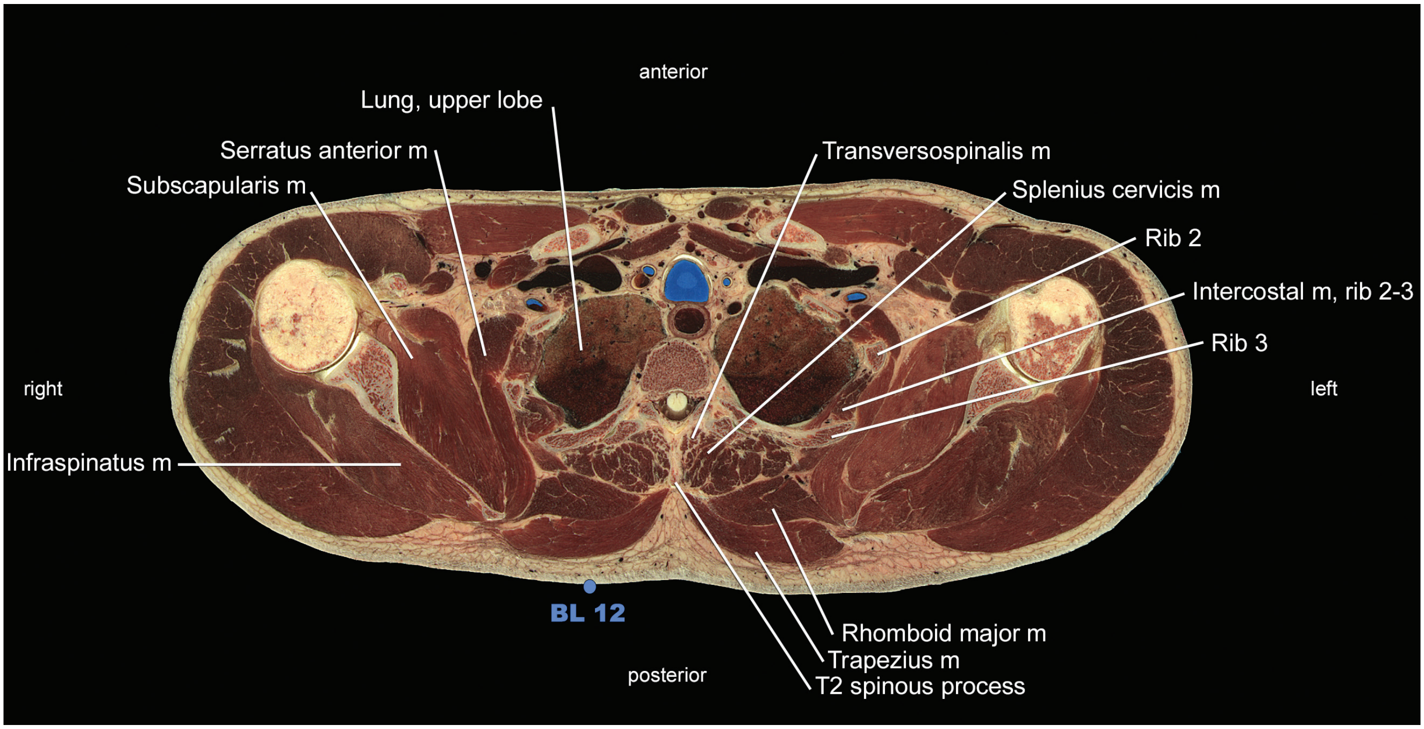


Figure 7-26. Anatomical structures closely affiliated with BL 12 figure prominently in this cross section, namely the trachea (in blue), lungs, and myofascia of the upper back.

and often receives contribution from C4. May provide fibers to the levator scapulae muscle.

Clinical Relevance: Nerves traversing this well-muscled region run the risk of entrapment and irritation. In addition, reflexes between the BL points on the back and the spinal cord yield pathways through which to affect internal organ function. That is, afferent input from BL points on the back travels through the dorsal rami of the spinal nerves to reach the spinal cord. Abundant interneuronal connections between somatic and autonomic pathways produce reverberating effects, including somatovisceral and somatosomatic reflexes. Organs or body regions influenced by BL points depend on their location within the trunk. The classical Shu-Mu subsystem of points pairs twelve BL points with twelve discrete organs or structures. However, the neuroanatomical reality does not justify this one-to-one assignment. That is, nerves from internal organs diverge to join the spinal cord over several segments. What the point-pairing system does provide is a starting point from which an acupuncturist can begin examining and palpating for tenderness, tissue, or texture changes that may indicate either abnormalities in the local musculature, reflexes from dysfunctional viscera, or both. Viewing the organ linkages as regions instead of specific levels, one can associate BL 11 through BL 15 with the cardiopulmonary system; BL 17 through BL 19 to hepatobiliary activities, and BL 20 and BL 21 to digestion in the cranial abdomen. Coursing caudally, BL 22 and BL 23 correspond to the adrenal gland and kidney while BL 25-BL 27 connect with intestinal activity. BL 28 has been assigned to the urinary bladder, but treating bladder dysfunction may call for stimulation of several dorsal sacral spinal nerves to neuromodulate micturition and bladder sensation.

Vessels

- **Second posterior intercostal artery:** Arises from the supreme intercostal artery, a branch of the costocervical artery of the subclavian artery. Provides branches that supply the dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and the skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and the parietal pleura.
- **Second posterior intercostal vein:** Posterior intercostal veins anastomose with the anterior intercostal veins, which are tributaries of the internal thoracic veins. The 1st through the 3rd intercostal veins either empty into the brachiocephalic vein or superior vena cava. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Large vessels, exhibiting diameters greater than 1 mm, travel caudal to the thoracic vertebrae and pierce the superficial fascia to supply cutaneous levels.[1] Certain vessels accompany a nerve and perforate slips of semispinalis muscle over along one or more vertebral segments. Other vessels inhabit deep vertebral regions and reside near the rotator muscles. Obviously, tension in the paraspinal muscle bundles impacts not only nerves but also partner vessels by reducing oxygen perfusion and eliminating metabolic waste products. This then precipitates further myofascial trigger point generation.

Indications and Potential Point Combinations

- **Early viral illness, with fever, headache:** BL 12, GV 14, BL 10, ST 36.
- **Respiratory problems:** dyspnea, bronchitis, and asthma: BL 12, BL 13, LU 1, LI 4, ST 36. Consider adding Dingchuan (0.5 cun on either side of GV 14), BL 20, BL 23.[2]
- **Back pain, shoulder pain:** BL 12 if tender, plus trigger points and spinal segmental BL points. Consider warming and myofascial release in the areas of BL 12, BL 13, SI 13, SI 12, and associated trigger points and taut bands.[3]
- **Urticaria:** BL 12, LI 11, LU 7, SP 10, ST 36.

Evidence-Based Applications

- **Allergic rhinitis:** BL 12[4] point injection
- **Allergy-related diseases (rhinitis, asthma, or eczema):** Herbal plaster applied to BL 12 and BL 13.[5]

References

1. Saito T and Murakami G. Arteries and veins behind the thoracic vertebrae with special reference to the cutaneous blood supply. *Okajimas Folia Anat Jpn.* 1998;74(6):243-257.
2. Zhuang LX, Zhao MH, Yang JJ, et al. A study on the time-effect relationship in the treatment of bronchial asthma with medicinal vesiculation therapy. *Zhen Ci Yan Jiu.* 2007;32(1):53-57.
3. Wang LQ. Observation on therapeutic effects of scraping therapy and warming acupuncture-moxibustion on 50 cases of fasciitis of back muscles. *Zhongguo Zhen Jiu.* 26(7):478-480.
4. Zhao C, Yue F, and Yao S. Treatment of allergic rhinitis by medicinal injection at fengmen acupoint. *J Tradit Chin Med.* 1990;10(4):264-266.
5. Tai C-J and Chien L-Y. *Am J Chin Med.* 2004;32(6):967-976.
6. Wang Y, Sun J, Jin R, et al. Influence of acupuncture on expression of T-type calcium channel protein in airway smooth muscle cell in airway remodeling rats with asthma. *Zhongguo Zhen Jiu.* 2012;32(6):534-540.

BL 13

Fei Shu "Lung Shu"

On the thoracic vertebral region, 1.5 cun lateral to the inferior border of the T3 spinous process.

CAUTION: Needle carefully to avoid pneumothorax.[1]

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Serratus posterior superior muscle:** Elevates the upper four ribs, thereby raising the sternum and increasing the anteroposterior diameter of the thorax.
- **Erector spinae muscles (transversospinalis, longissimus thoracis, and iliocostalis thoracis muscles):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.
- **Transversospinal muscles (part of the erector spinae group):** These muscles originate from the transverse processes of vertebrae and insert on the spinous processes of the upper vertebrae. They include the semispinalis (capitis, cervicis, and thoracis), multifidus, and rotatores (cervicis, thoracis, and lumborum) muscles. All are innervated by dorsal primary rami of spinal nerves. The semispinalis arises from transverse processes of C4 to T12 vertebrae; the multifidus arises from the transverse processes of T1-T3; the rotatores arise from the transverse processes of vertebrae and insert onto the lower

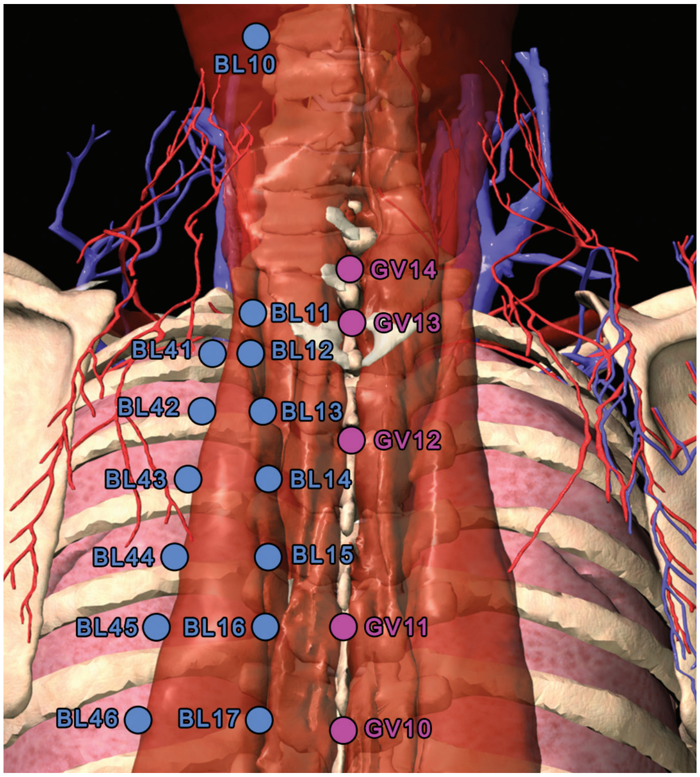


Figure 7-27A. BL 13, "Lung Transport", signifies the start of the Back Shu points on the inner BL channel. Although not all inner BL line points qualify as Back Shu, all Back Shu fall along the inner BL line in a discontinuous fashion. The diagnostic information and treatment benefits of the Back Shu points become available as a result of various viscerocutaneous, cutaneovisceral, cutaneosmuscular, and visceromuscular reflexes.[9] The layout of the Back Shu point-organ relationships expose the spinal segmental craniocaudal distribution of sympathetic (from T1 to L3) and parasympathetic spinal nuclei (S2-S4) that innervate the viscera. BL 13, "Lung Transport", derives and sends signals from and to the lungs, the most cranial member of the viscera in this system, as its name implies. Back Shu points that become tender may indicate either a viscerosomatic reflex that took hold because nociceptive impulses from the organ facilitated the recipient spinal cord segment. Alternatively, a tender Back Shu point may predominantly reflect local musculoskeletal dysfunction or a neuropathic nerve. The remainder of the examination should yield more establishing a definitive diagnosis. Note that in this image, the location of both the inner and outer BL points pertain to muscle borders rather than strict cun, or body inch, measurements, improving their correspondence to spinal nerve branching patterns as a result.

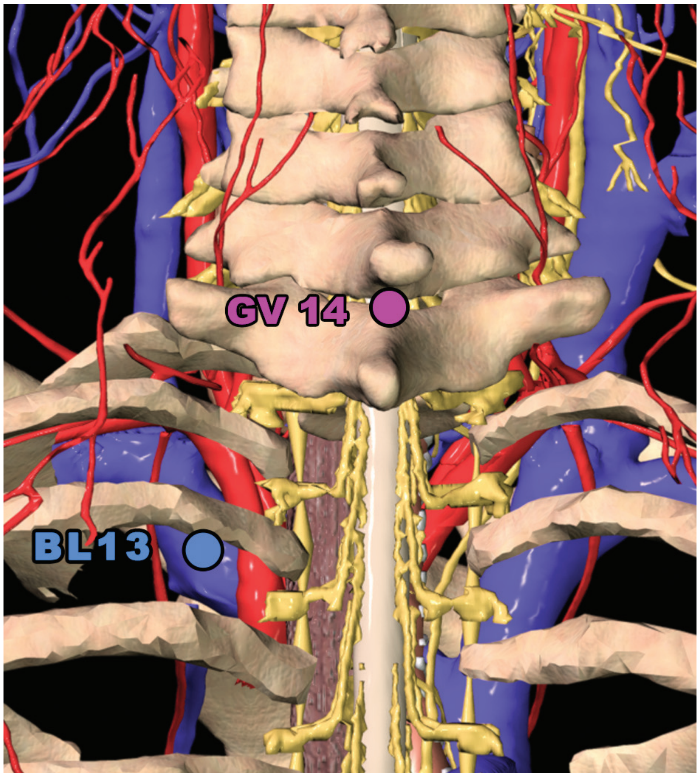


Figure 7-27B. Note the chain of sympathetic ganglia traveling parallel to the spinal cord on the left and right sides just ventral to the head of each rib. This anatomic proximity argues for various neuromodulatory techniques that modulate sympathetic activity, such as the osteopathic manipulative approach called "rib raising" in which pressure is applied to the rib heads of a patient lying supine. This technique is frequently used for lung conditions such as pneumonia, chronic obstructive pulmonary disease (COPD), and asthma.[10] Acupuncture, like the osteopathic manipulative technique of rib raising, has the capacity to neuromodulate sympathetic function, but it lacks the mechanical attributes of mobilizing the rib cage through the direct, upward pressure of the physician's extended fingers beneath the rib heads of the supine patient. Clearly, a multiplicity of approached can combine to optimize patient wellness and recovery.

border and lateral portion of the lamina of the vertebra located above it (and only exist in the thoracic region).

The transversospinal muscles extend the head, cervical, and thoracic regions; they stabilize vertebral movements; assist with local extension and rotational movements. Rotatores may also function as proprioceptive organs.

- **Splenius cervicis muscle:** Bilateral action extends the neck and head; unilateral action laterally flexes and rotates the head and neck to the ipsilateral side.

Clinical Relevance: Trigger points lurking beneath BL 13 may be housed in the trapezius, rhomboid major, splenius cervicis, and erector spinae group, as becomes apparent in the cross section seen in Figure 7-28. Referred pain from these sites travels to the neck and shoulder. Note the differences in texture between the superficial and deep layers of muscle beneath BL 13. Care and attention paid to the ways in which the resistance to needle entry feels throughout the insertion process bestows insights into the muscle layer the tip encounters along its course.

Acupuncture, massage, and laser therapy address restrictions in this well-muscled region to improve circulation, reduce pain, and counter nerve irritation and entrapment. In addition, studies show that patients suffering from chronic mechanical neck pain exhibit alterations in the differential activation of cervical extensors such as the splenius and semispinalis muscles.[4] Neuromodulation by means of acupuncture and related techniques influence unconscious proprioceptors and increase signals sent to the central nervous system. Thus, the multiplicity of mechanisms underlying neck pain falls within the spectrum of changes induced by acupuncture, including modulation of cortical excitability, reflex-mediated responses, sympathetic activation, psychological influences, and peripheral sensitization.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C5, T1, T2, T3 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **T2-T5 spinal nerves, ventral rami (2nd to 5th intercos tal nerves):** Innervate serratus posterior superior muscle.
- Dorsal scapular nerve (C4, C5): innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.
- **C5, C6 dorsal primary rami:** Supplies the splenius cervicis muscle.

Clinical Relevance: Nerves traversing this well-muscled region run the risk of entrapment and irritation. In addition, reflexes between the BL points on the back and the spinal cord yield pathways through which to affect internal organ function. That is, afferent input from BL points on the back travels through the dorsal rami of the spinal nerves to reach the spinal cord. Abundant interneuronal connections between somatic and autonomic pathways produce reverberating effects, including somatovisceral and somatosomatic reflexes. Organs or body regions influenced by BL points depend on their location within the trunk. The classical Shu-Mu subsystem of points pairs twelve BL points with twelve discrete organs or structures. However, the neuroanatomical reality does not justify this one-to-one assignment. That is, nerves from internal organs diverge to join the spinal cord over several segments. What the point-pairing system does provide is a starting point from which an acupuncturist can begin examining and palpating for tenderness, tissue, or texture changes that may indicate either abnormalities in the local musculature, reflexes from dysfunctional viscera, or both. Viewing the organ linkages as regions instead of specific levels, one can associate BL 11 through BL 15 with the cardiopulmonary system; BL 17 through BL 19 to hepatobiliary activities, and BL 20 and BL 21 to digestion in the cranial abdomen. Coursing caudally, BL 22 and BL 23 correspond to the adrenal gland and kidney while BL 25-BL 27 connect with intestinal activity. BL 28 has been assigned to the urinary bladder, but treating bladder dysfunction may call for stimulation of several dorsal sacral spinal nerves to neuromodulate micturition and bladder sensation.

Vessels

- **Third posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Third posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. The 1st through the 3rd intercostal veins either empty into the brachiocephalic vein or superior vena cava. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Complications caused by surgery designed to block T2 sympathetic ganglion function in cases of palmar hyperhidrosis may cause various complications, including compensatory sweating and facial anhidrosis (since the T2 postganglionic fibers affect the face in some patients).[5] In order to avoid problems caused by T2 ganglion block, surgeons may instead perform sympathicotomy or ramicotomy at T3 and T4. However, significant bleeding may result from injury to the ventral crossing intercostal veins at the third and fourth intercostal spaces on the right side. Review the location of the sympathetic ganglia at T3 in Figure 7-27B and the proximity of BL 13 to the T3 ganglion on the left.

Indications and Potential Point Combinations

- **Lung problems: cough, dyspnea, bronchitis, pneumonia, asthma,[6] and pleuritis:** BL 13, LU 1, LU 5, LI 4, ST 36, GV 14.
- **Fever:** BL 13, GV 14, LI 11, LI 4, GV 20.

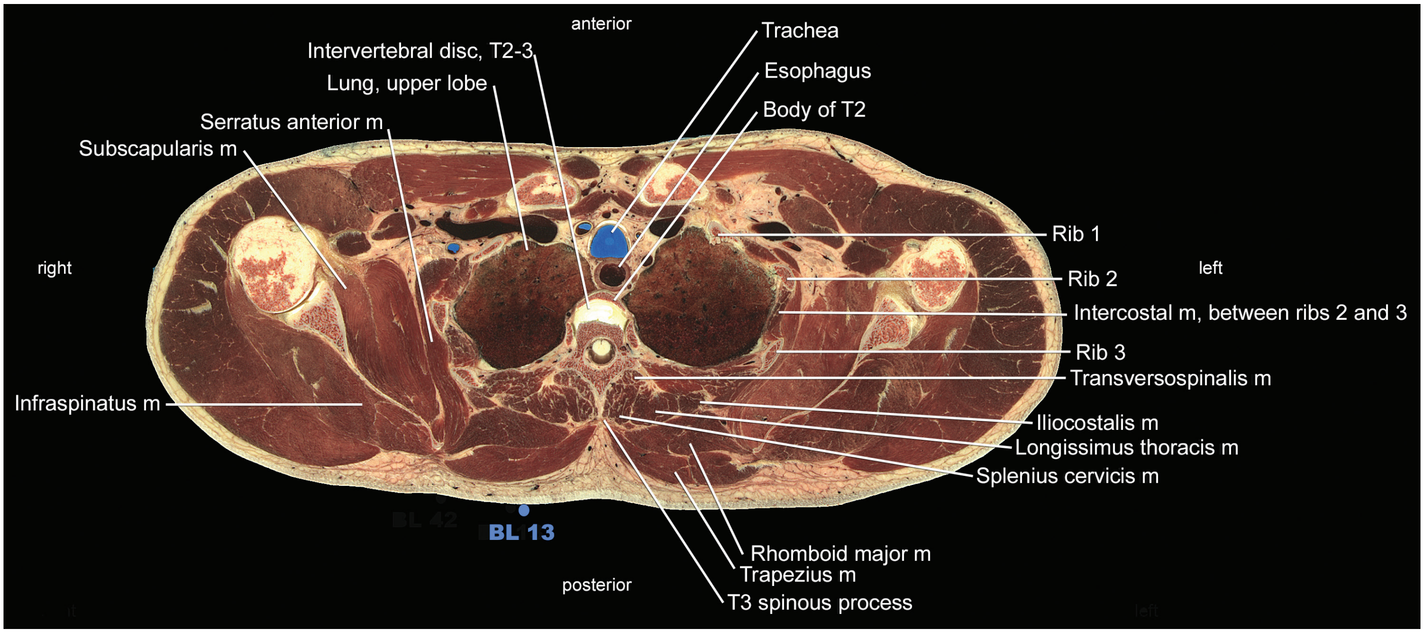


Figure 7-28. Signals "transported" from the lungs to the spinal cord, then reflexing to the body surface at "Lung Transport" (BL 13) may cause tissue, texture, and tenderness changes in this region. This happens because sympathetic neurons supplying the lungs arise from T1 to T4 communicate with nerve fibers supplying somatic tissue connected to the same segments. Although BL 13 lands at T3, nociceptive signals ascend and descend when they reach the spinal cord, causing changes at more than one level. The dermatomes associated with the lung span the T2-T4 levels, but tenderness to palpation stemming from lung issues may incite maximal discomfort at BL 13.[11]

Evidence-Based Applications

- **Bronchial asthma in children,** treated with BL 13, BL 43, Dingchuan, CV 22, and CV 17 in a Chinese study aided in preventing and treating the condition.[7]
- Herbal plaster applied to BL 13, BL 23, GV 14, CV 22, CV 17, and LU 1 in patients with **COPD** reduced frequency of episodes, improved quality of life, and increased pulmonary function in a Chinese study.[8]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[2]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[3]

References

1. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupuncture in Medicine*. 2004;22(1):40-43.
2. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine*. 1995;13(2):91-92.
3. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.
4. O'Leary S, Cagnie B, Reeve A, et al. Is there altered activity of the extensor muscles in chronic mechanical neck pain? A functional magnetic resonance imaging study. *Arch Phys Med Rehabil*. 2011;92:929-934.
5. Haam S, Kim D, Hwang J, et al. An anatomical study of the relationship between the sympathetic trunk and intercostal veins of the third and fourth intercostal spaces during thoracoscopy. *Clinical Anatomy*. 2010;23:702-706.
6. Ouyang BS, Gao J, Sun G, et al. Impact of acupoint heat-sensitive moxibustion on lung function and life quality of patients with chronic persistent bronchial asthma: a randomized controlled study. *Zhongguo Zhen Jiu*. 2011;31(11):965-970.
7. Wen B-L, Liu B-Y, Peng J, et al. Clinical research of acupoint application for "treatment of winter disease in summer" used to prevent and treat bronchial asthma in children. *Journal of Traditional Chinese Medicine*. 2012;32(1):31-39.
8. Yang SQ, Zhang W, Li JX, et al. Observation of the therapeutic effect on COPD of cold phlegm blocking the lung type at stable stage treated with acupoint sticking therapy in different season. *Zhongguo Zhen Jiu*. 2012;32(2):117-122.
9. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine*. 2008;36(3):473-479.
10. Henderson AT, Fisher JF, Blair J, et al. Effects of rib raising on the autonomic nervous system: a pilot study using noninvasive biomarkers. *J Am Osteopath Assoc*. 2010;110(6):324-330.
11. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine*. 2008;36(3):473-479.

BL 14

Jue Yin Shu "Fainting" or "Reverting Yin Shu"

On the thoracic vertebral region, 1.5 cun lateral to the inferior border of the T4 spinous process. Ideally, locate in the 4th intercostal space between the longissimus and iliocostalis thoracis muscles.

CAUTION: Needle carefully to avoid pneumothorax.[1] Review the relationship between BL 14 and the lung in Figure 7-29A.

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles:** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.
- **Transversospinal muscles (part of the erector spinae group):** These muscles take their origin from the transverse processes of vertebrae and insert on the spinous processes of the upper vertebrae. They include the semispinalis (capitis, cervicis, and thoracis), multifidus, and rotatores (cervicis, thoracis, and lumborum) muscles. All are innervated by dorsal primary rami of spinal nerves. The semispinalis arises from transverse processes of C4 to T12 vertebrae; the multifidus arises from the transverse processes of T1-T3; the rotatores arise from the transverse processes of vertebrae and insert onto the lower border and lateral portion of the lamina of the vertebra located above it (and only exist in the thoracic region).

The transversospinal muscles extend the head, cervical, and thoracic regions; they stabilize vertebral movements; assist with local extension and rotational movements. Rotatores may also function as proprioceptive organs.

Clinical Relevance: Trigger points lurking beneath BL 14 may be housed in the trapezius, rhomboid major, and erector spinae group, as becomes apparent in the cross section seen in Figure 7-30. Referred pain from trigger points in the deep paraspinal muscles such as the multifidi and rotatores refer pain strongly to the local region. At BL 14, pain can span the distance from the spine to the medial border of the scapula. Iliocostalis thoracis trigger points refer to the groove between the scapula and spine. They may also send pain to the chest at about the same horizontal plane as the trigger point. Trigger points in the midthoracic levels of the iliocostalis thoracis that refer to the parasternal region can cause the patient to complain of chest pain and worry about cardiac dysfunction.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T1, T2, T3, and T4 spinal nerves:** Dorsal ramus innervates skin,

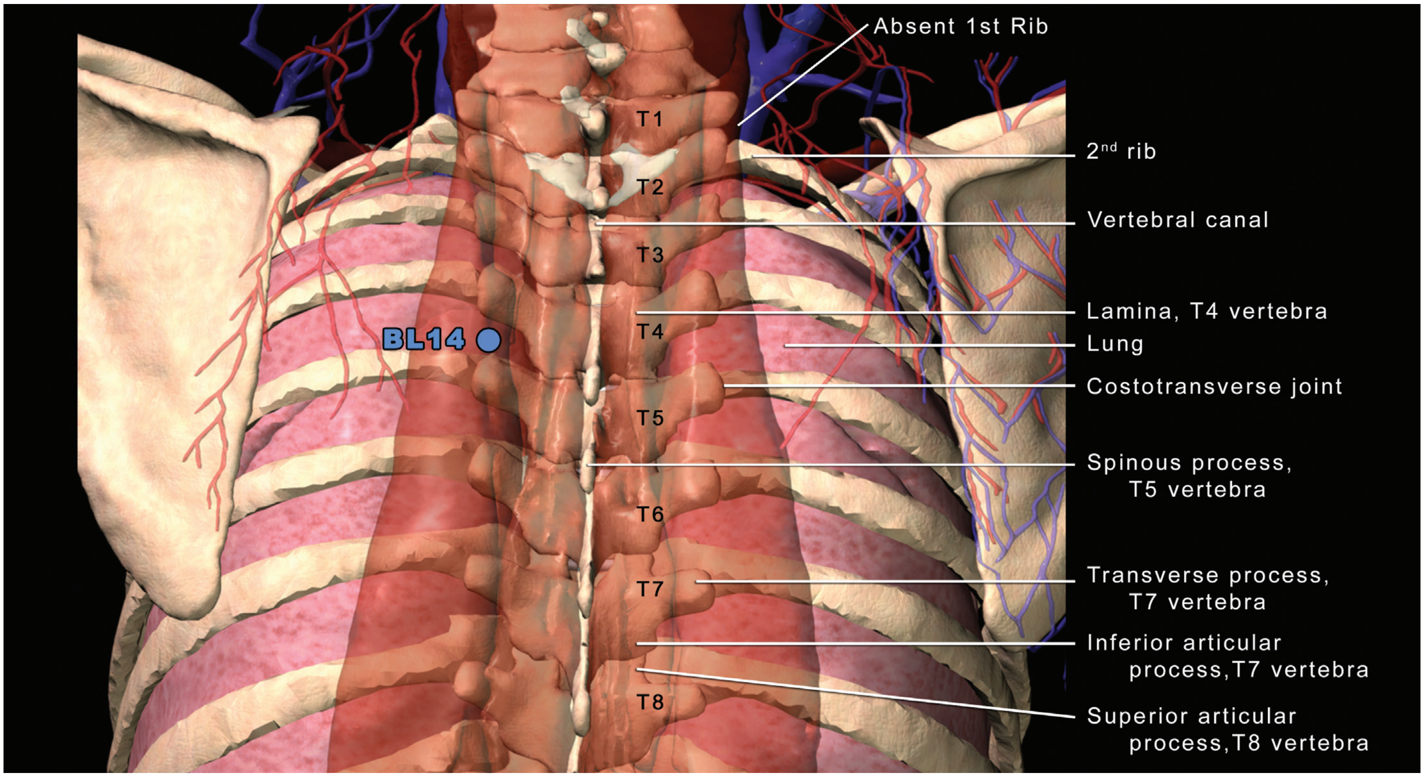

Absent 1st Rib
T1
2nd rib
T2
Vertebral canal
T3
Lamina, T4 vertebra
BL14
T4
Lung
Costotransverse joint
T5
Spinous process, T5 vertebra
T6
Transverse process, T7 vertebra
T7
Inferior articular process, T7 vertebra
T8
Superior articular process, T8 vertebra

Figure 7-29A. Needles entering BL 14, like the other BL points on the thorax, risk penetrating the lung,as indicated here. Note, too, that BL 14 has landed in the 4th intercostal space. This causes it to sit more cranial than the traditional location specifies. Disparities such as this highlight the reality that points placed on two-dimensional images show where to begin palpating. Features that determine ultimate point placement include locating a depression in the tissue, finding tenderness to palpation, detecting a taut band or trigger point, or isolating other expressions of tissue dysfunction and neuronal misfiring. One also needs to avoid areas of infection, masses, and cancer.

bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: Nerves traversing this well-muscled region run the risk of entrapment and irritation. In addition, reflexes between the BL points on the back and the spinal cord yield pathways through which to affect internal organ function. That is, afferent input from BL points on the back travels through the dorsal rami of the spinal nerves to reach the spinal cord. Abundant interneuronal connections between somatic and autonomic pathways produce reverberating effects, including somatovisceral and somatosomatic reflexes. Organs or body regions influenced by BL points depend on their location within the trunk. The classical Shu-Mu subsystem of points pairs twelve BL points with twelve discrete organs or structures. However, the neuroanatomical reality does not justify this one-to-one assignment. That is, nerves from internal organs diverge to join the spinal cord over several segments. What the point-pairing system does provide is a starting point from which an acupuncturist can begin examining and palpating for tenderness, tissue, or texture changes that may indicate either abnormalities in the local musculature, reflexes from dysfunctional viscera, or both. Viewing the organ linkages as regions instead of specific levels, one can associate BL 11 through BL 15 with the cardiopulmonary system; BL 17 through BL 19 to hepatobiliary activities, and BL 20 and BL 21 to digestion in the cranial abdomen. Coursing caudally, BL 22 and BL 23 correspond to the adrenal gland and kidney while BL 25-BL 27 connect with intestinal activity. BL 28 has been assigned to the urinary bladder, but treating bladder dysfunction may call for stimulation of several dorsal sacral spinal nerves to neuromodulate micturition and bladder sensation.

Vessels

- **Fourth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Fourth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Complications caused by surgery designed to block T2 sympathetic ganglion function in cases of palmar hyperhidrosis may cause various complications, including compensatory sweating and facial anhidrosis (since the T2 postganglionic fibers affect the face in some patients).[4] In order to avoid problems caused by T2 ganglion block, surgeons may opt for sympathicotomy or ramicotomy at T3 and T4. However, significant bleeding may result from injury to the ventral crossing intercostal veins at the third and fourth intercostal spaces on the right side. Review the location of the sympathetic ganglia at T4 in Figure 7-29B and the proximity of BL 14 to the T4 ganglia.

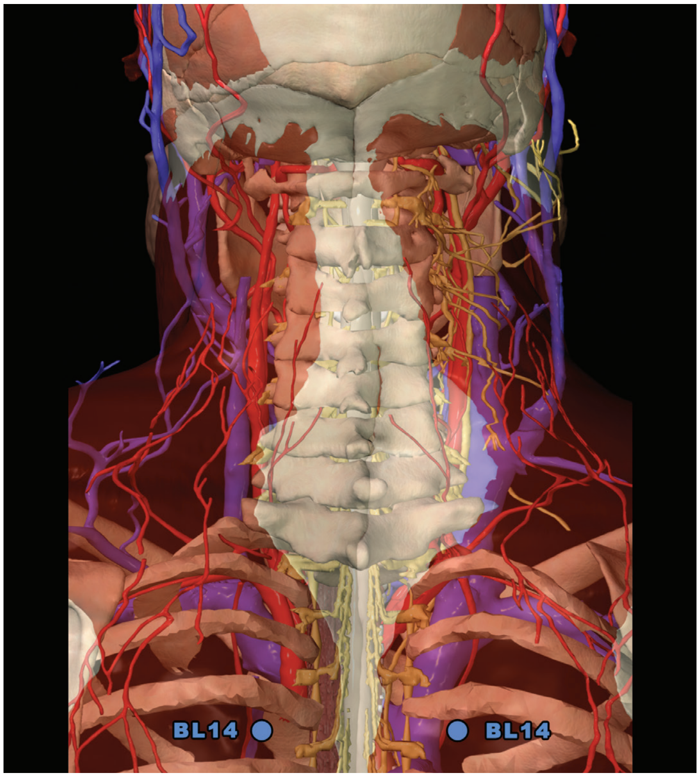


Figure 7-29B. This image is designed to promote "3D thinking". That is, given the prevalence of trigger point pathology in this region, acupuncturists may grow accustomed to focusing on myofascial dysfunction when examining and needling the upper thorax. Reminding oneself of the sympathetic chain ganglia, spinal nerves, and vascular elements beneath the musculature expands one's awareness of the physiologic activities responsible for reducing pain as well as the somatovisceral changes in cardiopulmonary function that needling may induce.

Indications and Potential Point Combinations

- **Tachycardia, myocarditis, pericarditis, angina pectoris, cough from arrhythmia, chest pressure and pain:** After instituting proper medical interventions and monitoring as necessary, consider BL 14, BL 15, PC 1, PC 6, ST 36, CV 17.
- **Agitation, anxiety:** BL 14, HT 3, HT 7, PC 7.
- **Intercostal pain:** If at this level, consider BL 14, BL 43, local trigger points.

Evidence-Based Applications

- Acupuncture at BL 14 and PC 6 caused bidirectional **regulation of cardiac sympathetic and vagal nerve activities** in a cardioprotective fashion.[2]
- Massage at BL 14 and BL 15, consisting of "palm-pushing", "palm-rubbing" and "thumb-poking" for 15 minutes every other day relieved symptoms of angina pectoris in patients with coronary artery disease.[3]

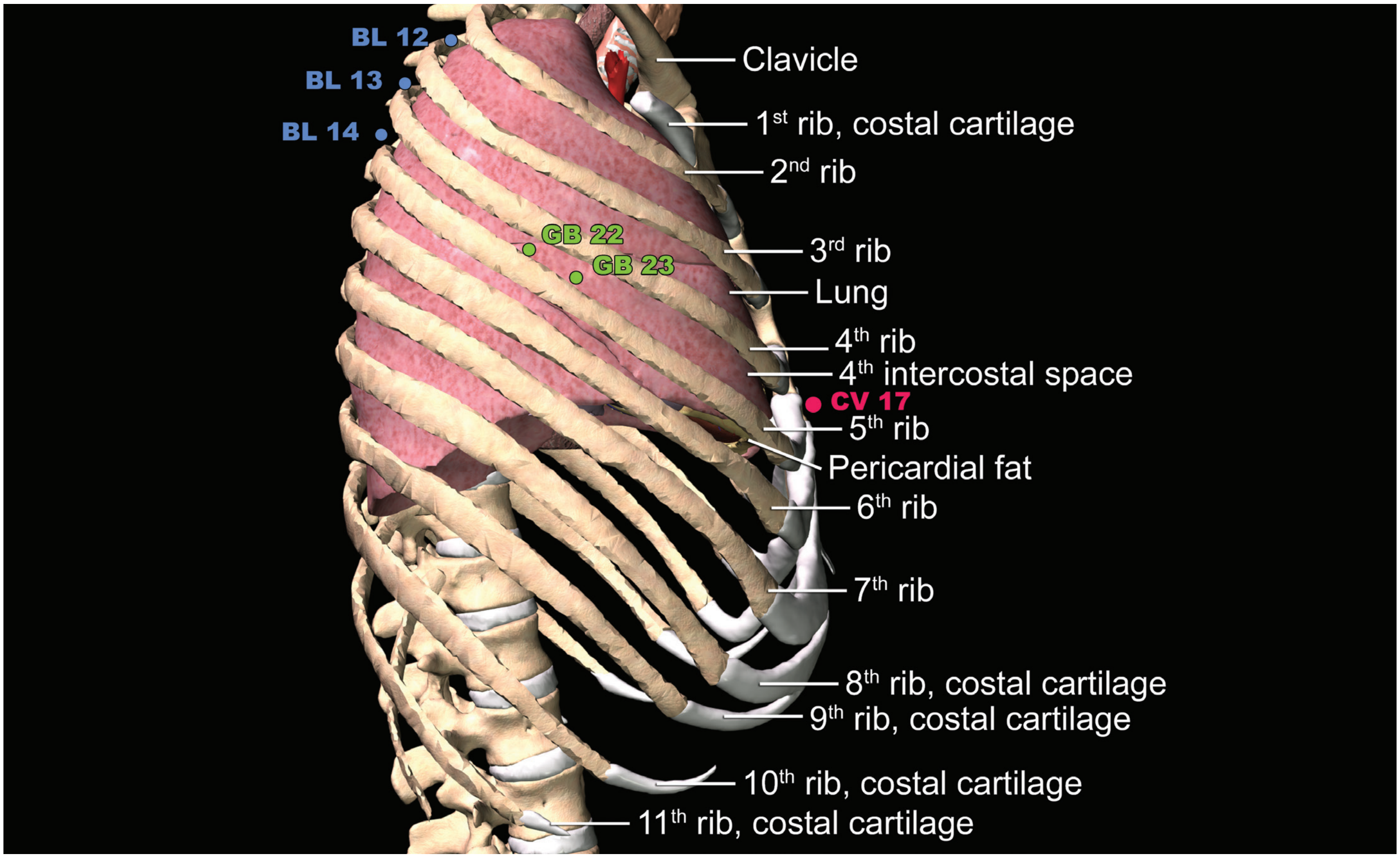

BL 12
BL 13
BL 14
Clavicle
1st rib, costal cartilage
2nd rib
GB 22
GB 23
3rd rib
Lung
4th rib
4th intercostal space
CV 17
5th rib
Pericardial fat
6th rib
7th rib
8th rib, costal cartilage
9th rib, costal cartilage
10th rib, costal cartilage
11th rib, costal cartilage

Figure 7-29C. It is often helpful to view points in the context of not only shared channels but also overlapping dermatomes. Note the way in which GB 22 and GB 23 share the 4th intercostal space with BL 14. Also, view the ventral lung fields behind the caudal sternum where the heart and pericardium peek through the 5th intercostal space. Finally, find CV 17 on the ventral midline. While not all Back Shu and Front Mu points line up along the same intercostal spaces, seeing BL 14, CV 17, and the pericardium related in this way is visually and neuroanatomically satisfying. The sympathetic neurons supplying the pericardium originate from T1 to T5.[5] The name "Jue Yin Shu" for BL 14 links its status as a Back Shu point for the pericardium to the topographical channel name for PC, "Jue Yin".

References

1. Leow TK. Pneumothorax using Bladder 14. *Medical Acupuncture*. 16(2). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_2/case_2.html on 01-10-06.
2. Shi X, Zhao Y, Want X, and Duan D. Research on the action of acupuncture on human cardiac autonomic nerve. *Acupuncture Research*. 2992;27(1):68-70.
3. Cunzhong F. The therapeutic effects of point massage for angina pectoris in 30 cases of coronary heart disease. *Journal of Traditional Chinese Medicine*. 2006;26(3):197.
4. Haam S, Kim D, Hwang J, et al. An anatomical study of the relationship between the sympathetic trunk and intercostal veins of the third and fourth intercostal spaces during thoracoscopy. *Clinical Anatomy*. 2010;23:702-706.
5. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine*. 2008;36(3):473-479.

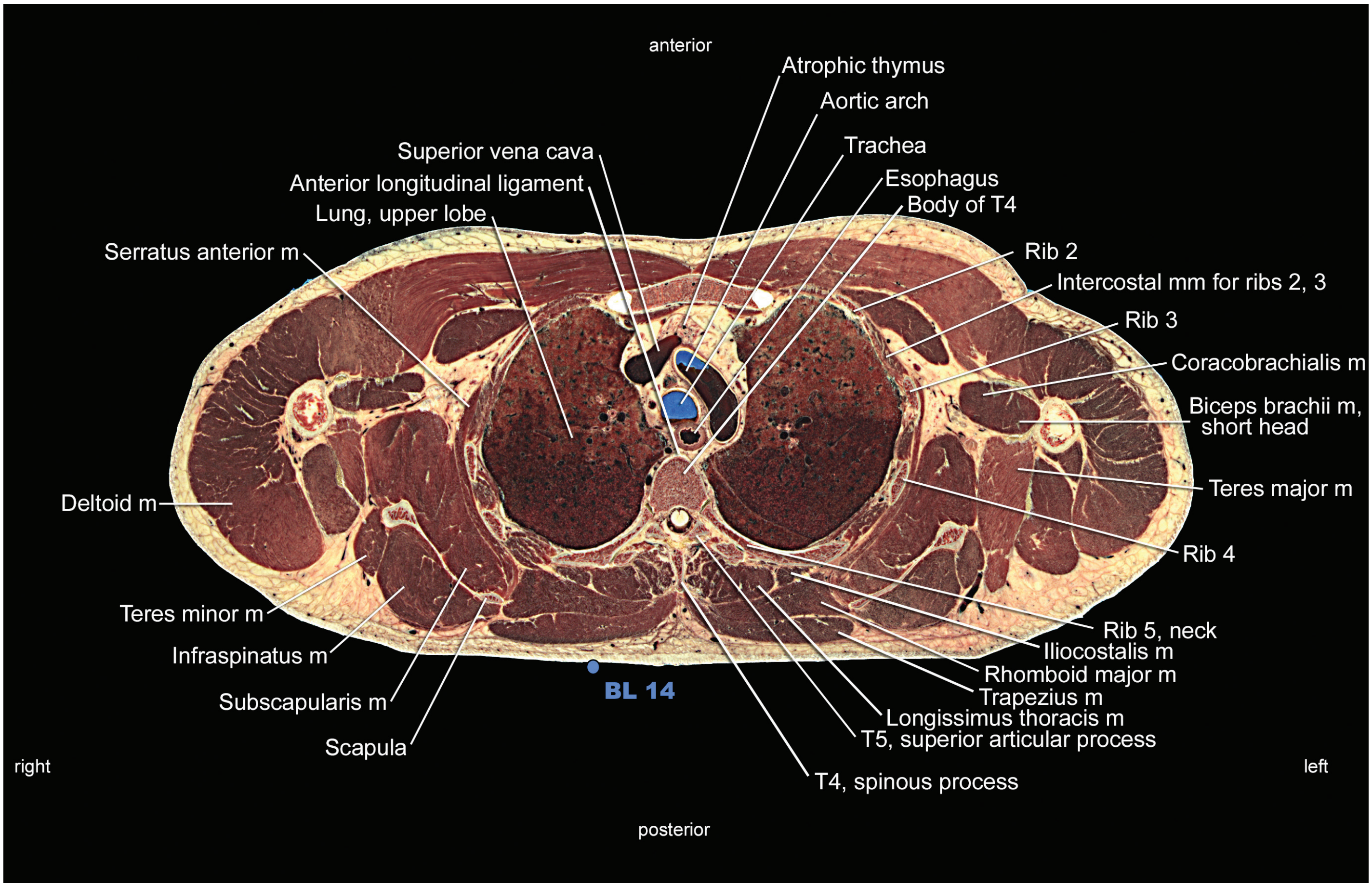

anterior
Atrophic thymus
Aortic arch
Trachea
Superior vena cava
Esophagus
Anterior longitudinal ligament
Body of T4
Lung, upper lobe
Serratus anterior m
Rib 2
Intercostal mm for ribs 2, 3
Rib 3
Coracobrachialis m
Biceps brachii m, short head
Deltoid m
Teres major m
Rib 4
Teres minor m
Rib 5, neck
Infraspinatus m
Iliocostalis m
Rhomboid major m
BL 14
Subscapularis m
Trapezius m
Longissimus thoracis m
Scapula
T5, superior articular process
right
left
T4, spinous process
posterior

Figure 7-30. While the base of the heart and pericardium became apparent in Figure 7-29C, the major vessels entering and exiting the heart stand out starkly in this cross section, level with BL 14.

BL 15

Xin Shu "Heart Shu"

On the thoracic vertebral region, about 1.5 cun lateral to the inferior border of the T5 spinous process. Locate in the 5th intercostal space.

CAUTION: Needle carefully to avoid pneumothorax, as illustrated in Figure 7-31.

Muscles

- **Trapezius muscle:** The musculotendinous part provides added resistance to needle insertion. Caudal, or inferior, fibers depress the scapula and lower the shoulder.
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles:** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.
- **Transversospinal muscles (part of the erector spinae group):** These muscles originate from the transverse processes of vertebrae and insert on the spinous processes of the upper vertebrae. They include the semispinalis (capitis, cervicis, and thoracis), multifidus, and rotatores (cervicis, thoracis, and lumborum) muscles. All are innervated by dorsal primary rami of spinal nerves. The semispinalis arises from transverse processes of C4 to T12 vertebrae; the multifidus arises from the transverse processes of T1-T3; the rotatores arise from the transverse processes of vertebrae and insert onto the lower border and lateral portion of the lamina of the vertebra located above it (and only exist in the thoracic region).

The transversospinal muscles extend the head, cervical, and thoracic regions; they stabilize vertebral movements; assist with local extension and rotational movements. Rotatores may also function as proprioceptive organs.

Clinical Relevance: Trigger points near BL 15 occur in the trapezius, rhomboid major, and erector spinae group, as seen in Figure 7-32. Referred pain from trigger points in the deep paraspinal muscles such as the multifidi and rotatores refer pain strongly locally. This can include the site in and around BL 15, shown in Figure 7-31. Iliocostalis thoracis trigger points refer to the groove between the scapula and spine. They may also send pain to the chest at about the same horizontal plane as the trigger point. Trigger points in the midthoracic levels of the iliocostalis thoracis that refer to the parasternal region can cause the patient to complain of chest pain and worry about cardiac dysfunction.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T2-T5 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

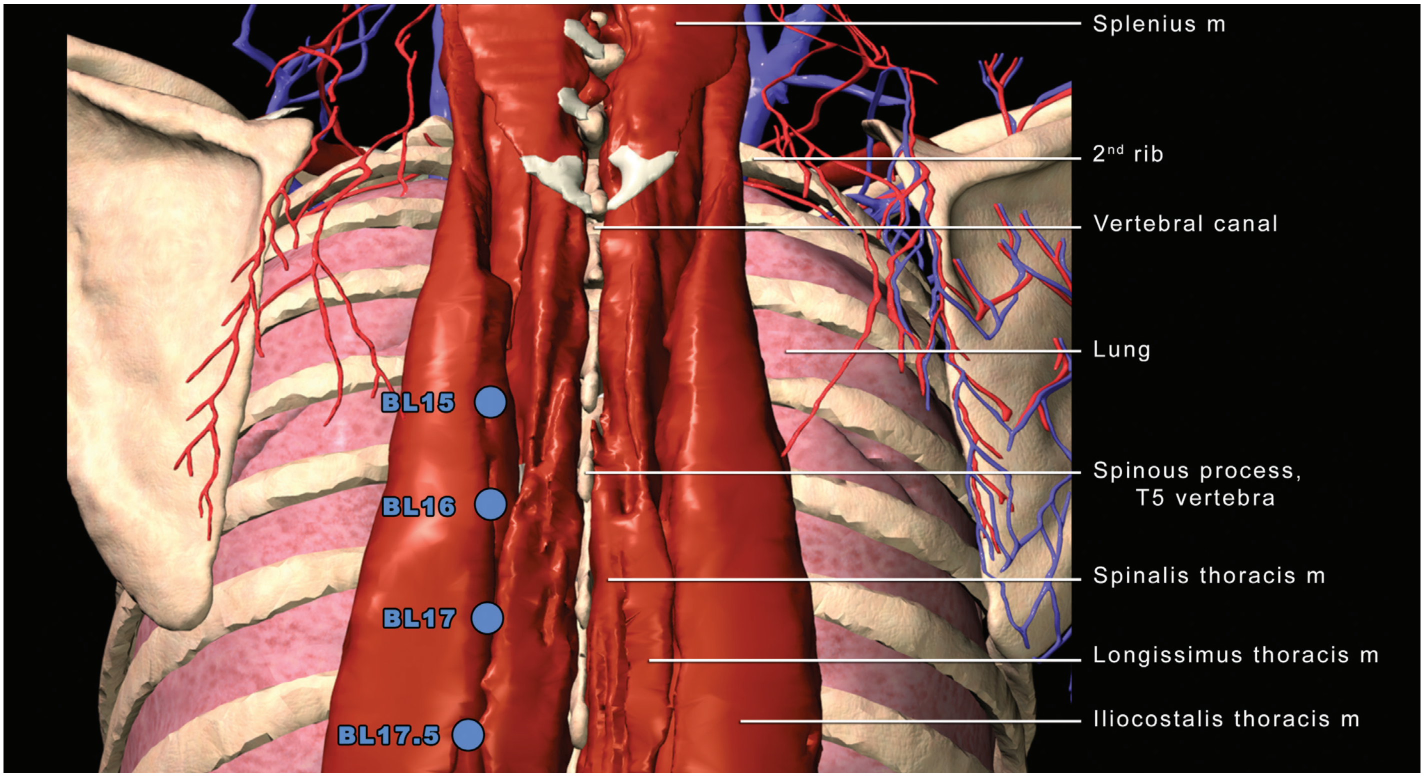


Figure 7-31. Like the other points on the inner BL line, one finds BL 15 in the groove between the longissimus thoracic and iliocostalis thoracic muscles. The dorsal primary ramus of the spinal nerves divides into medial and lateral branches deep to the border of these two muscles, immediately lateral to the articular processes of each vertebra. The medial branch surfaces close to the spinous process (associated with the GV line) while the lateral branch covers the territory of the BL channel. However, much overlap exists in the neurovascular jurisdictions of the BL and GV trajectories.

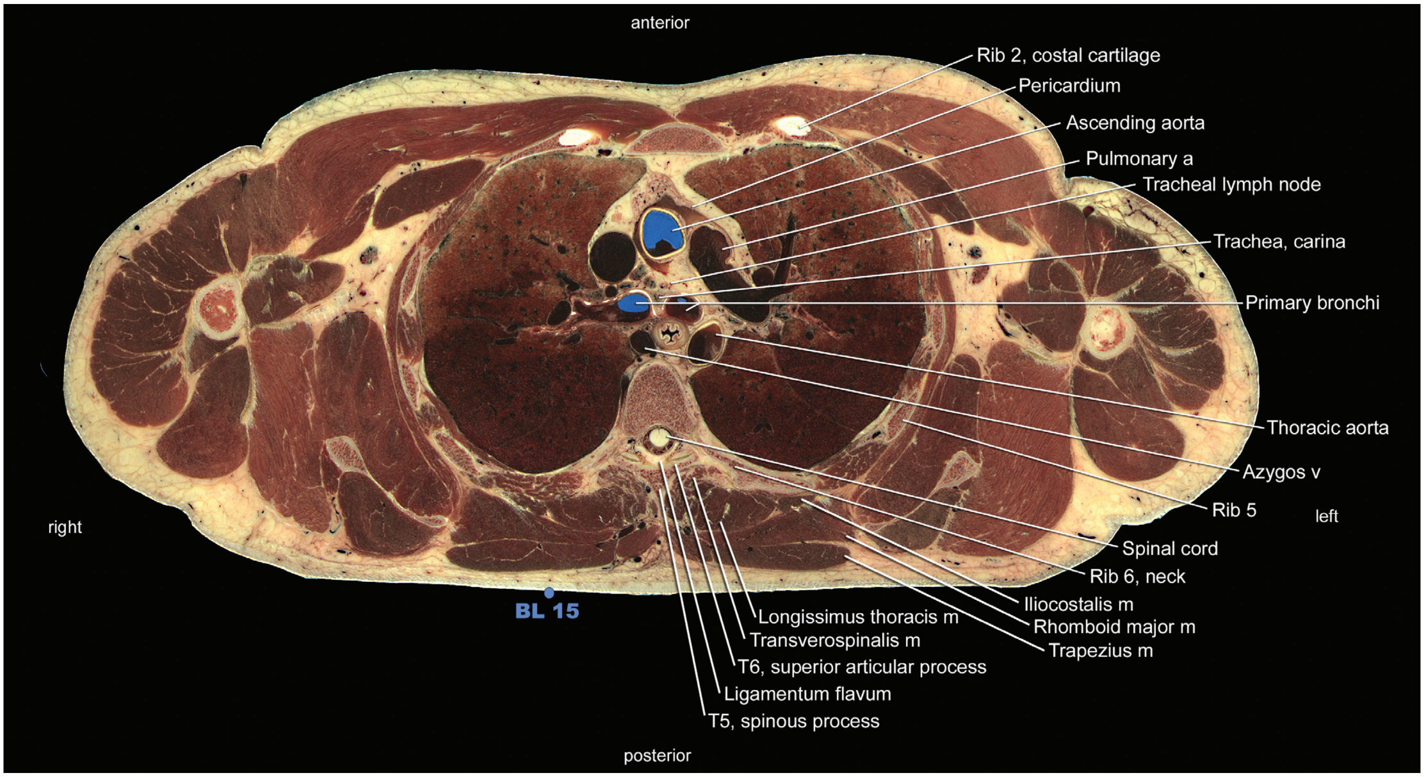


Figure 7-32. BL 15, "Heart Shu", may display tenderness to palpation in cardiac patients, as BL 15 resides in the T5 dermatome and the heart receives its sympathetic supply from T1-T5.[7] Despite the association of BL 15 with the heart, PC 6 provides a decidedly stronger anti-arrhythmic effect, perhaps due to the latter site's linkage to the rostral vetntrolateral medulla (RVLM) rather than to the cranial thoracic spinal cord segments. In this case, a direct connection to the brainstem outweighs somatovisceral reverberations through the paraspinal sympathetic chain and ganglia. Trace the pathway from BL 15 to the heart and back to the back in this cross section to appreciate the course the nerve signals take during acupuncture.

- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. In addition, reflexes between the BL points on the back and the spinal cord yield pathways through which to affect internal organ function. That is, afferent input from BL points on the back travels through the dorsal rami of the spinal nerves to reach the spinal cord. Abundant interneuronal connections between somatic and autonomic pathways produce reverberating effects, including somatovisceral and somatosomatic reflexes. Organs or body regions influenced by BL points depend on their location within the trunk. The classical Shu-Mu subsystem of points pairs twelve BL points with twelve discrete organs or structures. However, the neuroanatomical reality does not justify this one-to-one assignment. That is, nerves from internal organs diverge to join the spinal cord over several segments. What the point-pairing system does provide is a starting point from which an acupuncturist can begin examining and palpating for tenderness, tissue, or texture changes that may indicate either abnormalities in the local musculature, reflexes from dysfunctional viscera, or both. Viewing the organ linkages as regions instead of specific levels, one can associate BL 11 through BL 15 with the cardiopulmonary system; BL 17 through BL 19 to hepatobiliary activities, and BL 20 and BL 21 to digestion in the cranial abdomen. Coursing caudally, BL 22 and BL 23 correspond to the adrenal gland and kidney while BL 25-BL 27 connect with intestinal activity. BL 28 has been assigned to the urinary bladder, but treating bladder dysfunction may call for stimulation of several dorsal sacral spinal nerves to neuromodulate micturition and bladder sensation.

Vessels

- **Fifth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Fifth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Given that the 5th intercostal artery and vein supply structures associated with the spine and spinal cord, improving blood flow by neuromodulating BL points on the back gives this region a better chance to heal in the event of disabling spine and spinal cord injury.

Indications and Potential Point Combinations

- **Heart problems such as atrial fibrillation,[6] angina pectoris, and tachycardia:** After stabilizing and instituting appropriate monitoring and conventional treatment measures, consider BL 15, CV 14, HT 2, HT 3, PC 6, ST 36.Trigger points in this region (T5, T6) can produce referred pain patterns that extend to the shoulder and the chest wall. When left-sided, the pain caused by these trigger points can mimic cardiac angina.[1]

- **Intercostal neuralgia:** Isolate involved rib spaces, tender zones, and restricted intercostals muscles; needle locally. Add BL (inner and outer line) for involved segments. Consider BL 15 for midthoracic intercostals neuralgia, especially if worsened by anxiety.
- **Tension in the back:** BL 15 if tender, other local points along the inner and outer BL line.

Evidence-Based Applications

- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud's syndrome**, demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[2]
- Acupuncture at ST 36, BL 15, BL 20, HT 5, and PC 6 reduced the number of attacks per week in **angina pectoris** patients and reduced ST-segment depression during exercise, possibly indicating protection of the myocardium from ischemia.[3]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes**.[4]
- Massage at BL 14 and BL 15, consisting of "palm-pushing", "palm-rubbing" and "thumb-poking" for 15 minutes every other day relieved symptoms of angina pectoris in patients with **coronary artery disease.**[5]

References

1. Simons DG, Travell JG, and Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body.* Baltimore: Williams & Wilkins, 1999. P. 914.
2. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine.* 1997;241:119-124.
3. Richter A, Herlitz J, and Hialmarson A. Effect of acupuncture in patients with angina pectoris. *European Heart Journal.* 1991;12:175-178.
4. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society.* 1995;2(1):3-12.
5. Cunzhong F. The therapeutic effects of point massage for angina pectoris in 30 cases of coronary heart disease. *Journal of Traditional Chinese Medicine.* 2006;26(3):197.
6. Lombardi F, Belletti S, Battezzati PM, et al. Acupuncture for paroxysmal and persistent atrial fibrillation: an effective non-pharmacological tool? *World J Cardiol.* 2012;4(3):60-65.
7. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

BL 16

Du Shu "Governing Shu"

On the thoracic vertebral region, 1.5 cun lateral to the inferior border of the T6 spinous process. Locate in the 6th intercostal space.

CAUTION: Needle carefully to avoid pneumothorax.

Muscles

- **Trapezius muscle:** The caudal (inferior) fibers depress the scapula and lower the shoulder.
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Transversospinal muscles (part of the erector spinae group):** These muscles originate from the transverse processes of vertebrae and insert on the spinous processes of the upper vertebrae. They include the semispinalis (capitis, cervicis, and thoracis), multifidus, rotatores (cervicis, thoracis, and lumborum) muscles. All are innervated by dorsal primary rami of the spinal nerves. The semispinalis arises from transverse processes of C4 to T12 vertebrae; the multifidus arises from the transverse processes of T1-T3; the rotatores arise from the transverse processes of vertebrae and insert onto the lower border and lateral portion of the lamina of the vertebra located above it (and only exist in the thoracic region).

The transversospinal muscles extend the head, cervical, and thoracic regions; they stabilize vertebral movements; assist with local extension and rotational movements. Rotatores may also function as proprioceptive organs.

Clinical Relevance: Muscles enveloping the BL channel at T6 exhibit far less depth than more cranial levels do. (See Figure 7-33B.) Trigger points at BL 16 occur in the trapezius, rhomboid major, and erector spinae group. Referred pain from trigger points in the deep paraspinal muscles such as the multifidi and rotatores refer pain strongly locally. Iliocostalis thoracis trigger points refer to the groove between the scapula and spine. They may also send pain to the chest at about the same horizontal plane as the trigger point. Trigger points in the midthoracic levels of the iliocostalis thoracis that refer to the parasternal region could lead the patient to believe they are experiencing cardiac dysfunction.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T4-T6 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid

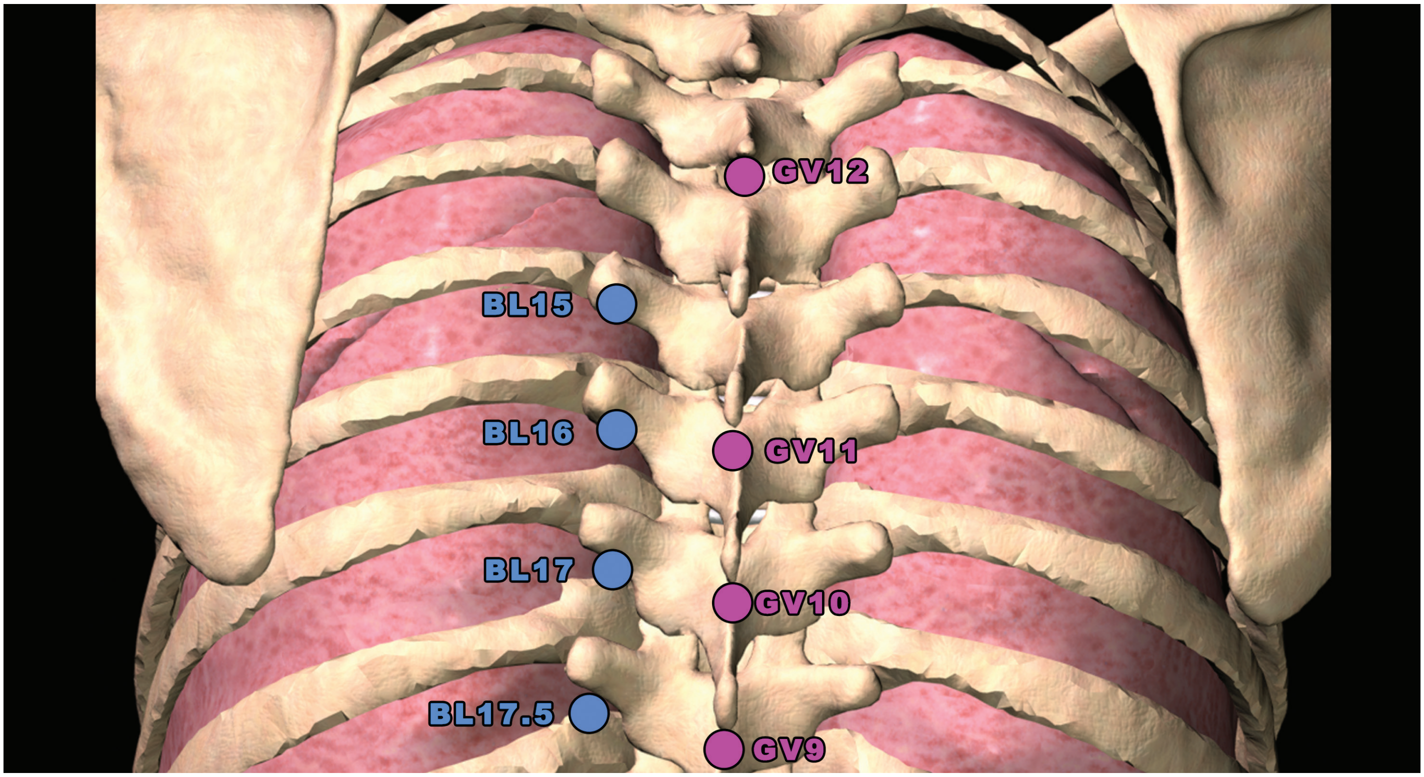


Figure 7-33A. BL 16, "Governing Shu", speaks of the relationship between the BL channel and the GV line, as illustrated here. The azygous system of veins, which includes the azygous, hemiazygous, and accessory hemiazygous veins, embody the vascular basis of the Governor Vessel, one of the eight singular vessels that some call "curious" or "extra" meridian pathways. Instead of ferrying rarified energies, the eight singular vessels consist of actual vascular conduits that are singular, or unique, in nature. The term "azygous" means "unpaired", which applies as well to the hemiazygous and accessory hemiazygous veins.

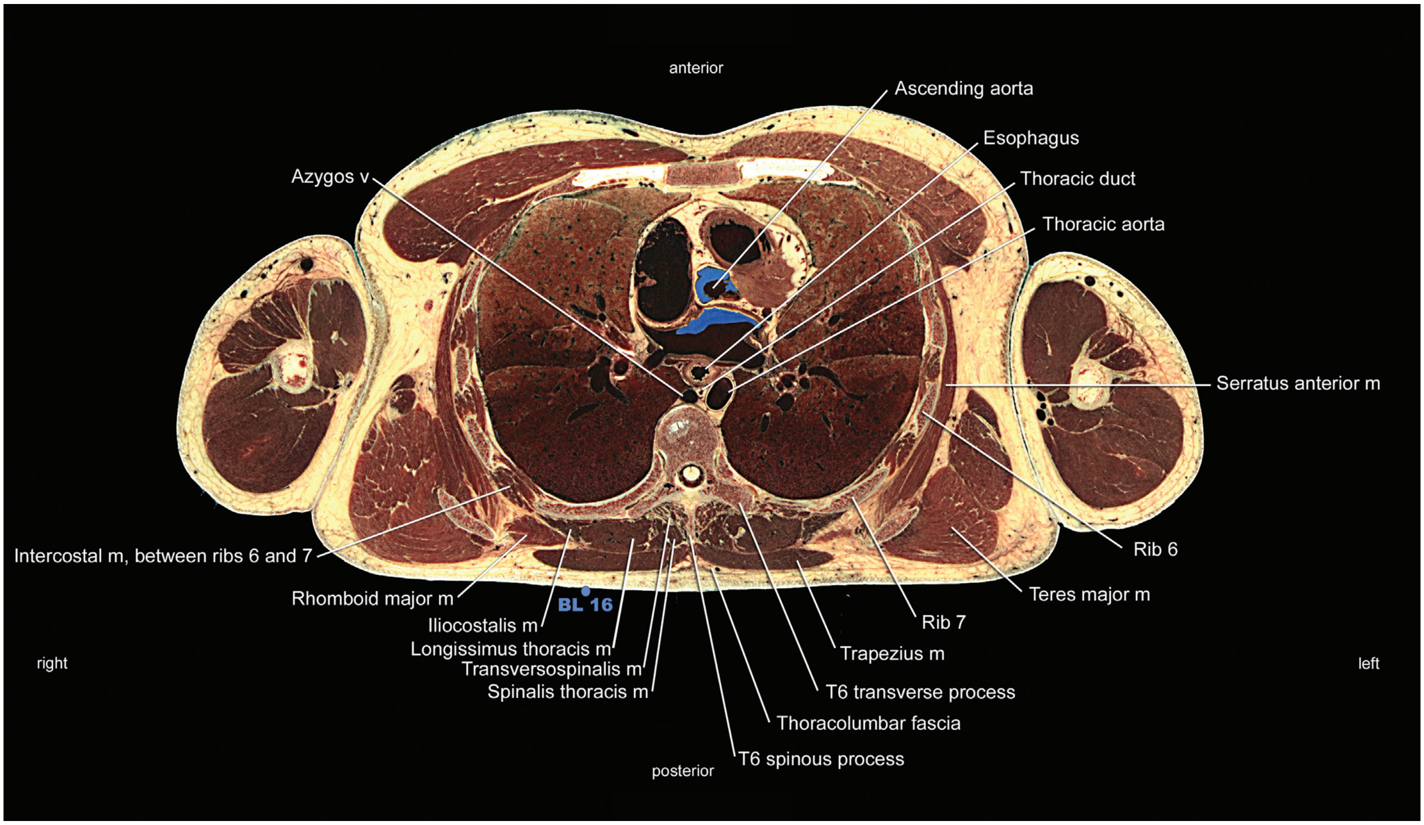

anterior
Ascending aorta
Esophagus
Azygos v
Thoracic duct
Thoracic aorta
Serratus anterior m
Intercostal m, between ribs 6 and 7
Rib 6
Rhomboid major m
BL 16
Teres major m
Iliocostalis m
Rib 7
Longissimus thoracis m
Trapezius m
right
Transversospinalis m
left
Spinalis thoracis m
T6 transverse process
Thoracolumbar fascia
T6 spinous process
posterior

Figure 7-33B. This cross section highlights several magnificent vascular structures where they reside at center stage. As the "Governing Shu", BL 16 associates not with a viscus but with the GV, a vascular network that includes the azygous vein, shown prominently in this cross section anterior to the vertebral body. The azygous vein enters the superior vena cava at or below the level of BL 16 in most cases, at the same level of the bifurcation of the pulmonary trunk. It may join the caval venous system directly or it may empty indirectly, by means of the hemiazygous and accessory hemiazygous veins.

muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression. Furthermore, patients with back pain at this level, especially those with osteoporosis, may be suffering from a vertebral body compression fracture.[2] In these cases, high velocity, low amplitude thrusting manipulation could cause further injury, while acupuncture, careful massage, and laser therapy would more safely provide adjunctive pain relief.

Vessels

- **Sixth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Sixth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: The name for BL 16 as "Du Shu" references the Governor Vessel, manifested in part by the azygous venous system that figures prominently at this level (see Figure 7-33B), for it is at the mid-thoracic level that the hemiazygous vein joins the azygous system cranial to the vertebrae.

Indications and Potential Point Combinations

- **Chest or back pain:** Trigger points in this region (T5, T6) can produce referred pain patterns that extend to the shoulder and the chest wall. When left-sided, the pain caused by these trigger points can mimic cardiac angina.[1]

References

1. Simons DG, Travell JG, and Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body.* Baltimore: Williams & Wilkins, 1999. P. 914.
2. Young C, Munk PL, Heran MK, et al. Treatment of severe vertebral body compression fractures with percutaneous vertebroplasty. *Skeletal Radiol.* 2011;40:1531-1536.

BL 17

Ge Shu "Diaphragm Shu"

On the thoracic vertebral region, approximately 1.5 cun lateral to the caudal border of the T7 spinous process.

CAUTION: Needle carefully to avoid pneumothorax.

Muscles

- **Trapezius muscle:** Inferior fibers depress the scapula and lower the shoulder.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Muscles comprising the BL channel at T7 exhibit far less depth than more cranial levels do. (See Figure 7-34.) Trigger points at BL 17 occur in the trapezius and erector spinae group. Referred pain from trigger points in the deep paraspinal muscles such as the multifidi and rotatores refer pain strongly locally. Trigger points in the midthoracic levels of the iliocostalis thoracis that refer to the parasternal region could lead the patient to believe they are experiencing cardiac dysfunction.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T4-T7 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

Vessels

- **Seventh posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Seventh posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Note the many small vessels in cross section between the aorta and T7 in Figure 7-34. These are likely branches of the adjoining hemiazygous and accessory hemiazygous veins as they travel in the direction of the azygous (or azygos) vessel. While acupuncture would not directly impact venous drainage in the posterior intercostal veins or the azygous system, pumping or compressive forces properly applied to the back would facilitate venous emptying into the caval system and

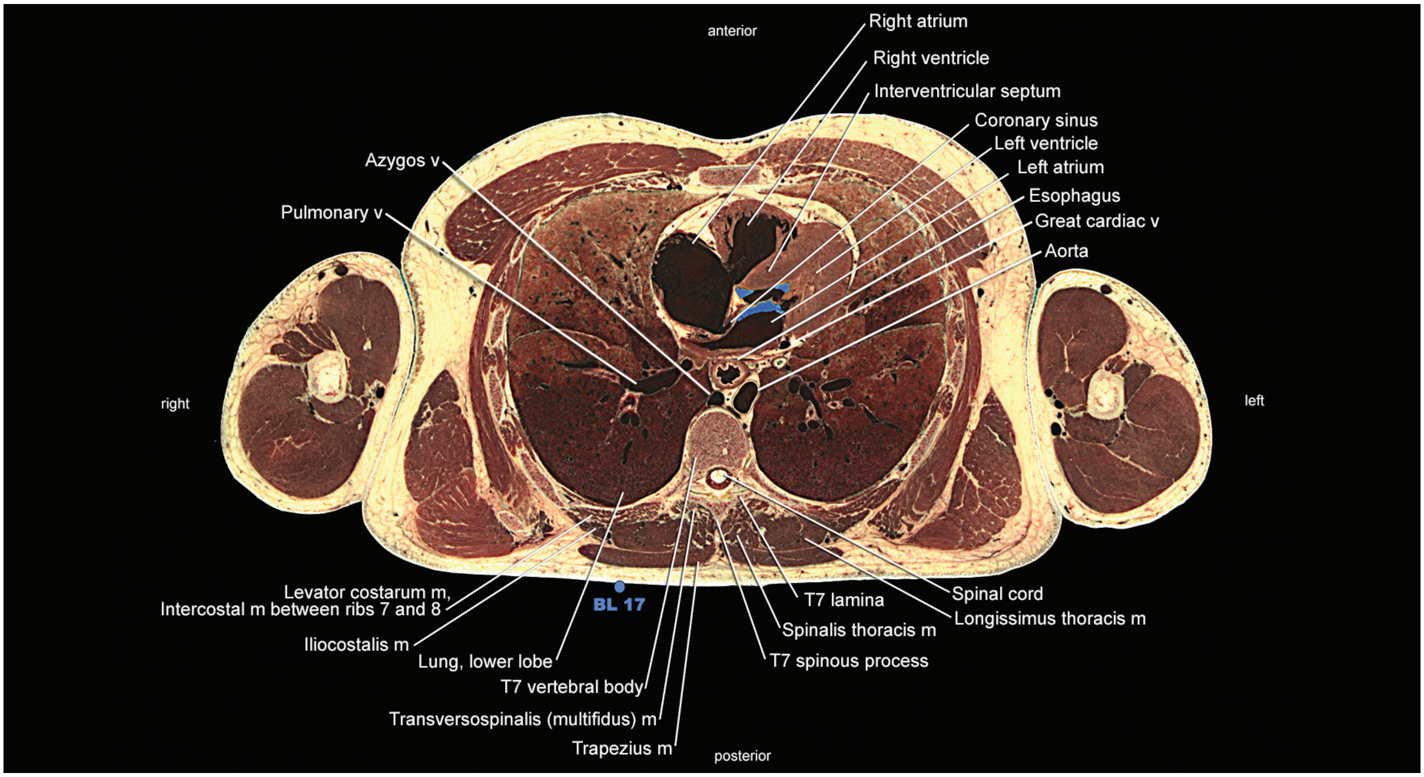

anterior
Right atrium
Right ventricle
Interventricular septum
Coronary sinus
Left ventricle
Left atrium
Esophagus
Great cardiac v
Aorta
Azygos v
Pulmonary v
right
left
Levator costarum m,
Intercostal m between ribs 7 and 8
Iliocostalis m
Lung, lower lobe
T7 vertebral body
Transversospinalis (multifidus) m
Trapezius m
BL 17
T7 lamina
Spinalis thoracis m
T7 spinous process
Spinal cord
Longissimus thoracis m
posterior

Figure 7-34. BL 17 serves a multifaceted role in Chinese medicine, said to influence the diaphragm, blood, and the esophagus. This cross section illustrates the presence of several influential blood-carrying structures sharing the plane with BL 17, including the heart, the pulmonary veins, the aorta, and the azygous venous system. The esophagus sits surrounded by these vascular conduits causing one to wonder, perhaps, how boluses of food affect venous return as they travel toward the stomach.

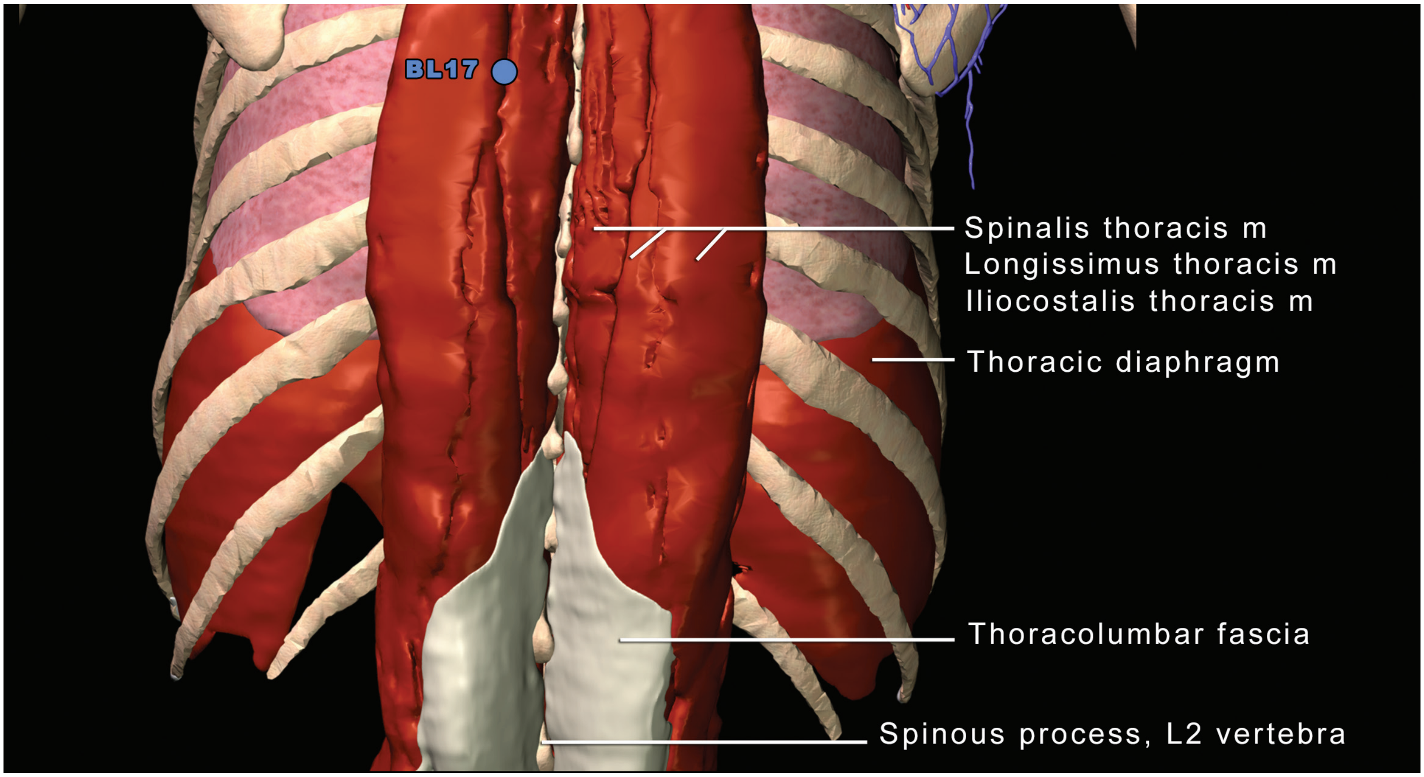


Figure 7-35. The phrenic nerve (C3-C5) supplies the sole source of motor function to the diaphragm as well as sensation to its central tendon; the lower six or seven intercostal nerves and the subcostals supply sensation to the periphery of the diaphragm. The link between BL 17 and the diaphragm may pertain to the fact that its lateral, or costal, portion attaches to the ribs 7-9.

improve elimination of metabolic waste from tense and stressed myofascia of the back.

Indications and Potential Point Combinations

- **Hiccoughs:** BL 17, CV 22, ST 36.[1]
- **Back pain:** BL 17 for local pain; add other tender trigger points; address BL and GV points just below and above vertebral segments related to the presenting somatic dysfunction.
- **Dysphagia:** BL 17, ST 36, CV 22, CV 15.
- **Vomiting or regurgitation:** BL 17, CV 12, PC 6.
- **Anemia:** BL 17, BP 10, ST 36.

Evidence-Based Applications

- Acupuncture and electroacupuncture at BL 17, BL 17.5, BL 20, BL 23, ST 36, and SP 6 effectively regulated levels of glucagon and immune factors, reduced blood coagulability, improved microcirculation, and heightened insulin sensitivity in **type-II diabetics.**[2]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus.**[3]

References

1. Hong L, Zhao YP, Zhang XY et al. Reversal effect of electroacupuncture on the symptom of intractable hiccups in Hepatitis B virus carriers (letter). *Journal of Pain and Symptom Management*. 2008;35(4):335-336.

2. Chen J, Ma Y, Cai S, Liang H, and Shen J. Effects of acupuncture on the high hemagglutination state, blood-sugar-raising hormone and immunocyte factor levels in type-II diabetes patients. *World J Acup-Mox*. 2001;11(4):12-17.

3. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine*. 1995;13(2):91-92.

BL 17.5

Yi Shu; Wei Guan Xia Shu
Pancreas Shu;
"Stomach Controller Lower Shu"

Accessory Back Shu point for pancreas.

On the thoracic vertebral region, approximately 1.5 cun lateral to the caudal border of the T8 spinous process. Find between the longissimus thoracis and iliocostalis thoracis muscle columns.

CAUTION: Needle carefully to avoid pneumothorax. Refer to Figure 7-37 for the remaining contour of lung tissue visible in a cross section at this level.

Muscles

- **Trapezius muscle:** The inferior fibers depress the scapula and lower the shoulder.
- **Latissimus dorsi muscle**: Extends, adducts, medially rotates humerus.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Levator costarum muscle:** May assist with lifting the ribs during inspiration and managing spinal movement through proprioception.

Clinical Relevance: Muscles comprising the BL channel at T8 exhibit far less depth than more cranial levels do. (See Figure 7-37.) Trigger points at BL 17.5 may arise in the dwindling trapezius but are more likely to arise in the more massive longissimus thoracis. Furthermore, referred pain from trigger points in the deep paraspinal muscles such as the multifidi and rotatores refer pain strongly locally. Trigger points in the midthoracic levels of the iliocostalis thoracis that refer to the parasternal region could lead the patient to believe they are experiencing cardiac dysfunction.

As becomes evident in Figure 7-36, the cranial border of the latissimus dorsi muscle may land within the territory of BL 17.5 and as such may encounter an entering needle. When palpated at BL 17.5, patients sometimes complain of tenderness along this edge.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T4-T8 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back, including the levator costarum muscles.[2] Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

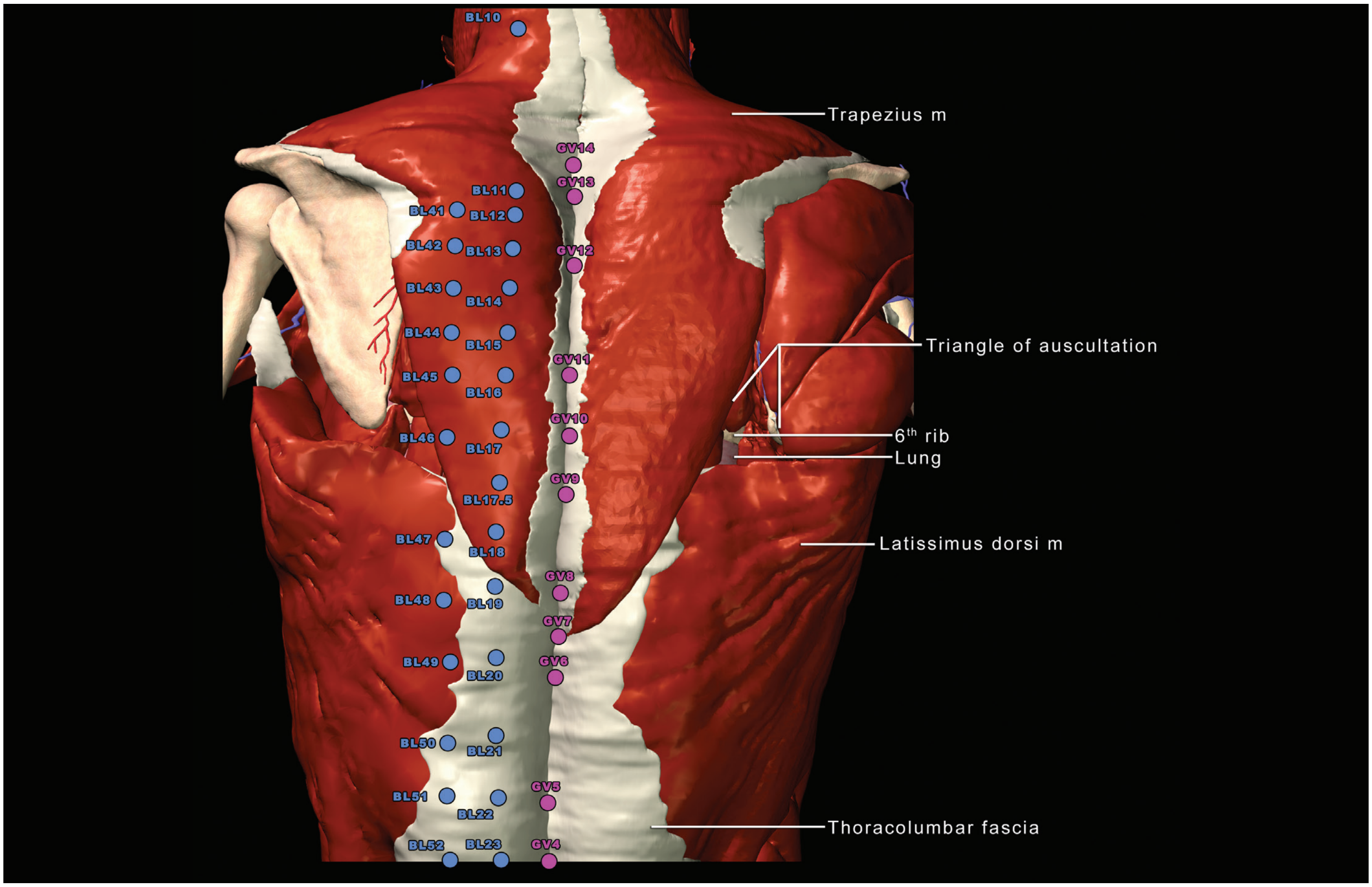


Figure 7-36. Some consider the point between BL 17 and BL 18 (BL 17.5) as the "accessory" Back Shu point for the pancreas. Point formulae for diabetic conditions usually partner BL 17.5 with BL 20, as the early acupuncturists confused the digestive functions of the pancreas with activities of the spleen.

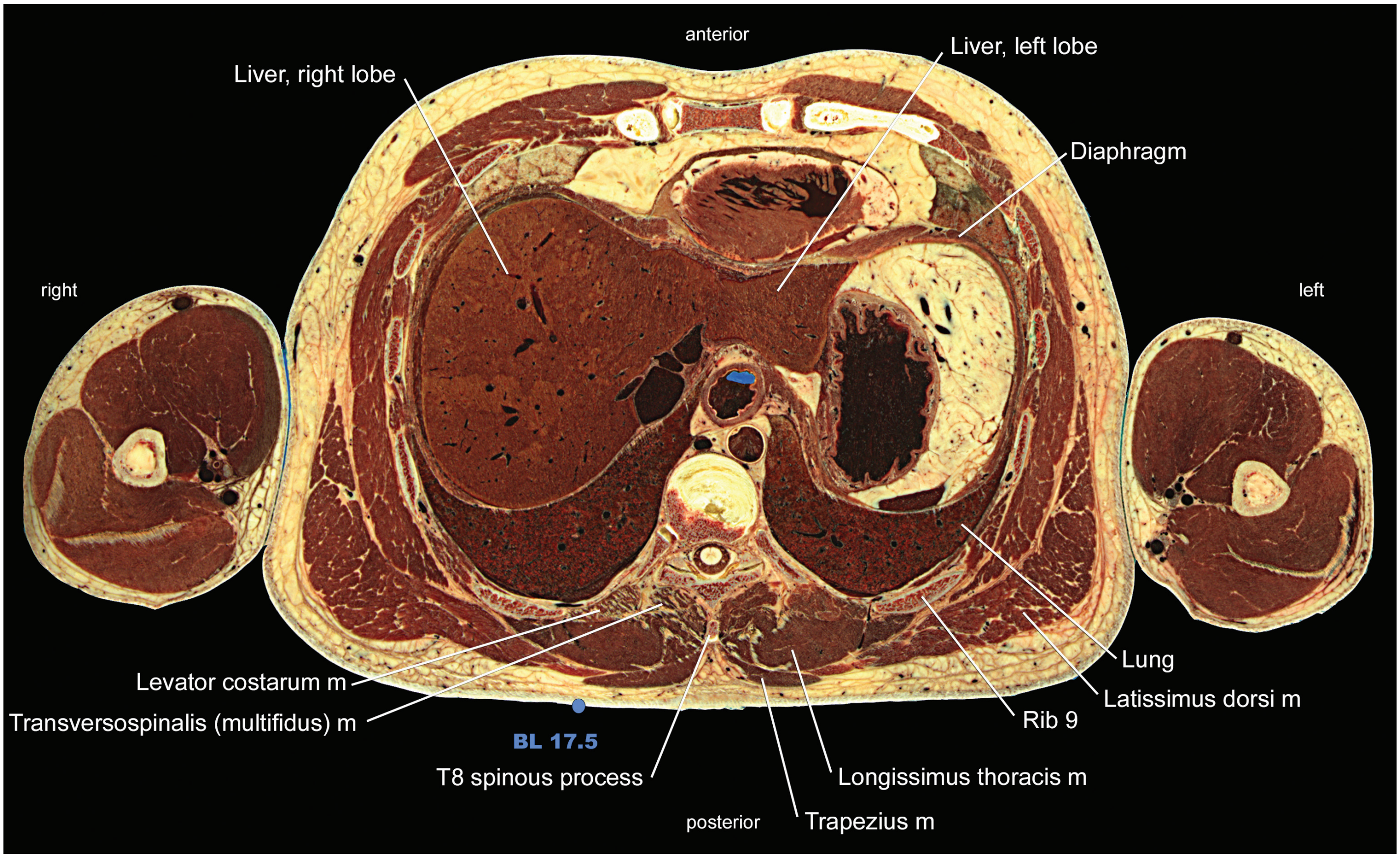


Figure 7-37. While no pancreas appears in this cross section at the level of "Pancreas Shu" (BL 17.5), the transition between the lung and liver shows up well here. The diaphragm, too, associated historically with BL 17, becomes apparent on the left ventral intra-abdominal wall.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

Vessels

- **Eighth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Eighth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Local thoracic pain:** BL 17.5 if tender. Check for diaphragmatic restriction or other compromised respiratory patterns secondary to myofascial restriction over the thoracic cage. Treat tender trigger points.
- **Pancreatitis:** BL 17.5, BL 20, CV 12, PC 6, ST 36.[3]
- **Diabetes mellitus:** BL 17.5, BL 20, SP 6, LR 13, ST 36.
- **Diabetic nephropathy:** BL 17.5, BL 20, BL 23, and ST 36.[4]

Evidence-Based Applications

- Acupuncture and electroacupuncture at BL 17, BL 17.5, BL 20, BL 23, ST 36, and SP 6 effectively regulated levels of glucagon and immune factors, reduced blood coagulability, improved microcirculation, and heightened insulin sensitivity in **type-II diabetics.**[1]
- Acupuncture at BL 17.5, BL 20, SP 6, ST 36, and other points, along with a controlled diet, assisted in lowering **postprandial blood glucose levels** more than in a control group of geriatric patients with impaired glucose tolerance.

References

1. Chen J, Ma Y, Cai S, Liang H, and Shen J. Effects of acupuncture on the high hemagglutination state, blood-sugar-raising hormone and immunocyte factor levels in type-II diabetes patients. *World J Acup-Mox.* 2001;11(4):12-17.
2. Morrison AB. The levatores costarum and their nerve supply. *J Anat.* 1954;88(Pt 1):19-24.
3. Ge HY and Chen B. Clinical observation of acute pancreatitis treated with acupoint application combined with medicine. *Zhongguo Zhen Jiu.* 2012;32(7):602-604.
4. Chen YB, Chen RN, and Li YL. Observation on therapeutic effect of type II early diabetic nephropathies intervened by acupoint thread embedding. *Zhongguo Zhen Jiu.* 2012;32(5):390-394.
5. Wu Y, Fei M, He Y, et al. Clinical observation on senile patients with impaired glucose tolerance treated by point application. *J Tradit Chin Med.* 2006;26(2):110-112.

BL 18

Gan Shu "Liver Shu"

On the thoracic vertebral region, 1.5 inferior border of the T9 spinous process. Find along the border separating the longissimus thoracis and iliocostalis thoracis muscles.

CAUTION: Needle carefully to avoid pneumothorax. View Figure 7-38A to examine where the caudal, dorsal lung fields fall in relation to the inner and outer BL channel points. Note, however, that these are unexpanded lungs.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: The longissimus thoracis muscle beneath BL 18 begins to build in bulk. (See Figure 7-39.) More muscle tissue between a point and underlying organs translates to

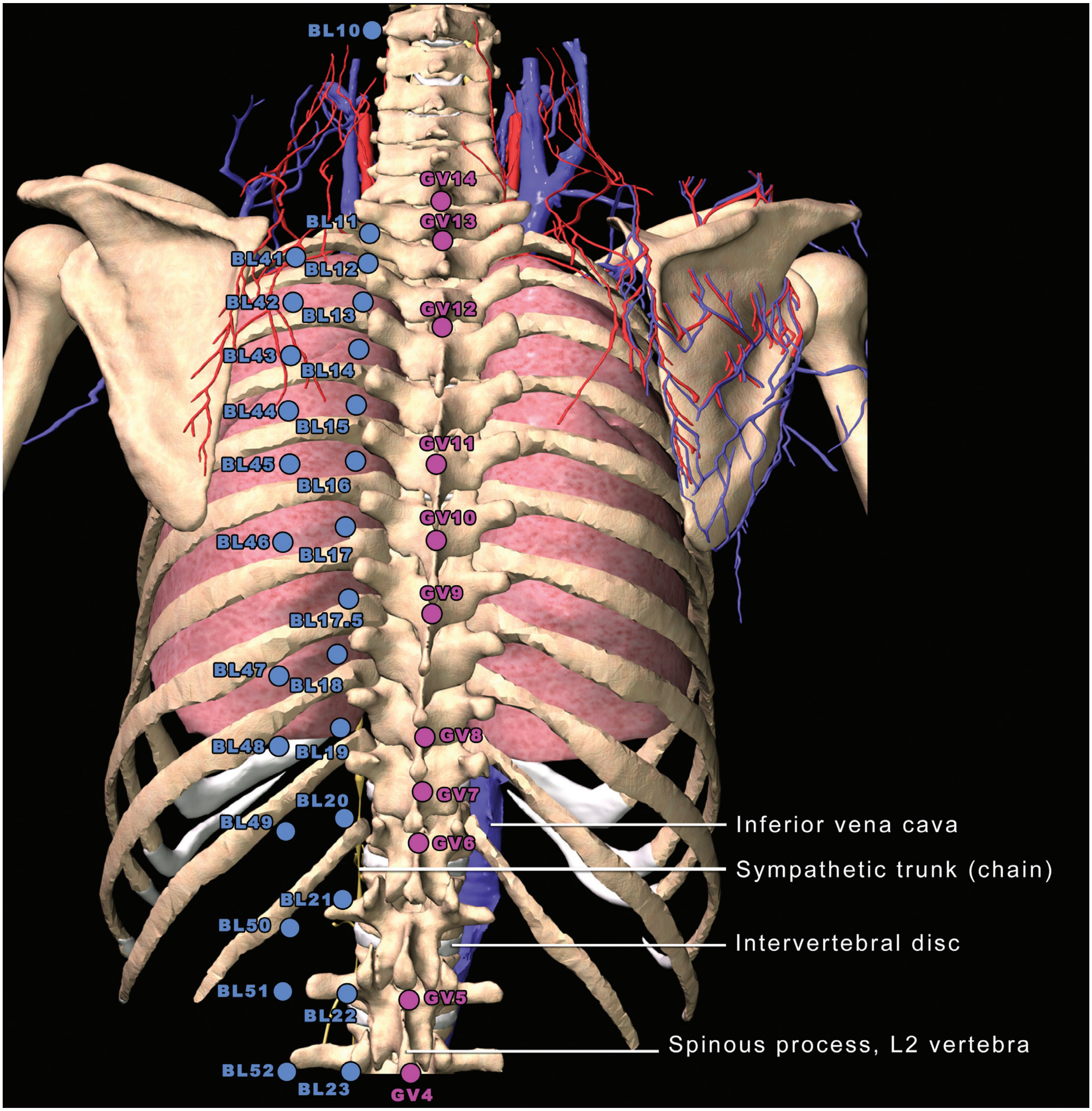

BL10
GV14
BL11
GV13
BL41
BL12
BL42
BL13
GV12
BL43
BL14
BL44
BL15
GV11
BL45
BL16
GV10
BL46
BL17
GV9
BL17.5
BL47
BL18
GV8
BL48
BL19
GV7
BL20
Inferior vena cava
BL49
GV6
Sympathetic trunk (chain)
BL21
BL50
Intervertebral disc
BL51
GV5
BL22
Spinous process, L2 vertebra
BL52
BL23
GV4

Figure 7-38A. The Back Shu points divide roughly into three groups: cranial thoracic, thoracolumbar, and lumbosacral, corresponding to the organs residing in the upper, middle, and lower "heaters" in Chinese medicine. The heaters correspond to organ activities in the thorax, cranial abdomen, and caudal abdomen/pelvis.

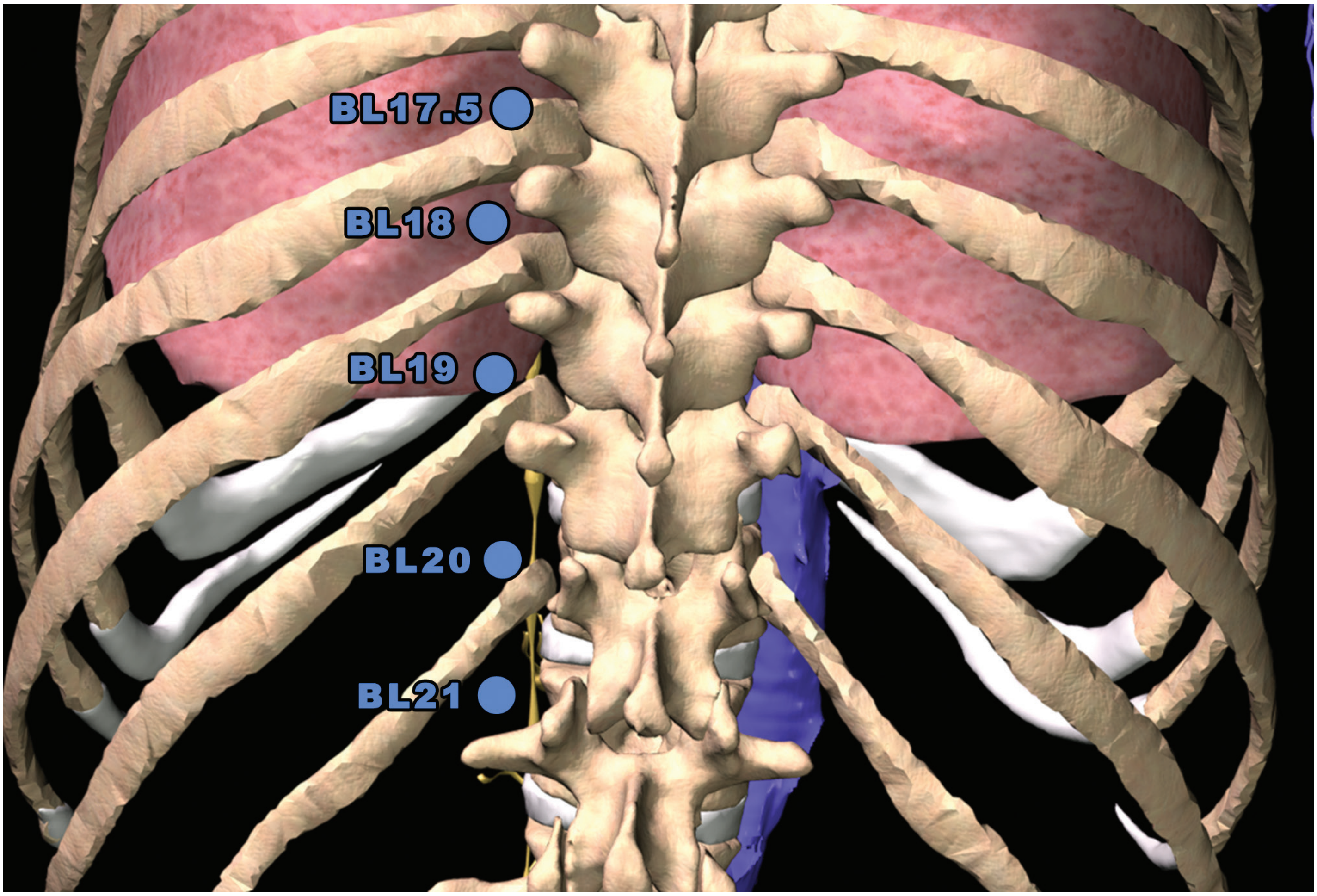


Figure 7-38B. This close-up of BL18 reveals the continuation of the paravertebral sympathetic chain ganglia, close to the inner BL channel.

greater needling safety. At the same time, muscles in the caudal thoracic region can develop numerous trigger points that issue back pain vertically from sacroiliac joint to shoulder or around the waist to the abdomen, roughly following the dermatome described by an entrapped spinal nerve branch.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T5-T9 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 18 acts as the Liver Back Shu point because the overlapping sympathetic nerve pathways supplying the liver arise from the T8 to T11 spinal cord segments.

Vessels

- **Ninth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Ninth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygos venous system, which conveys venous blood to the superior vena cava. The azygos vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Liver and gall bladder dysfunction:** BL 18, BL 19, LR 14, GB 24, ST 36.
- **Pain in the lateral costal region:** Palpate for trigger points, if tender within the T8-T10 dermatome, BL 18, with BL 17.5 and BL 19 as well as local tender areas.

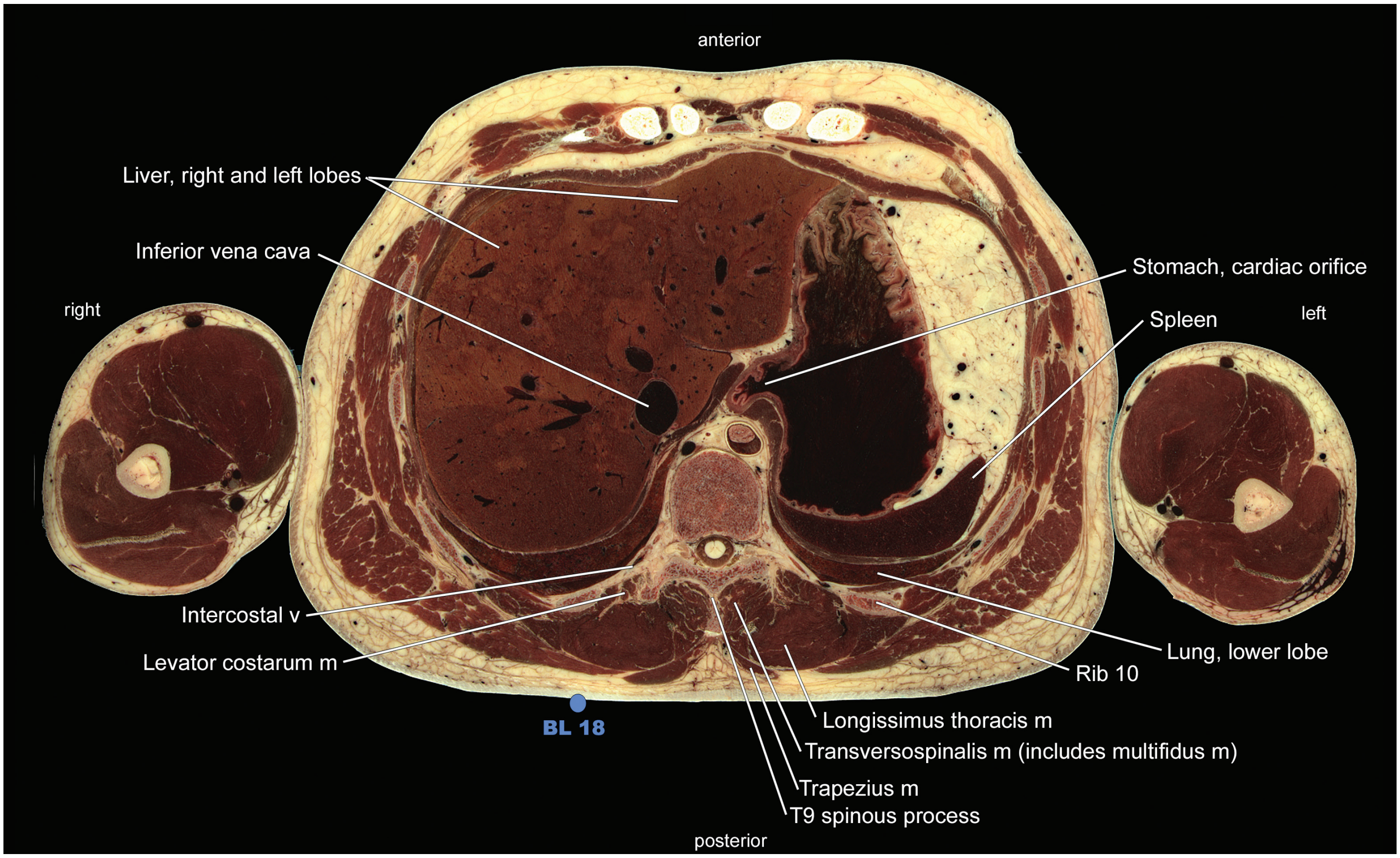

anterior
Liver, right and left lobes
Inferior vena cava
right
Stomach, cardiac orifice
Spleen
left
Intercostal v
Levator costarum m
Lung, lower lobe
Rib 10
BL 18
Longissimus thoracis m
Transversospinalis m (includes multifidus m)
Trapezius m
T9 spinous process
posterior

Figure 7-39. The liver dominates this cross section at BL 18, the "Liver Shu" point.

- **Back pain:** BL 18 and other points tender to palpation along the erector spinae muscles. Consider accompanying outer BL line points. Add BL 40, BL 60.

References

1. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

BL 19

Dan Shu "Gall Bladder Shu"

On the thoracic vertebral region, 1.5 cun lateral to the caudal border of the T10 spinous process. Locate in the 10th intercostal space between the longissimus and iliocostalis thoracis muscle. View the distinct border between the two muscles in Figure 7-41 on the left side of the back.

CAUTION: Needle carefully to avoid pneumothorax.

Muscles

- **Trapezius muscle:** Inferior fibers depress the scapula and lower the shoulder.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm. The location of the serratus posterior inferior and the serratus posterior superior muscles suggests that they provide proprioceptive information to the spine that aids its stability.[1] Myofascial restriction likely contributes to back pain.
- Erector spinae muscles: Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: The longissimus thoracis muscle beneath BL 19 has continued to grow in thickness and strength as it descends the spine. (See Figure 7-41.) More muscle tissue beneath a point translates to greater needling safety. However, trigger point dysfunction manifests in this and surrounding muscles, as well, referring pain to the back, side, or abdomen.

In addition, BL 19 encounters the beginnings of the thoracolumbar fascia. The vertebral aponeurosis portion of the thoracolumbar fascia attaches medially to the spinous processes of the thoracic vertebrae. Its cranial portion blends with the deep fascia of the neck. Its caudal extent forms a continuous layer that covers the erector spinae muscle and descends toward the sacrotuberous ligament. The thoracolumbar fascia aids in stabilizing the lumbar spine through force adjustment. The fascia may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles.[2,3]

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.

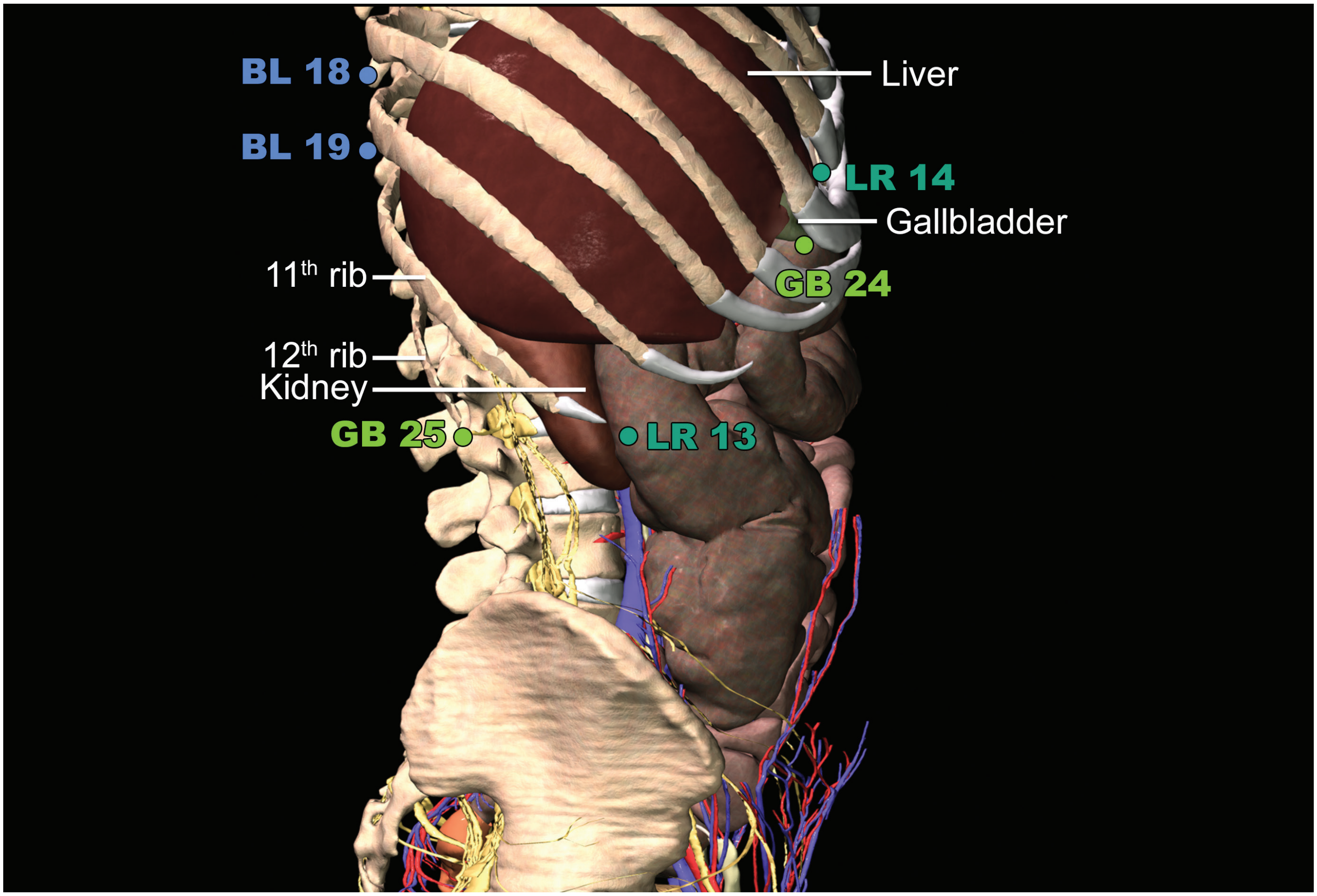


Figure 7-40. This right lateral view of the trunk depicts the way in which BL 19, the Back Shu point for the Gallbladder, rests near the same horizontal plane as the gallbladder itself, similar to how BL 18 overlays the liver. Note, as well, how the Front Mu pairs for BL 18 and BL 19 (i.e., LR 14 and GB 24, respectively, live along adjacent dermatomes.

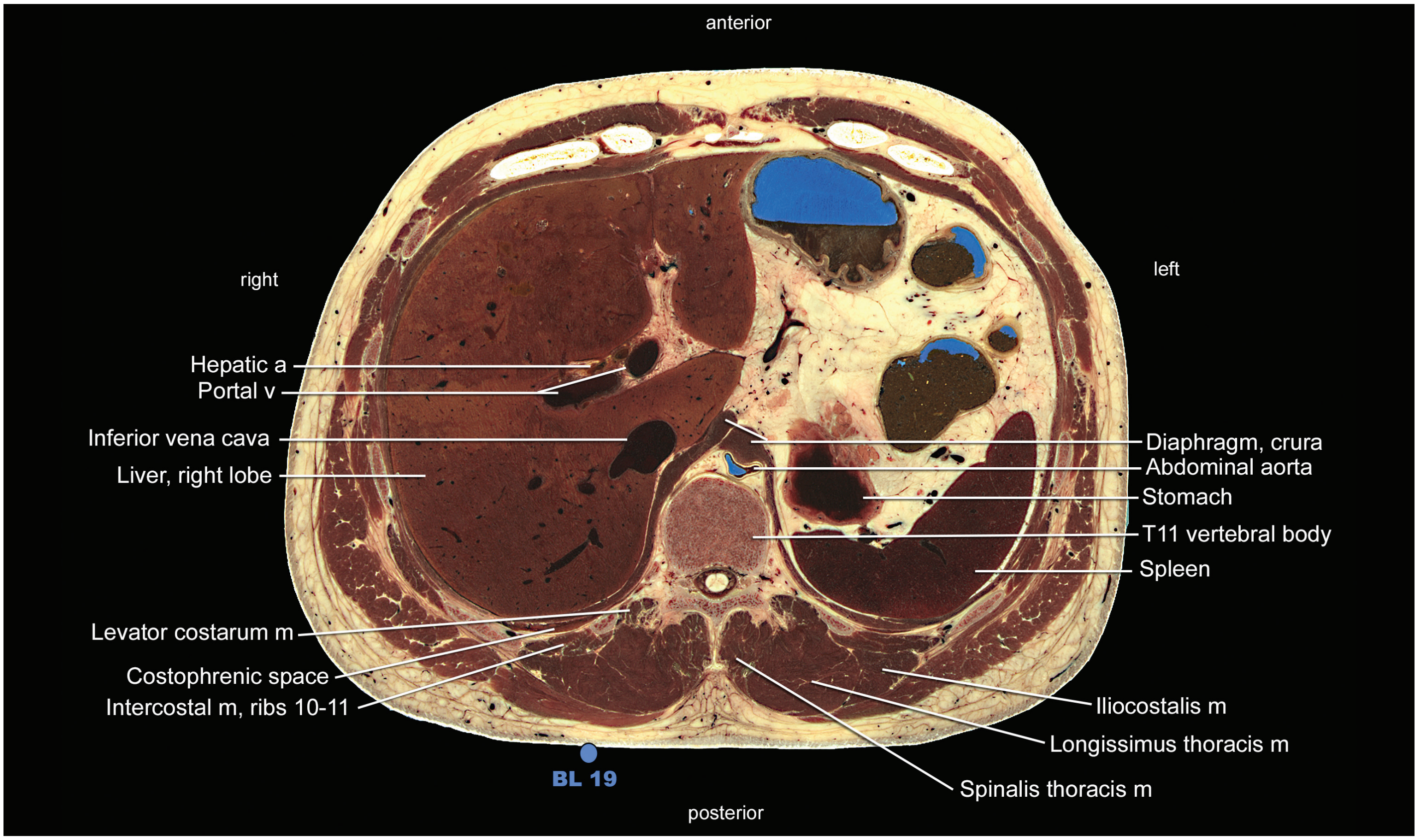


Figure 7-41. While the gallbladder does not appear in this cross section, BL 19 or "Gallbladder Shu", at the T10 dermatome, connects through somatovisceral and viscerosomatic reflexes to the gallbladder. That is, the T9-T11 dermatomes associate with the same spinal segments that issue sympathetics to the gallbladder. The powerful erector spinae muscles are growing in size as they migrate toward the lumbar levels.

- **T6-T10 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 19 acts as the Gallbladder Back Shu point in the T10 dermatome because the overlapping sympathetic nerve pathways supplying the liver arise from the T9 to T11 spinal cord segments.[4]

Vessels

- **Tenth posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Tenth posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Gall bladder problems (cholecystitis, cholelithiasis):** BL 19, BL 18, GB 24, GB 34, LR 14, ST 19, ST 36.[5]
- **Pain in the lateral costal region:** BL 19 if tender, along with other tender points in this and nearby dermatomes and myotomes.
- **Depression:** BL 15, BL 17, BL 18, BL 19, LI 4, LR 3, GV 20, Yintang.[6]

References

1. Vilensky JA, Baltes M, Weikel L, et al. Serratus posterior muscles: anatomy, clinical relevance, and function. *Clinical Anatomy.* 2001;14:237-241.
2. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129
3. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
4. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.
5. Song MP. Clinical observation on frequency-changeable electroacupuncture for treatment of cholelithiasis. *Zhongguo Zhen Jiu.* 2006;26(11):772-774.
6. Fan L, Fu WB, Xu NG, et al. Impacts of acupuncture and moxibustion on outcome indices of depression patients' subjective reports. *Zhongguo Zhen Jiu.* 2012;32(5):385-389.

BL 20

Pi Shu "Spleen Shu"

On the thoracic vertebral region, 1.5 cun lateral to the caudal, or inferior, border of the T11 spinous process, in the last intercostal space. Locate between the longissimus and iliocostalis muscles.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (includes the transversospinal muscles):** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Transversospinal muscles:** These muscles originate from the transverse processes of a given vertebra and insert on the spinous processes of the upper vertebra. Transversospinal muscles include the semispinalis (capitis, cervicis, and thoracis), multifidus, and rotatores (cervicis, thoracis, and lumborum) muscles. All are innervated by dorsal primary rami of spinal nerves. The semispinalis arises from transverse processes of C4 to T12 vertebrae; the multifidus arises from the transverse processes of T1-T3; the rotatores arise from the transverse processes of vertebrae and insert onto the lower border and lateral portion of the lamina of the vertebra located above it (and only exist in the thoracic region).

The transversospinal muscles extend the head, cervical, and thoracic regions; they stabilize vertebral movements; assist with local extension and rotational movements. Rotatores may also function as proprioceptive organs.

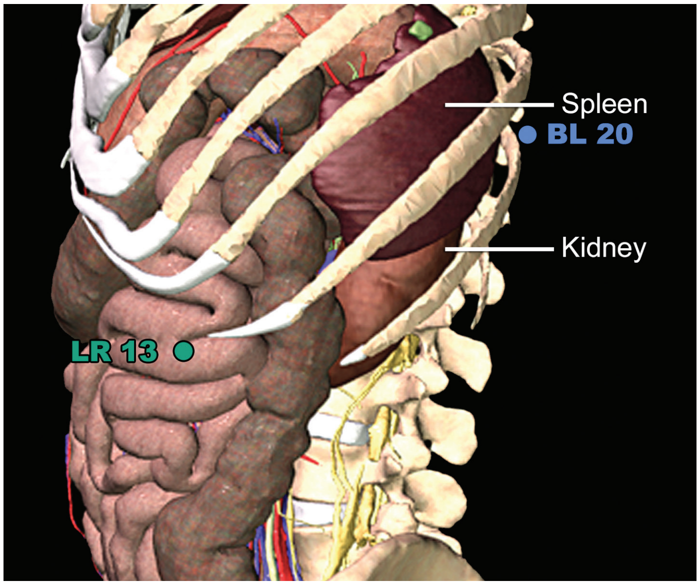


Figure 7-42. BL 20, "Spleen Shu" lands at the same level as the spleen (on the left side). It relates to its Front Mu partner, LR 13, by sharing spinal cord segments and adjacent dermatomes. The spleen organ receives sympathetic innervation from the T8 through T11 spinal cord segments, and BL 20 occupies the T11 dermatome.[11] The sympathetic chain and spinal nerves impacted by BL channel points show clearly in this image; look for them adjacent to the vertebral column cranial and caudal to the spleen.

Clinical Relevance: The longissimus and iliocostalis muscles at the level of BL 20 are becoming rounder in shape and often more resistant to needling because of their size, shape, and predisposition to developing myofascial restriction in this region. (See Figure 7-43 and compare with more cranial cross sections where the erector spinae muscles take on a flatter appearance.)

The thoracolumbar fascia begins to build in breadth and thickness, investing around the columns and laying atop of the paraspinal musculature. The thoracolumbar fascia aids in stabilizing the lumbar spine by adjusting forces placed upon it by musculature and ligamentous attachments. The fascia may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles.[8,9]

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T7-T11 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 20 serves as the Spleen Back Shu point in the T11 dermatome; the spleen organ receives its sympathetic nerve supply from the T8-T11 spinal cord segments, indicating neuroanatomic overlap and justification for its consideration as a neuroanatomic conduit of impulses from the soma to the viscera.[10]

Vessels

- **Eleventh posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **Eleventh posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Digestive problems:** lack of appetite, poor digestion, nausea, vomiting, dysentery, diarrhea, constipation: BL 20, LR 13, BL 21, CV 12, ST 36.

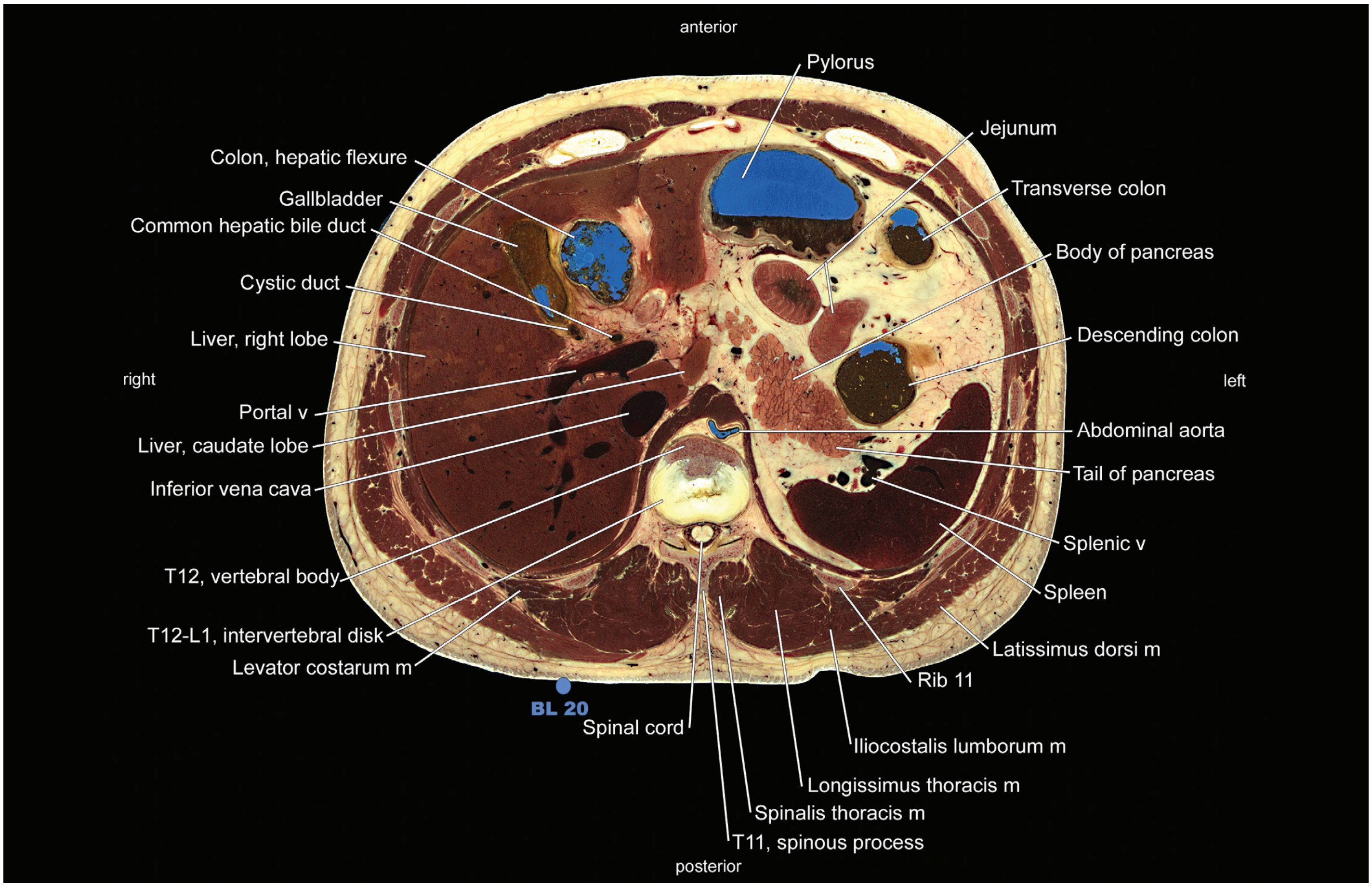

anterior
Pylorus
Jejunum
Colon, hepatic flexure
Transverse colon
Gallbladder
Common hepatic bile duct
Body of pancreas
Cystic duct
Descending colon
Liver, right lobe
right
left
Portal v
Abdominal aorta
Liver, caudate lobe
Tail of pancreas
Inferior vena cava
Splenic v
T12, vertebral body
Spleen
T12-L1, intervertebral disk
Latissimus dorsi m
Levator costarum m
Rib 11
BL 20
Spinal cord
Iliocostalis lumborum m
Longissimus thoracis m
Spinalis thoracis m
T11, spinous process
posterior

Figure 7-43. "Spleen Shu" lives at the same level as both the spleen and pancreas, seen in this cross section. The ancient Chinese mistook the pancreas and its effects on digestion for the spleen, to which they erroneously attributed activities such as, expressed in their metaphorical allegory, enzymatic degradation of food, its subsequent assimilation, and modulation of blood glucose levels to the spleen.[3]

Evidence-Based Applications

- Acupuncture at ST 36, BL 15, BL 20, HT 5, and PC 6 reduced the number of attacks per week in **angina pectoris** patients and reduced ST-segment depression during exercise, possibly indicating protection of the myocardium from ischemia.[1]
- Acupuncture and electroacupuncture at BL 17, BL 17.5, BL 20, BL 23, ST 36, and SP 6 effectively regulated levels of glucagon and immune factors, reduced blood coagulability, improved microcirculation, and heightened insulin sensitivity in **type-II diabetics**.[2]
- A case series reported that BL 20 and BL 21 effectively treated **stomach pain** from inflammation, ulcer, and carcinoma.[3]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[4]
- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis**.[5]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[6]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an immunomodulatory effect for patients with **lichen ruber planus**.[7]

References

1. Richter A, Herlitz J, and Hialmarson A. Effect of acupuncture in patients with angina pectoris. *European Heart Journal.* 1991;12:175-178.
2. Chen J, Ma Y, Cai S, Liang H, and Shen J. Effects of acupuncture on the high hemagglutination state, blood-sugar-raising hormone and immunocyte factor levels in type-II diabetes patients. *World J Acup-Mox.* 2001;11(4):12-17.
3. Zhou C. Treating 40 cases of actue stomach ache by electroacupuncture of Pishu and Weishu. *International Journal of Clinical Acupuncture.* 1993;4(2):189-190.
4. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.
5. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine.* 2004;24(3):163-165.
6. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
7. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine.* 1995;13(2):91-92.
8. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129
9. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
10. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.
11. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

BL 21

Wei Shu "Stomach Shu"

At the thoracolumbar junction, 1.5 cun lateral to the inferior border of the T12 spinous process. Locate in the groove between the longissimus and iliocostalis erector spinae muscles, caudal to the last rib.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: The longissimus and iliocostalis muscles at the level of BL 21 have grown rounder in shape. Their size and location predispose them to developing myofascial restriction. (See Figure 7-45.)

The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[7,8]

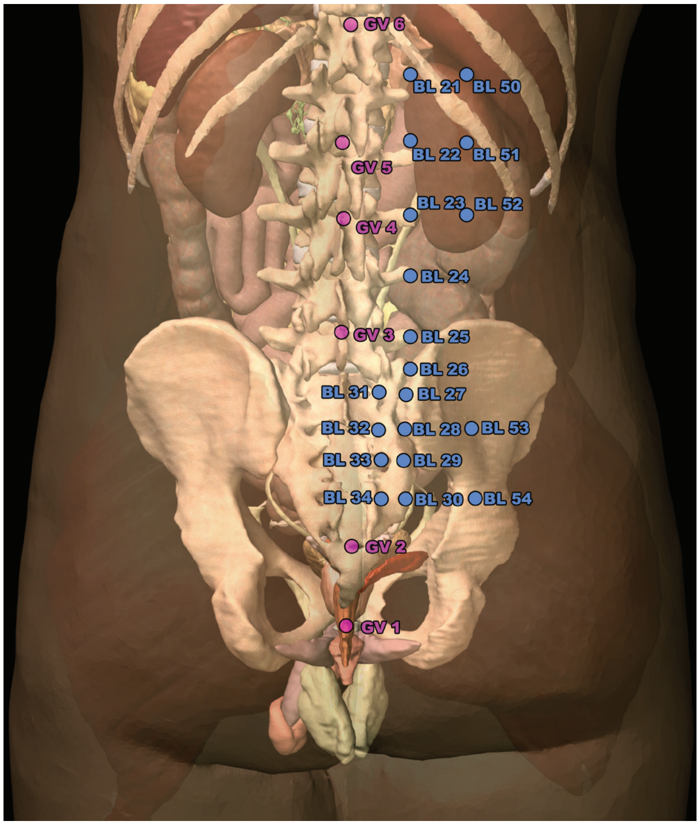


Figure 7-44. BL 21, "Stomach Shu", sits within the T12 dermatome. The stomach organ receives sympathetic nerve supply from the T5 through T12 spinal cord segments.[12] Thus, although the stomach usually does not extend to T12, its sympathetic nervous system connections associate, in part, with this level.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T7-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[9]

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 21 has been called the Stomach Back Shu point. It occupies the T12 dermatome, sharing spinal segmental innervation with the stomach organ, supplied by T5 through T12.[10]

Vessels

- **Twelfth posterior intercostal artery (subcostal artery):** Arises from the thoracic aorta. Supplies the muscles of the anterolateral abdominal wall.
- **Twelfth posterior intercostal vein (subcostal vein):** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava.

The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

From a singular vessel perspective, the subcostal vessels equate with the Dai Mai, or "belt meridian" vessel. Its physiologic effects pertain to the activities of the subcostal and L1 spinal nerves and associated sympathetic pathways.[11] Refer to section above under "Nerves" to review the activities of L1 that relate to the innervation of the pelvic region.

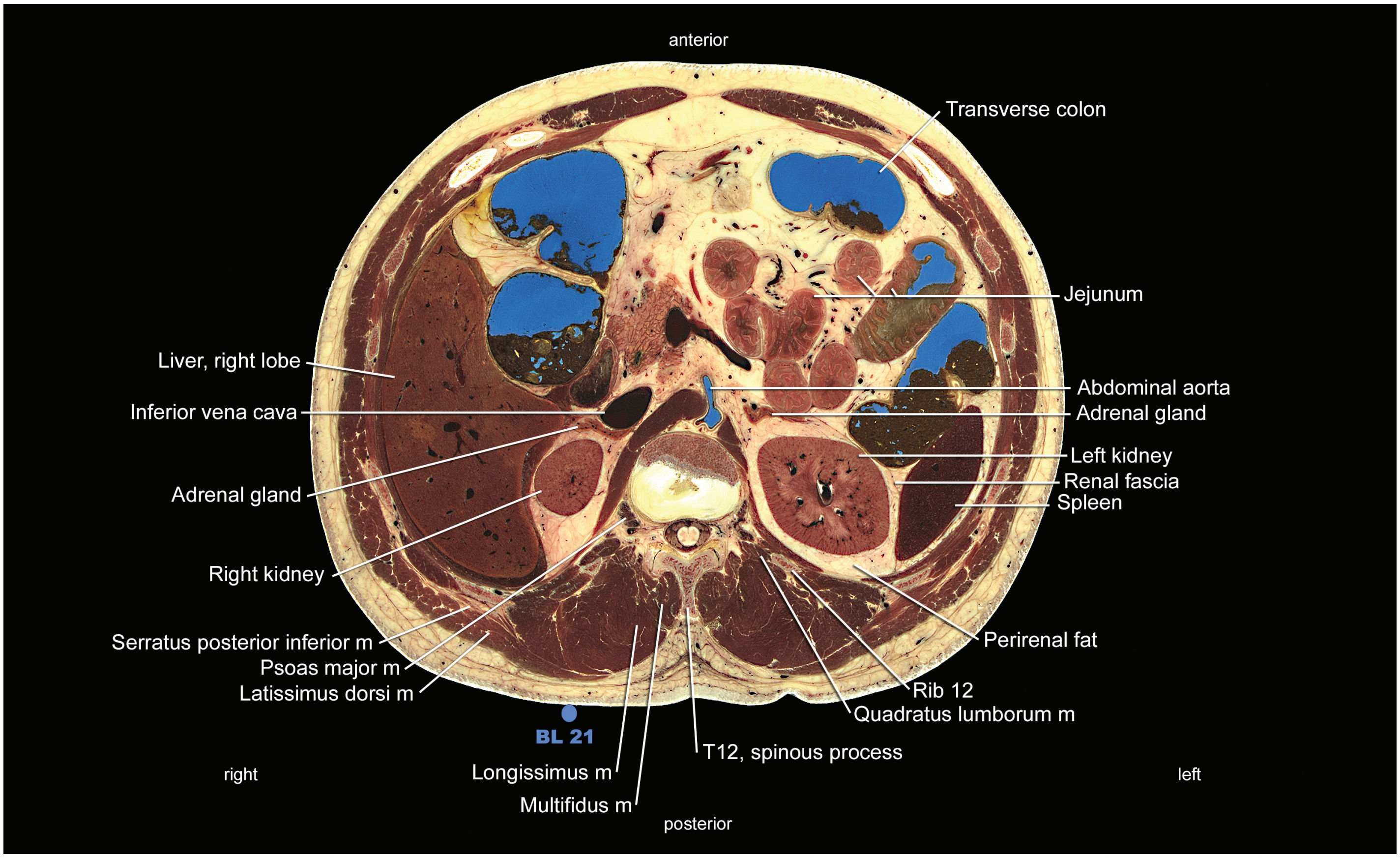


Figure 7-45. This cross-section clearly depicts several structures responsible for spinal integrity and postural support, including the erector spinae, the serratus posterior inferior, and quadratus lumborum musculature.

Indications and Potential Point Combinations

- **All gastrointestinal disorders:** lack of appetite, gastritis, nausea, fullness in stomach, vomiting, ulcers, diarrhea: BL 21, BL 20, CV 12, ST 36, LI 4, SP 6.
- **Low back pain:** BL 21, other BL line points that exhibit tenderness to palpation. GV points at levels with spinal pathology (other than cancer). BL 40, BL 60, KI 3.
- **Eructation and projectile vomiting stemming from a trigger point on the posterior abdominal wall:** BL 21.

Evidence-Based Applications

- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[1]
- Regarding the effects of acupuncture on canine **gastric motility** using ST 36, ST 40, ST 41, ST 42, ST 45, BL 12, or CV 12, only stimulation of ST 36 or BL 21 promoted gastric motility, whereas motility decreased with CV 12 stimulation. No significant changes in motility occurred after acupuncture at ST 40, ST 41, ST 42, or ST 45.[2]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[3]
- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis.**[4]
- A case series reported that BL 20 and BL 21 effectively treated **stomach pain** from inflammation, ulcer, and carcinoma.[5]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency** after transurethral resection of the prostate.[6]

References

1. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology.* 1992;147:16-18.
2. Jeong SM, Kim H-Y, and Nam T-C. Effect of traditional acupuncture on canine gastric motility. *J Vet Clin.* 2002;19(4):397-400.
3. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.
4. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine.* 2004;24(3):163-165.
5. Zhou C. Treating 40 cases of actue stomach ache by electroacupuncture of Pishu and Weishu. *International Journal of Clinical Acupuncture.* 1993;4(2):189-190.
6. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.
7. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129
8. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
9. Lierse W. Blood vessels and nerves of the human penis. *Urol Int.* 1982;37:145-151.
10. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.
11. Robinson N. The anatomical basis of the Eight Extraordinary Vessels: how to translate Qi Jing Ba Mai. *American Journal of Traditional Chinese Veterinary Medicine.* 2009;4(2):7-13.
12. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

BL 22

San Jiao Shu "Triple Burner Shu"

Accessory Back Shu point for the adrenal gland.

On the lumbar vertebral region, 1.5 cun lateral to the inferior border of the L1 spinous process. Find in the groove between the longissimus and iliocostalis lumborum muscles.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure.

Clinical Relevance: Excess tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[4] The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[5,6]

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: The epaxial muscles of the lumbar spine are larger than in the thoracic region; they can also harbor more trigger points and cause more nerve entrapment, as shown in Figure 7-47.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T8-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral

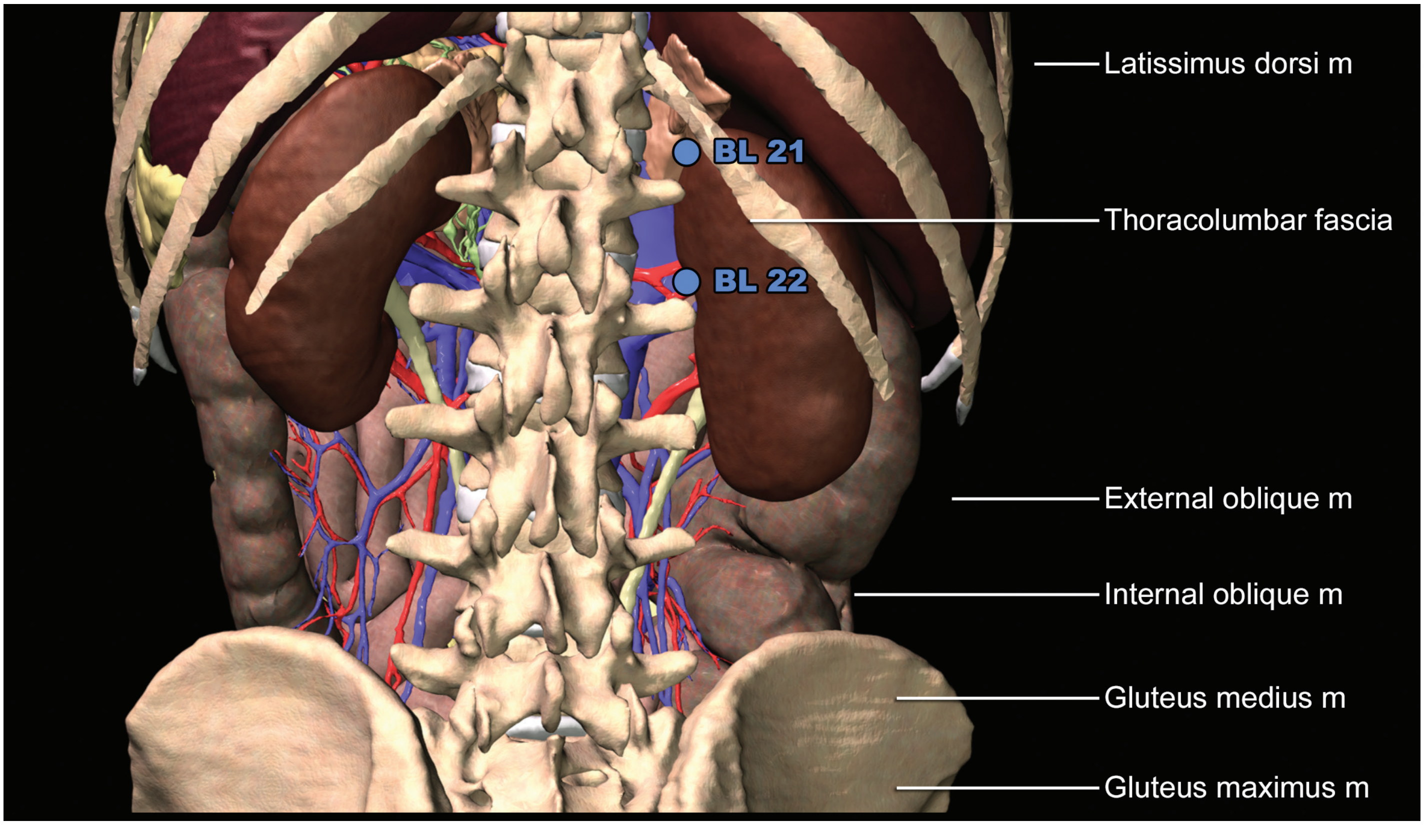


Figure 7-46. "Triple Burner Shu" refers to the endocrine aspects of the adrenal gland, which stokes the flames of the three internal heaters, or truncal regions. This image illustrates the topographical relationship of the adrenal gland and BL 22.

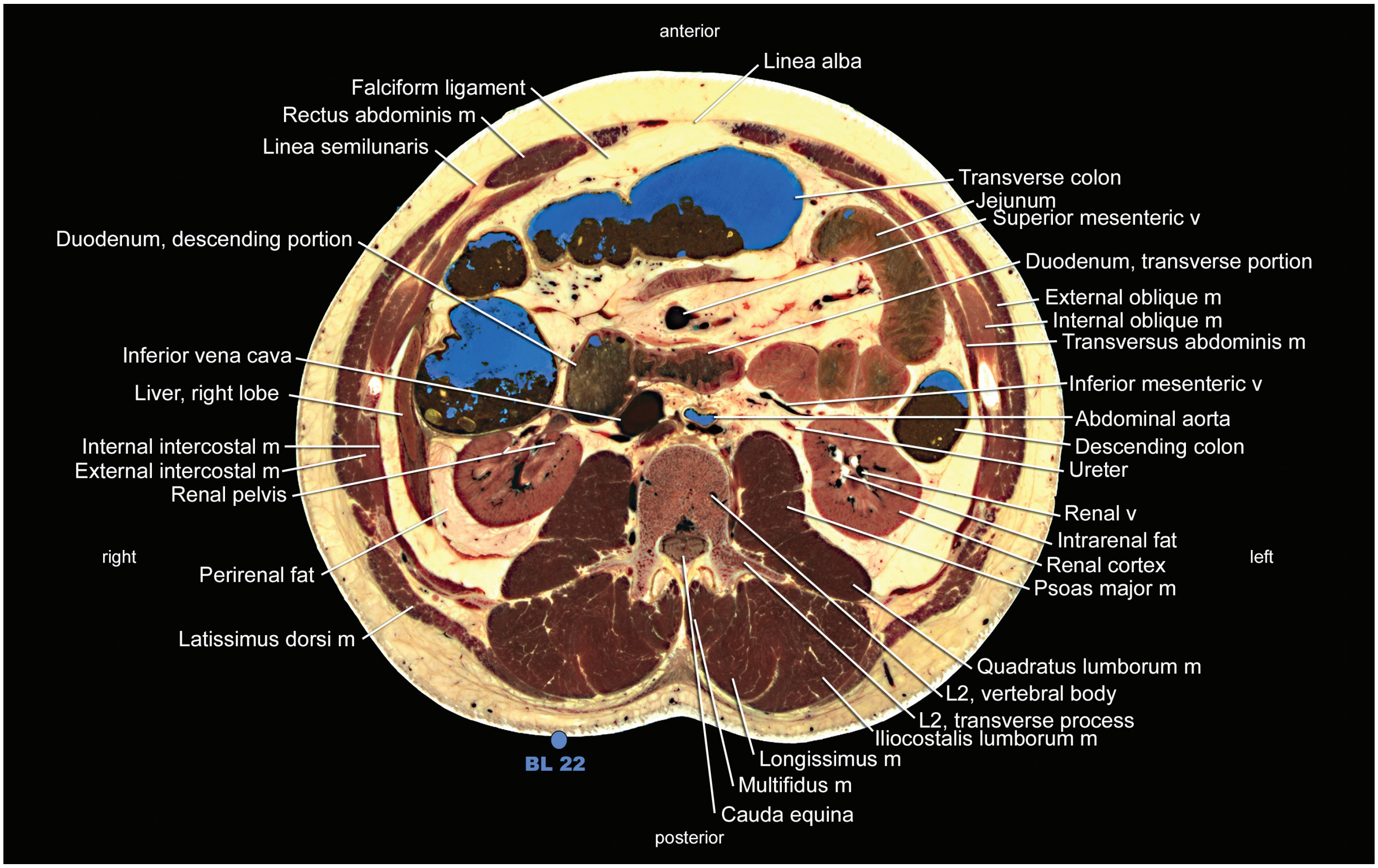

anterior
Linea alba
Falciform ligament
Rectus abdominis m
Linea semilunaris
Transverse colon
Jejunum
Superior mesenteric v
Duodenum, descending portion
Duodenum, transverse portion
External oblique m
Internal oblique m
Transversus abdominis m
Inferior vena cava
Inferior mesenteric v
Liver, right lobe
Abdominal aorta
Internal intercostal m
Descending colon
External intercostal m
Ureter
Renal pelvis
Renal v
Intrarenal fat
right
left
Renal cortex
Perirenal fat
Psoas major m
Latissimus dorsi m
Quadratus lumborum m
L2, vertebral body
L2, transverse process
Iliocostalis lumborum m
BL 22
Longissimus m
Multifidus m
Cauda equina
posterior

Figure 7-47. The spinal segmental relationship between BL 22 and L1 argues for the indications of BL 22, "Triple Heater Shu", for micturition, fluid distribution, and reproduction. The spinal segmental overlap of BL 22, the hypogastric nerve, and the adrenal gland provide the neuroanatomic basis for these endocrine and genitourinary applications.

ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature.

L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[7]

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 22 has been called the Triple Burner, or Triple Heater Back Shu point, associated strongly with the location and endocrine activities of the adrenal gland. It communicates with the T11-L1 dermatomes, sharing spinal segmental innervation with the adrenal gland, supplied by T5 through T11.

Vessels

- **First lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar psoas major muscle, psoas minor muscle, quadratus lumborum muscle, spinal cord and vertebral column, deep back muscles. The first lumbar may give rise to the inferior phrenic or middle suprarenal arteries. On occasion, one of the lumbar arteries provides the gonadal artery. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.
- **First lumbar vein:** The lumbar veins accompany the lumbar arteries and drain blood from the posterior body wall and the lumbar vertebral venous plexuses. The first and second lumbar veins drain into the ascending lumbar vein. The ascending lumbar veins feed into the azygous venous system. The lumbar veins communicate with the epidural venous plexus within the vertebral column.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Adrenal problems:** BL 22, BL 23, CV 5, GB 25, ST 36.
- **Back pain:** BL 22, BL 23, other local tender points in the region. Examine gluteal region for perpetuating trigger points. BL 40, BL 60.

Evidence-Based Applications

- Plum-blossom needle tapping at BL 22, BL 25, and Huatojiaji points from T8 to T12 helped improve symptoms in patients with ulcerative colitis.[1]

- Acupuncture provided an effective alternative to medication for the treatment of renal colic with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[2]

- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic oligoasthenoteratozoospermia (OAT syndrome).[3]

References

1. Zhang Y and Yang Z. Ulcerative colitis treated by acupuncture at Jiaji points (EX-B2) and tapping with plum-blossom needle at Sanjiaoshu (BL 22) and Dachangshu (BL 25) – a report of 43 cases. *Journal of Traditional Chinese Medicine*. 2005;25(2):83-84.
2. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology*. 1992;147:16-18.
3. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.
4. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech*. 2013;26(4):E124-E129.
5. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat*. 2008;30:125-129
6. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat*. 2012;221(6):507-536.
7. Lierse W. Blood vessels and nerves of the human penis. *Urol Int*. 1982;37:145-151.

BL 23

Shen Shu "Kidney Shu"

On the lumbar vertebral region, 1.5 cun lateral to the inferior border of the L2 spinous process. Find in the groove between the longissimus and iliocostalis lumborum muscles.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure. The ventral layer attaches to the lumbar transverse processes and envelops the quadratus lumborum muscle. (See Figure 7-49.) The middle layer attaches from the tips of the lumbar transverse processes to the layers near the surface. The dorsal layer extends from the midline to more lateral regions, investing around the deep muscles of the back and providing attachments for the latissimus dorsi and serratus posterior inferior muscles.[31] The dorsal layer has a bilaminar aspect that includes an aponeurotic layer.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[32,33]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Excessive tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Some have equated the damage possible from heightened pressure in the lumbar paraspinal musculature, constrained by its fascial sleeve, to a "compartment syndrome".

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[34]

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: The epaxial muscles of the lumbar spine are larger than in the thoracic region; they can also harbor more trigger points and cause more nerve entrapment, as shown in Figure 7-49.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T8-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[35] The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

BL 23 serves as the Kidney Shu point. It occupies the L2 dermatome, sharing spinal segmental innervation with the kidney itself, supplied by spinal cord segments T10 through L2.[36]

Vessels

- **Second lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar vertebrae and the back muscles and abdominal wall. On occasion, one of the lumbar arteries provides the gonadal artery. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.

- **Second lumbar vein:** The lumbar veins accompany the lumbar arteries and drain the posterior body wall and the lumbar vertebral venous plexuses. The first and second lumbar veins drain into the ascending lumbar vein. The ascending lumbar veins become the azygous venous system. The lumbar veins communicate with the epidural venous plexus inside the vertebral column.
- **Ascending lumbar veins:** Communicating vessels between the common iliac, iliolumbar, and lumbar veins.[37] The ascending lumbar veins course ventral to the transverse processes of the lumbar vertebrae. They communicate at the cranial end with the subcostal vein; this juncture forms the azygous vein on the right and the hemiazygous vein on the left. At their caudal extent, the ascending lumbar veins connect to their respective common iliac veins. Many variations take place in the venous network of the back.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Knowledge of the communications and variable anatomy of the ascending lumbar and iliolumbar veins reduces the risk of injury, hemorrhage, and further complications during surgery of the retroperitoneal space and pelvis. Should vascular damage occur, acupuncture and related techniques applied to the BL channel along the lumbar spine could aid in the restoration of circulation in a region following iatrogenic injury to the dorsal lumbar region. BL 23, BL 24, and BL 25 offer good regional access to influencing the ascending lumbar vein regions by means of somatoautonomic reflexes.[38]

Indications and Potential Point Combinations

- **Renal problems**: BL 23, GB 25, GV 4.
- **Urinary disorders:** BL 23, BL 28, BL 32, KI 3, SP 6.
- **Reproductive problems**: BL 22, BL 23, GV 2, SP 4.
- **Low back pain:** BL 23, local myofascial trigger points, BL 40, BL 60, ST 36.
- **Exhaustion:** BL 23, BL 22.
- **Osteoporosis**: BL 23, ST 36.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[1]
- Acupuncture at BL 23, BL 28, and GV 4 or CV 4, CV 6, and SP 6 benefited patients with diurnal symptoms associated with **idiopathic bladder instability**.[2]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis** in women.[3]
- A case series indicated that point injection at BL 23, BL 24, and BL 52 alleviated or improved **nephritic colic**.[4]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency after transurethral resection of the prostate.**[5]
- Acupuncture at CV 4, BL 23, BL 25, and ST 25 offers an **alternative to pharmacologic sedation and analgesics in patients receiving extracorporeal shockwave lithotripsy** who are unable to tolerate medication.[6]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of r**ecurrent lower urinary tract infection in adult women**.[7]
- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[8]
- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[9]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction**.[10]
- May delay **aging of the reproductive system** in rats.[11]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes**.[12]
- A case series showed that acupuncture of BL 23 and BL 35 benefited men suffering from **chronic prostatitis**.[13]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combination with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome**, thereby offering an alternative to pharmacologic induction of ovulation.[14]
- Acupuncture at BL 23 and BL 35 outperformed acupuncture at CV 3, CV 4, SP 6, and SP 9 in treating **chronic prostatitis**, possibly because of the influence of BL 35 on the pelvic nerve plexus.[15]
- Electroacupuncture at BL 23 increased levels of luteinizing hormone releasing hormone (LHRH), luteinizing hormone (LH), follicle stimulating hormone (FSH), testosterone, and estradiol (E2) in aged rats; moxibustion at BL 23 also raised these levels. These results suggest that acupuncture and moxibustion may enhance the function of the **hypothalamus-pituitary-gonadal axis of aged rats**.[16]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia (OAT syndrome)**.[17]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36,

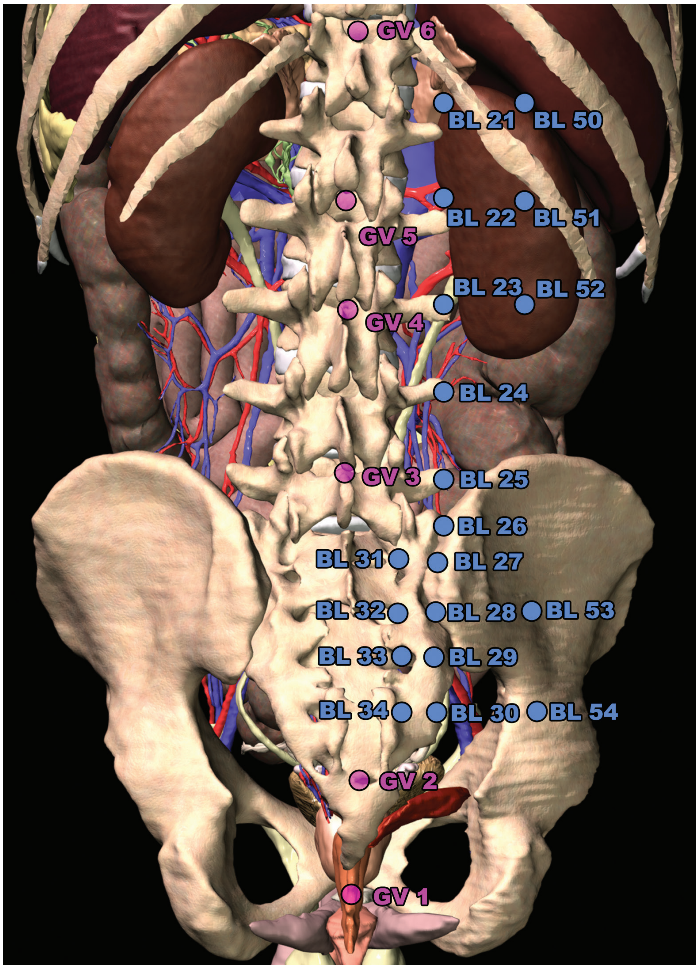


Figure 7-48A. Points that encircle the kidneys, creating the "kidney tiara" to improve renal function, include GV 4, BL 23, BL 52, and GB 25, stimulated bilaterally. This view portrays part of the kidney tiara in the context of neighboring GV and BL sites.

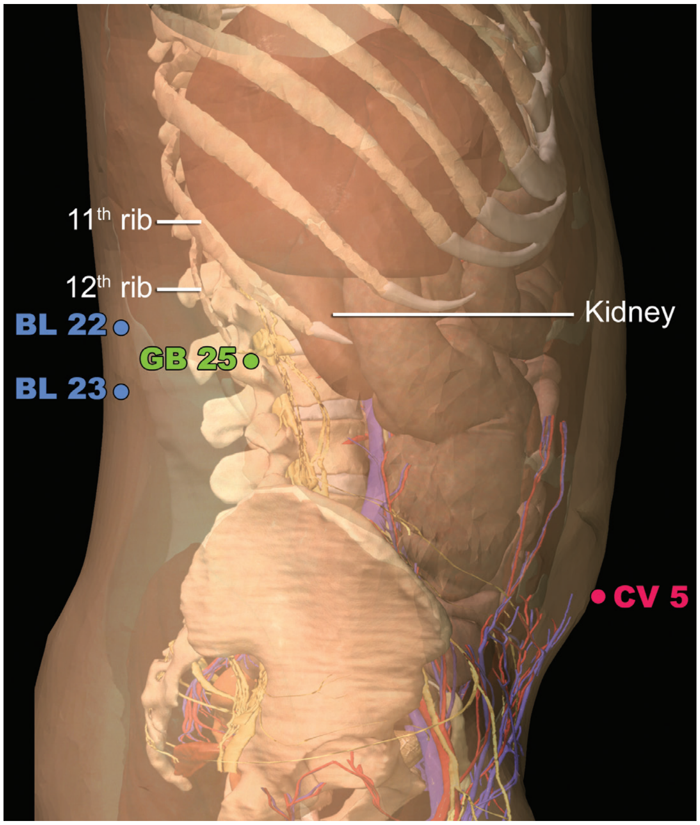


Figure 7-48B. This image exhibits the ways in which two Shu-Mu point pairs connect. BL 22 and CV 5 relate along the T11-L1 dermatomal band, associated with the adrenal gland that receives input from the sympathetic preganglionic fibers from T5-T11. BL 23 and GB 25 embrace the kidney, their associated organ. The kidney receives autonomic fibers from T10-L2; BL 23 lives at the L2 dermatome,[39] while GB 25 sits at the T11-12 level.

SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[18]

- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[19]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in **improvement in sperm quality**, specifically in the ultrastructural integrity of spermatozoa.[20]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain**: KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[21]
- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) **improved the orthopedic management of chronic low back pain.**[22]
- EA applied to BL 23, BL 24, BL 25, and BL 26 outperformed TENS for the treatment of **low back pain.**[23]
- EA at BL 23, BL 25, BL 40, and SP 6, combined with back exercises provided more relief of **chronic low back pain** and improvement in functional capacity compared to exercise alone; the benefits were maintained at a 3-month follow-up.[24]
- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[25]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[26]
- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain**, even at a 3 month follow-up.[27]
- Acupuncture and electroacupuncture at BL 17, BL 17.5, BL 20, BL 23, ST 36, and SP 6 effectively regulated levels of glucagon and immune factors, reduced blood coagulability, improved microcirculation, and heightened insulin sensitivity in **type-II diabetics.**[28]
- Acupuncture at BL 23, BL 24, BL 32, BL 39, and BL 54 improved four measures of bladder dysfunction (bladder compliance, maximal bladder capacity, bladder volume at desire to void, and urge to void) in patients with **diabetic bladder dysfunction.**[29]
- Acupuncture at BL 23 daily for 8 weeks **promoted bone formation**, restored bone volume, improved bone architecture, and reversed osteoporosis in senescence-accelerated mice. The mechanism presumably involved increasing testosterone secretion and reducing bone turnover.[30]

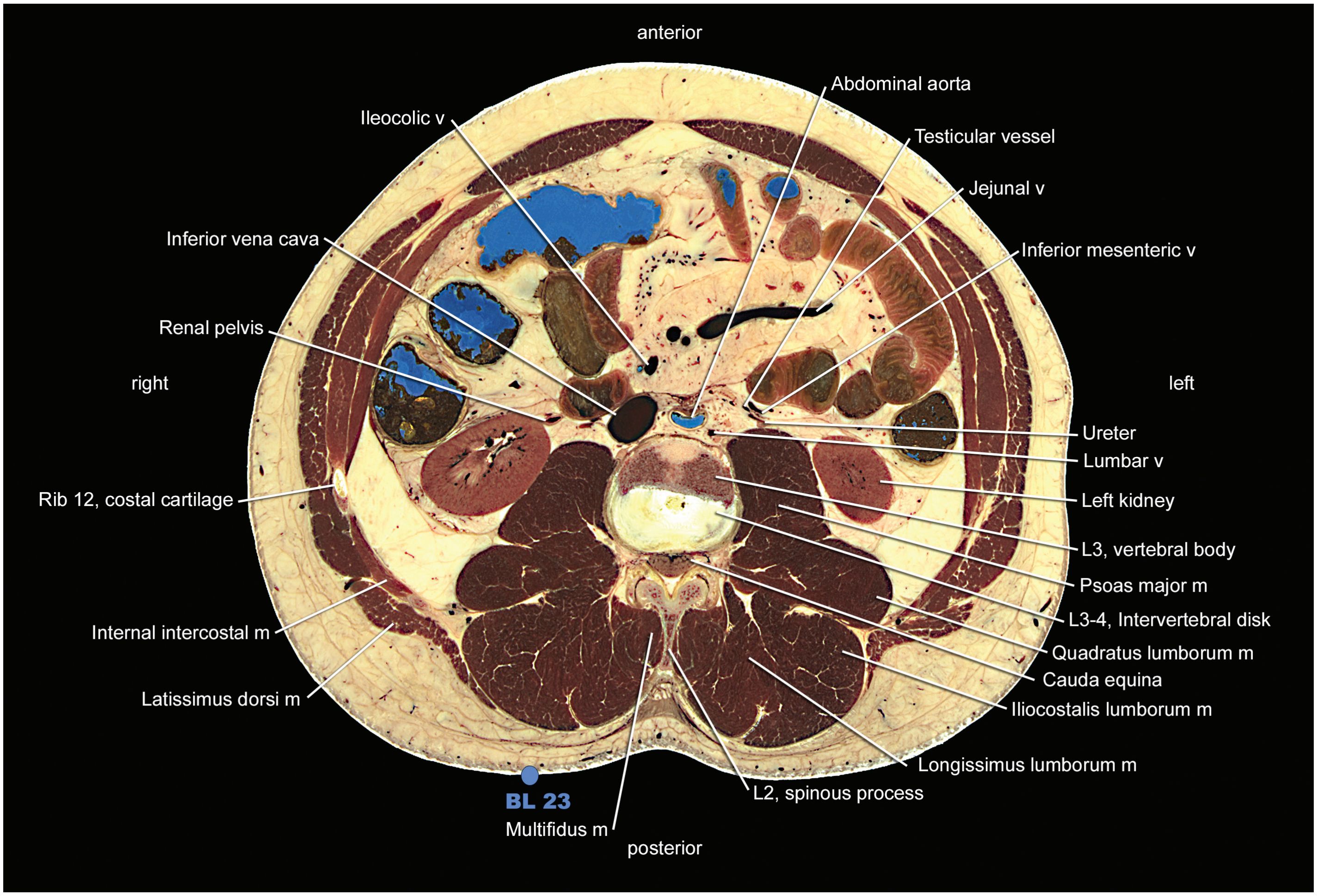


Figure 7-49. In addition to its indications for renal, genitourinary, and geriatric conditions, BL 23 serves as the most popular and likely the most vital point for the acupuncture treatment of low back pain. Note the dense expanse of paraspinal musculature, including the quadratus lumborum and psoas major muscles at this level. The tough thoracolumbar fascia surrounds and separates this cluster of muscles holding up the spine, providing support, and dissipating forces. When excessive tension accumulates in the thoracolumbar fascia, constriction of these structures causes pain, neuropathic insult, and functional impairment.

References

1. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research*. 2003;31:552-556.
2. Philp T, Shah JR, and Worth PHL. Acupuncture in the treatment of bladder instability. *British Journal of Urology*. 1988;61:490-493.
3. Alraek T and Baerheim A. "An empty and happy feeling in the bladder…": health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine*. 2001;9(4):219-223.
4. Li W, Liu W, and Jiang H. Point injection for treating nephritic colic in 101 cases. *Journal of Traditional Chinese Medicine*. 2003;23(3):199-200.
5. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics*. 2004;23:58-62.
6. Quatan N, Bailey C, Larking A, Boyd PJ, and Watkin N. Sticks and stones: use of acupuncture in extracorporeal shockwave lithotripsy. *Journal of Endourology*. 2003;17(10):867-870.
7. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care*. 1998;16:37-39.
8. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System*. 2000;79:173-180.
9. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology*. 1992;147:16-18.
10. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine*. 2004;24(2):126-127.
11. Zhu D, Ma Q, Li C, and Wang L. Effect of stimulation of shenshu point on the aging process of genital system in aged female rats and the role of monoamine neurotransmitters. *Journal of Traditional Chinese Medicine*. 2000;20(1):59-62.
12. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society*. 1995;2(1):3-12.
13. Ge S, Meng F, and Xu B. Acupuncture treatment in 102 cases of chronic prostatitis. *Journal of Traditional Chinese Medicine*. 1988;8(2):99-100.
14. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand*. 2000;79:180-188.
15. Ge S and Meng F. Acupuncture in the treatment of chronic prostatitis: a report of 350 cases. *International Journal of Clinical Acupuncture*. 1991;2(1):19-23.
16. Huang C, Chen H, Fan J, Qin X, Zhou L, and Liu J. Effects of acupuncture on the hypothalamus-pituitary-gonadal (HPG) axis of the aged rats. *World J Acup-Mox*. 1998;8(3):27-30.
17. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.
18. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.
19. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine*. 2005;25(3):177-181.
20. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility*. 2005;84(1):141-147.
21. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture*. 2004;15(3):17-18.
22. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain*. 2002;99:579-587.
23. Tsukayama H, Yamashita H, Amagai H, and Tanno Y. Randomised controlled trial comparing the effectiveness of electroacupuncture and TENS for low back pain: a prelim-

inary study for a pragmatic trial. *Acupuncture in Medicine.* 2002;20(4):175-180.

24. Yeung CKN, Leung MCP, and Chow DHK. The use of electro-acupuncture in conjunction with exercise for the treatment of chronic low-back pain. *Journal of Alternative and Complementary Medicine.* 2003;9(4):479-490.

25. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.

26. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed.* 2000;28(1):25-33.

27. Molsberger AF, Mau J, Pawelec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.

28. Chen J, Ma Y, Cai S, Liang H, and Shen J. Effects of acupuncture on the high hemagglutination state, blood-sugar-raising hormone and immunocyte factor levels in type-II diabetes patients. *World J Acup-Mox.* 2001;11(4):12-17.

29. Tong Y, Jia Q, Sun Y, et al. Acupuncture in the treatment of diabetic bladder dysfunction. *Journal of Alternative and Complementary Medicine.* 2009;15(8):905-909.

30. Zhang X, Peng Y, Yu J, et al. Changes in histomorphometric and mechanical properties of femurs induced by acupuncture at the Shenshu point in the SAMP6 mouse model of senile osteoporosis. *Gerontology.* 2009;55:322-332.

31. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129.

32. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129

33. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.

34. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *2013;26(4):E124-E129.*

35. Lierse W. Blood vessels and nerves of the human penis. *Urol Int.* 1982;37:145-151.

36. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

37. Lolis E, Panagouli E, and Venieratos D. Study of the ascending lumbar and iliolumbar veins: Surgical anatomy, clinical implications and review of the literature. *Annals of Anatomy.* 2011;193:516-529.

38. Barrey C, Ene B, Louis-Tisserand G, et al. Vascular anatomy in the lumbar spine investigated by three-dimensional computed tomography angiography: the concept of a vascular window. *World Neurosurg.* 2012; http://dx.doi.org/10.1016/j.wneu.2012.03.019.

39. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479\

BL 24

Qi Hai Shu "Sea of Qi Shu"

On the lumbar vertebral region, 1.5 cun lateral to the caudal border of the L3 spinous process. Locate in the groove between the longissimus and iliocostalis lumborum muscles. See Figure 7-51 to further examine this myofascial cleavage plane that defines the inner Bladder channel trajectory.

CAUTION: Extra caution required in pregnancy on account of overlapping innervation with pelvic organ pathways.

Connective Tissues

- **Thoracolumbar fascia:** Encloses or envelops the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure. The ventral layer attaches to the lumbar transverse processes and envelops the quadratus lumborum muscle. (See Figure 7-51.) The middle layer attaches from the tips of the lumbar transverse processes to the layers near the surface. The dorsal layer extends from the midline to more lateral regions, wrapping around the deep muscles of the back and providing attachments for the latissimus dorsi and serratus posterior inferior muscles.[7] The dorsal layer has a bilaminar aspect that includes an aponeurotic layer. Observe the separation between the two layers as occurs in the cross section, Figure 7-51.

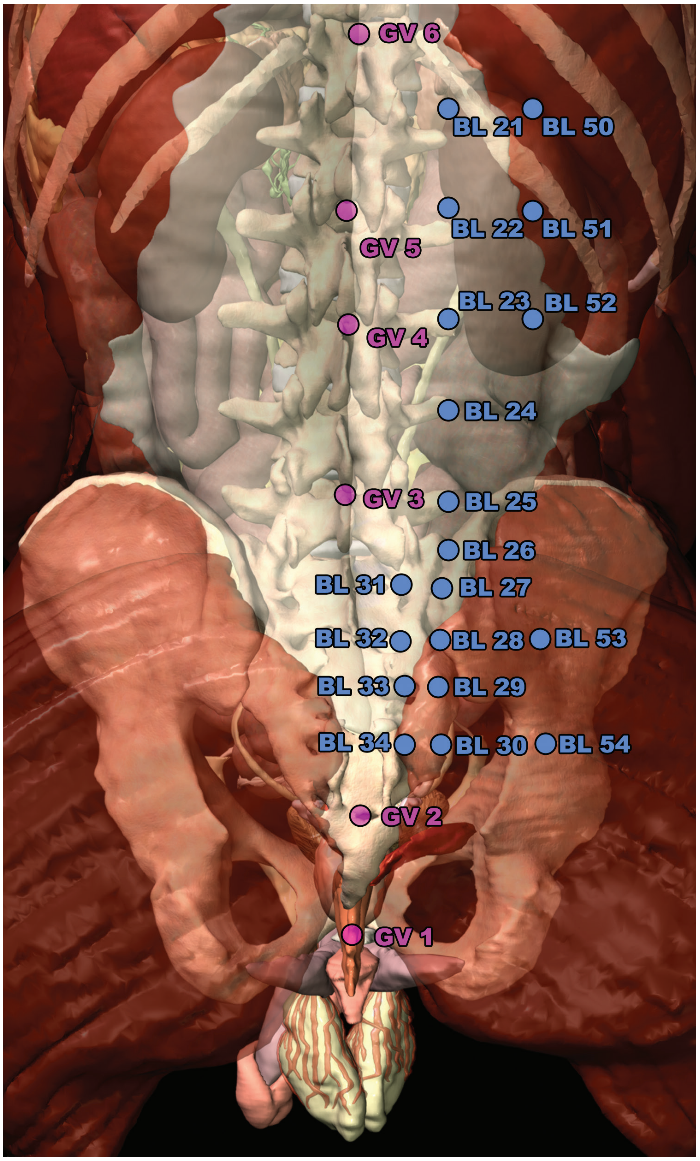


Figure 7-50A. BL 23 and BL 24 land at the levels where the thoracolumbar fascia reaches its broadest lateral extent, signifying this as a high-tension zone where numerous trajectories of force interweave within the muscles and connective tissue. This image exposes, as well, the caudal extent of the fascia onto the sacrum and ilia.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[8,9]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Excessive tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Some have equated the damage possible from heightened pressure in the lumbar paraspinal musculature, constrained by its fascial sleeve, to a "compartment syndrome".

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[10]

Muscles

- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: Strong, powerful, and potentially painful muscles dominate this layer of the lower trunk, as exposed by Figure 7-51. Inadvertent or intentional puncture of the psoas muscle, especially when instilling herbal mixtures, has caused psoas abscess formation.[11] Pyogenic abscess of the psoas can cause diagnostic confusion in the early stages, as patients receiving acupuncture in the low back already have pain, and practitioners may not recognize that a deep infection is developing. Left unrecognized and untreated, potential sequelae include necrotizing fasciitis, septicemia, septicemia, and death. In that acupuncture often involves needling several locations, bilateral and multiple abscesses may occur.

Nerves

- **T9-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami

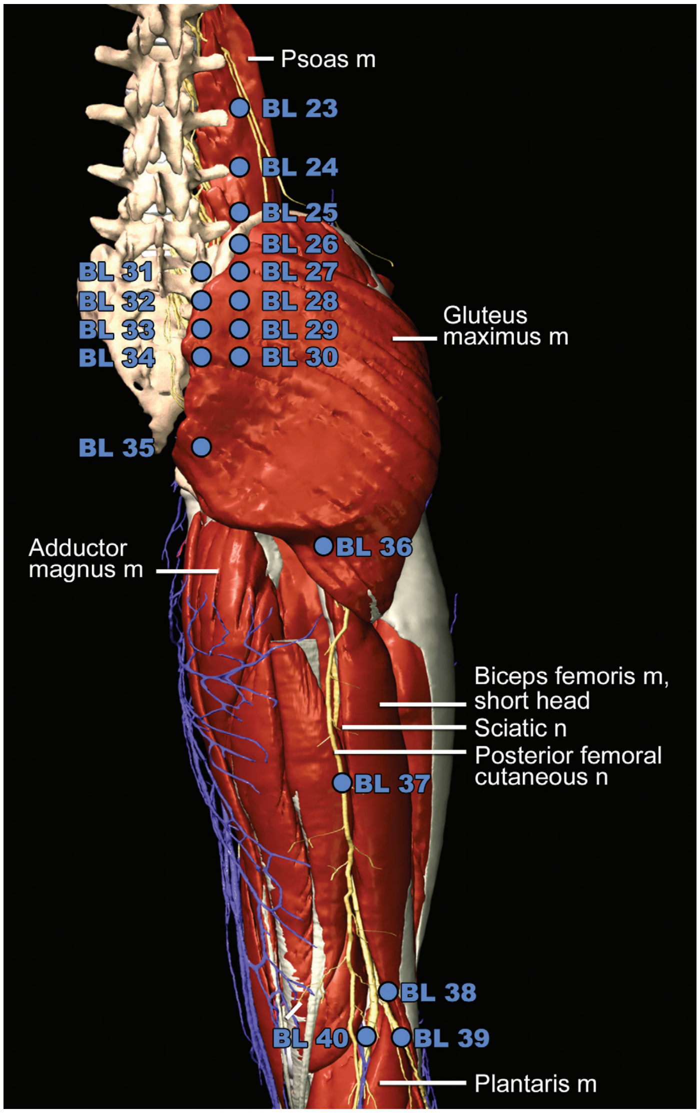


Figure 7-50B. Deep to the erector spinae and quadratus lumborum, the psoas muscle serves as a dominant hip and spine flexor. In the face of myofascial strain, the psoas can entrap lumbar nerve branches coursing through this strong, expansive muscle.[15] Neuromodulating these mid-lumbar spinal cord segments (i.e., countering central sensitization with acupuncture stimulation) would involve targeting the mid-lumbar points such as BL 23 and BL 24 to treat this condition neuroanatomically and following up with laser therapy unless contraindicated. However, the medical literature contains several reports of injury developing after acupuncture designed to reach the psoas muscle. The most common adverse effect involves abscess formation,[16] but pneumoretroperitoneum and polyarticular septic arthritis in conjunction with bilateral psoas abscesses[17] have also been reported.

communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora.

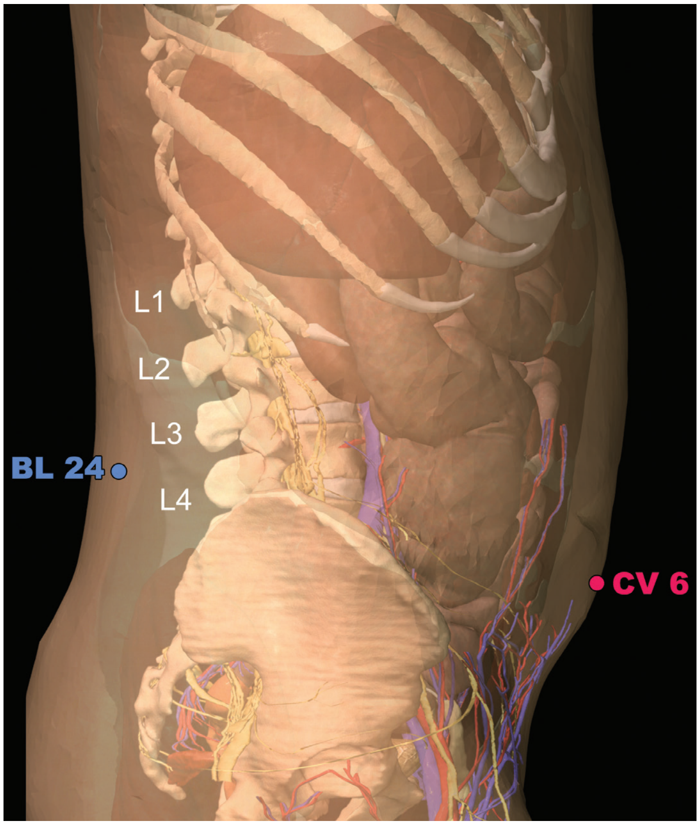


Figure 7-50C. The "Sea of Qi", CV 6, resides in the caudal belly where, in a pregnant female, one would note expansion as the developing fetus grows in size. BL 24, the Shu point associated with CV 6 ("Sea of Qi Shu") corresponds along a similar horizontal plane, spinal segmental innervation, and as the point where a gravid uterus accentuates the lumbar lordosis in the mid- and late-term.

Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[12] The L1 and L2 spinal cord segments provide sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.

- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **L3 spinal nerve:** Comprises part of the lateral femoral cutaneous, the femoral, the anterior femoral cutaneous, and the obturator nerves. The lateral femoral cutaneous nerve supplies the skin on the anterior and lateral regions of the thigh.

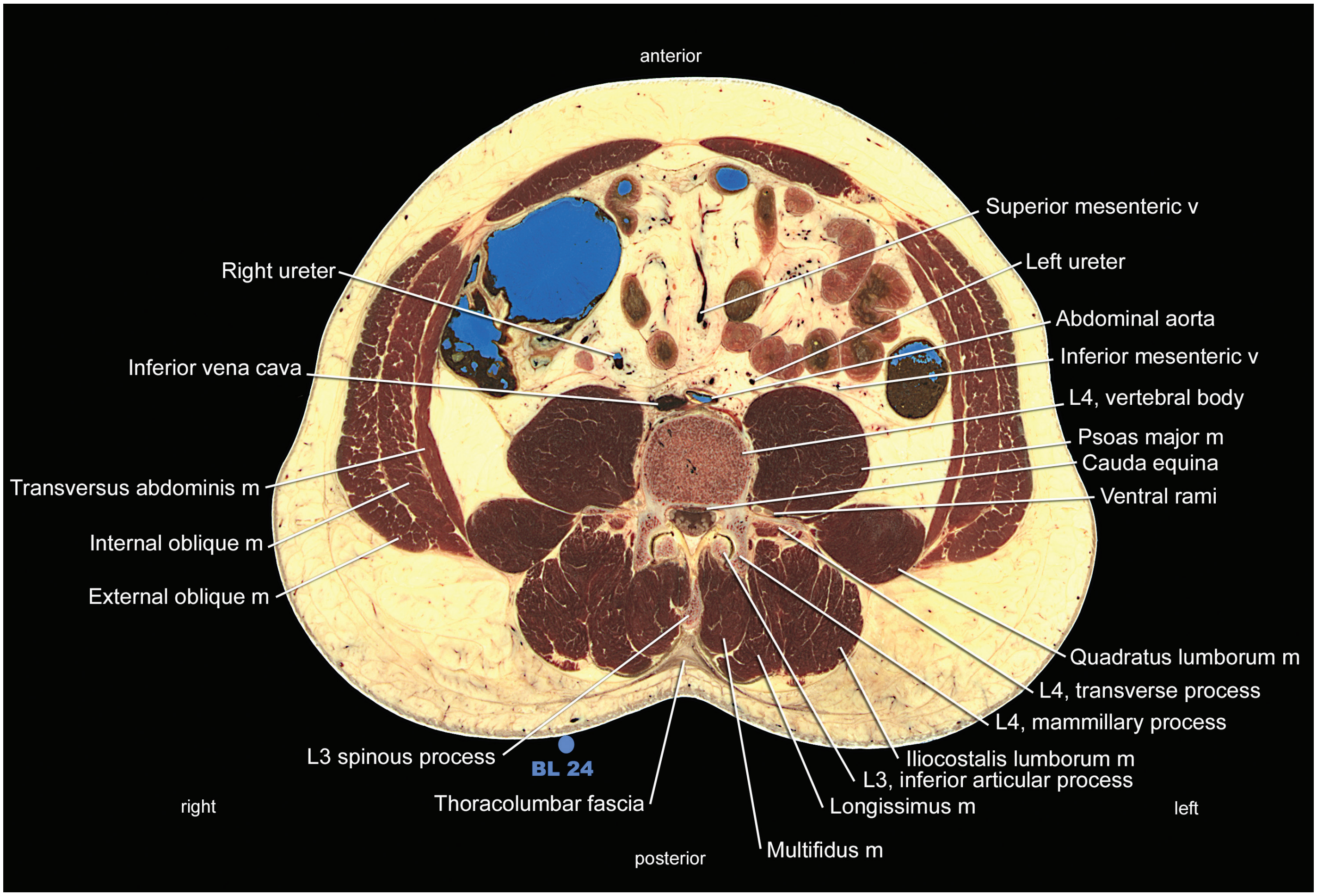

anterior
Superior mesenteric v
Left ureter
Right ureter
Abdominal aorta
Inferior mesenteric v
Inferior vena cava
L4, vertebral body
Psoas major m
Cauda equina
Transversus abdominis m
Ventral rami
Internal oblique m
External oblique m
Quadratus lumborum m
L4, transverse process
L4, mammillary process
Iliocostalis lumborum m
L3 spinous process
BL 24
L3, inferior articular process
right
Thoracolumbar fascia
Longissimus m
left
posterior
Multifidus m

Figure 7-51. As shown in Figure 7-50A, the thoracolumbar fascia achieves its maximal width at the BL 23-BL 24 level. The three layers of the fascia become more visible in this cross section covering and enveloping the quadratus lumborum and the erector spinae as a group. The paraspinal retinacular sheath (PRS) constitutes a portion of the posterior (dorsal) layer of the thoracolumbar fascia. The PRS attaches at the midline onto the spinous process and extends to the transverse process, distinct from both the superficial (most dorsal) layer of the thoracolumbar fascia and the middle layer.[18] The PRS surrounds the paraspinal muscles that sit in the "cubby" formed by the spinous and transverse processes. This sheath fuses with the middle layer of the fascia that envelops the quadratus lumborum. This level at BL 24 depicts that separation clearly at the dorsal midline where the line points to the "Thoracolumbar fascia" near the bottom of the image.
This image also illustrates the facet joint of L3/L4. This raises the discussion point that acupuncturists should adhere to clean needling practices at all times. Failure to do so may lead to abscess formation or the development of septic arthritis in a facet joint.[19]

The femoral nerve supplies the anterior thigh muscles, the hip and knee joints, and the skin on the anteromedial surface of the thigh. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh as well.

The obturator nerve innervates the adductor longus, adductor brevis, gracilis, and pectineus muscles, as well as the obturator externus and adductor magnus muscles.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves.

Vessels

- **Third lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar vertebrae and the back muscles and abdominal wall. On occasion, one of the lumbar arteries provides the gonadal artery. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.
- **Third lumbar vein:** The lumbar veins drain the posterior body wall and the lumbar epidural vertebral venous plexuses.
- **Ascending lumbar veins:** Communicating vessels between the common iliac, iliolumbar, and lumbar veins.[13] The ascending lumbar veins course ventral to the transverse processes of the lumbar vertebrae. They communicate at the cranial end with the subcostal vein; this juncture forms the azygous vein on the right and the hemiazygous vein on the left. At their caudal extent, the ascending lumbar veins connect to their respective common iliac veins. Many variations take place in the venous network of the back.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Knowledge of the communications and variable anatomy of the ascending lumbar and iliolumbar veins reduces the risk of injury, hemorrhage, and further complications during surgery of the retroperitoneal space and pelvis. Should vascular damage occur, acupuncture and related techniques applied to the BL channel along the lumbar spine could aid in the restoration of circulation in a region following iatrogenic injury to the dorsal lumbar region. BL 23, BL 24, and BL 25 offer good regional access to influencing the ascending lumbar vein and other local vasculature by means of somatoautonomic reflexes.[14]

Indications and Potential Point Combinations

- **Low back pain:** BL 24, BL 23, other local tender points, BL 40, KI 3, ST 36.
- **Dysmenorrhea:** BL 24, BL 23, SP 6, CV 4.
- **Renal colic:** BL 23, BL 24, BL 52.

Evidence-Based Applications

- A case series indicated that point injection at BL 23, BL 24, and BL 52 alleviated or improved **nephritic colic.**[1]
- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[2]
- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[3]
- EA applied to BL 23, BL 24, BL 25, and BL 26 outperformed TENS for the treatment of **low back pain.**[4]
- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[5]
- Acupuncture at BL 23, BL 24, BL 32, BL 39, and BL 54 improved four measures of bladder dysfunction (bladder compliance, maximal bladder capacity, bladder volume at desire to void, and urge to void) in patients with **diabetic bladder dysfunction.**[6]

References

1. Li W, Liu W, and Jiang H. Point injection for treating nephritic colic in 101 cases. *Journal of Traditional Chinese Medicine*. 2003;23(3):199-200.

2. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology*. 1992;147:16-18.

3. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain*. 2001;17:296-305.

4. Tsukayama H, Yamashita H, Amagai H, and Tanno Y. Randomised controlled trial comparing the effectiveness of electroacupuncture and TENS for low back pain: a preliminary study for a pragmatic trial. *Acupuncture in Medicine*. 2002;20(4):175-180.

5. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology*. 2003;42:1508-1517.

6. Tong Y, Jia Q, Sun Y, et al. Acupuncture in the treatment of diabetic bladder dysfunction. *Journal of Alternative and Complementary Medicine*. 2009;15(8):905-909.

7. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129.

8. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat*. 2008;30:125-129

9. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat*. 2012;221(6):507-536.

10. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech*. 2013;26(4):E124-E129.

11. Koo EH, Choi SS, Chung DH, et al. Multiple psoas abscess formation after pharmacopuncture – a case report. *Korean J Pain*. 2010;23(4):270-273.

12. Lierse W. Blood vessels and nerves of the human penis. *Urol Int*. 1982;37:145-151.

13. Lolis E, Panagouli E, and Venieratos D. Study of the ascending lumbar and iliolumbar veins: Surgical anatomy, clinical implications and review of the literature. *Annals of Anatomy*. 2011;193:516-529.

14. Barrey C, Ene B, Louis-Tisserand G, et al. Vascular anatomy in the lumbar spine investigated by three-dimensional computed tomography angiography: the concept of a vascular window. *World Neurosurg*. 2012; http://dx.doi.org/10.1016/j.wneu.2012.03.019.

15. Kirchmair L, Llrk P, Colvin J, et al. Lumbar plexus and psoas major muscle: not always as expected. *Reg Anesth Pain Med*. 2008;33:109-114.

16. Koo EH, Choi SS, Chung DH, et al. Multiple psoas abscess formation after pharmacopuncture – a case report. *Korean J Pain*. 2010;23(4):270-273.

17. Ogasawara M, Oda K, Yamaji K, et al. Polyarticular septic arthritis with bilateral psoas abscesses following acupuncture. *Acupunct Med*. 2009;27(2):81-82.

18. Schuenke MD, Vleeming A, Van Hoof T, et al. A description of the lumbar interfascial triangle and its relation with the lateral raphe: anatomical constituents of load transfer through the lateral margin of the thoracolumbar fascia. *J Anat*. 2012;221:568-576.

19. Daivajna S, Jones A, O'Malley M, et al. Unilateral septic arthritis of a lumbar facet joint secondary to acupuncture treatment. *Acupuncture in Medicine*. 2004;22(3):152-155.

BL 25

Da Chang Shu "Large Intestine Shu"

On the lumbar vertebral region, 1.5 cun lateral to the caudal border of the L4 spinous process. Locate in the groove between the longissimus and iliocostalis lumborum muscles. See Figure 7-53 to further examine this myofascial cleavage plane that defines the inner Bladder channel trajectory.

CAUTION: Lumbar and sacral BL and GV points may affect uterine activity during pregnancy.

Connective Tissues

- **Thoracolumbar fascia:** Encloses or envelops the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure. The middle layer attaches from the tips of the lumbar transverse processes to the layers near the surface. The dorsal layer extends from the midline to more lateral regions, wrapping around the deep muscles of the back and providing attachments for the latissimus dorsi and serratus posterior inferior muscles.[14] The dorsal layer has a bilaminar aspect that includes an aponeurotic layer.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[15,16]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Excessive tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Some have equated the damage possible from heightened pressure in the lumbar paraspinal musculature, constrained by its fascial sleeve, to a "compartment syndrome".

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[17] Observe the separation between the dorsal layers of the thoracolumbar fascia in Figure 7-53.

Muscles

- **Erector spinae muscles:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Strong, powerful, and potentially painful

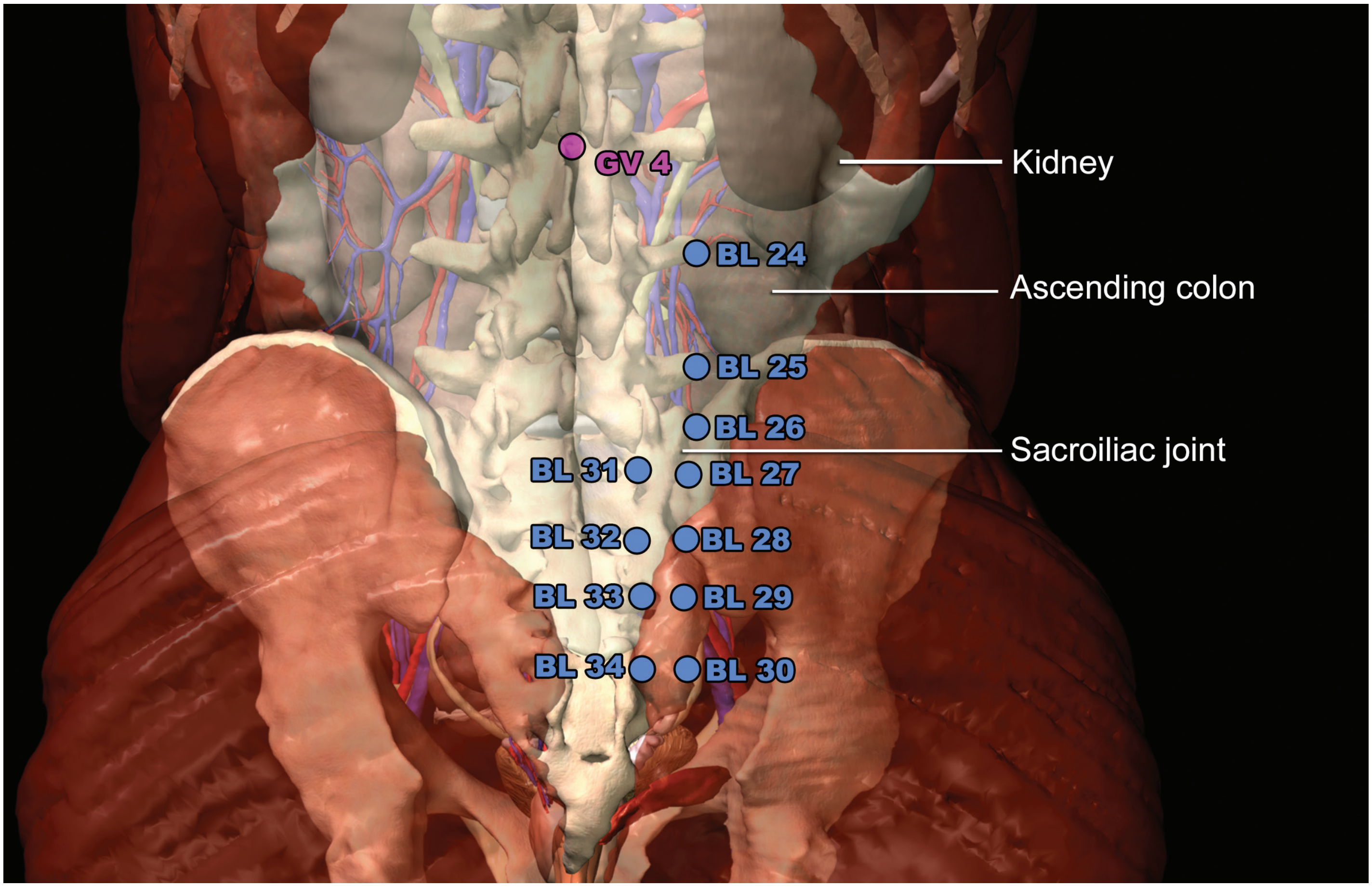


Figure 7-52. BL 25 treats both low back pain and constipation, which frequently co-occur reinforce one another. On the right side, BL 25 relates closely to the ascending colon. The left BL 25 impacts the descending colon, true to its title, "Large Intestine Shu".

muscles dominate this layer of the lower trunk, as shown in Figure 7-53. Although accessing the psoas muscle at this level would pose more difficulty than more cranial planes, inadvertent or intentional puncture of the psoas muscle, especially when instilling herbal mixtures, has caused psoas abscess formation.[18] Pyogenic abscess of the psoas can cause diagnostic confusion in the early stages, as patients receiving acupuncture in the low back already have pain, and practitioners may not recognize that a deep infection is developing. Left unrecognized and untreated, potential sequelae include necrotizing fasciitis, septicemia, septicemia, and death. In that acupuncture often involves needling several locations, bilateral and multiple abscesses may occur.

Nerves

- **T10-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **L3 spinal nerve**: Comprises part of the lateral femoral cutaneous, the femoral, the anterior femoral cutaneous, and the obturator nerves. The lateral femoral cutaneous nerve supplies the skin on the anterior and lateral regions of the thigh.

The femoral nerve supplies the anterior thigh muscles, the hip and knee joints, and the skin on the anteromedial surface of the thigh. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh as well.

The obturator nerve innervates the adductor longus, adductor brevis, gracilis, and pectineus muscles, as well as the obturator externus and adductor magnus muscles.

- **L4 spinal nerve:** The dorsal primary ramus supplies the muscles and skin of the back. L4 contributes to the obturator, anterior femoral cutaneous, and the femoral nerves, as described in the preceding paragraph. L4 forms part of the lumbosacral trunk, and contributes to the sciatic nerve, along with L5-S3. The sciatic nerve innervates the hamstring muscles and provides articular branches to the hip and knee joints.

Clinical Relevance: Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves.

BL 25, Large Intestine Shu, lies within the L4 dermatome. The sympathetic cell bodies in the thoracolumbar cord issue nerves to the large intestine from T8 to L4.[19]

Vessels

- **Fourth lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar vertebrae and the back muscles and abdominal wall. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.
- **Fourth lumbar vein:** The lumbar veins drain the posterior body wall and the lumbar epidural vertebral venous plexuses.
- **Ascending lumbar veins:** Communicating vessels between the common iliac, iliolumbar, and lumbar veins.[20] The ascending lumbar veins course ventral to the transverse processes of the lumbar vertebrae. They communicate at the cranial end with the subcostal vein; this juncture forms the azygous vein on the right and the hemiazygous vein on the left. At their caudal extent, the ascending lumbar veins connect to their respective common iliac veins. Many variations take place in the venous network of the back.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Knowledge of the communications and variable anatomy of the ascending lumbar and iliolumbar veins reduces the risk of injury, hemorrhage, and further complications during surgery of the retroperitoneal space and pelvis. Should vascular damage occur, acupuncture and related techniques applied to the BL channel along the lumbar spine could aid in the restoration of circulation in a region following iatrogenic injury to the dorsal lumbar region. BL 23, BL 24, and BL 25 offer good regional access to influencing the ascending lumbar vein and regional vasculature by means of somatoautonomic reflexes.[21]

Indications and Potential Point Combinations

- **Intestinal problems: constipation, diarrhea, abdominal pain or distention:** BL 25, ST 36, ST 37, CV 12.
- **Low back pain:** BL 25, BL 23, local tender points, BL 60, KI 3, ST 36.

Evidence-Based Applications

- Plum-blossom needle tapping at BL 22, BL 25, and Huatojiaji points from T8 to T12 helped improve symptoms in patients with **ulcerative colitis**.[1]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with chronic nonspecific **ulcerative colitis** in a case series.[2]
- Acupuncture at CV 4, BL 23, BL 25, and ST 25 offers an **alternative to pharmacologic sedation and analgesics in patients receiving extracorporeal shockwave lithotripsy** who are unable to tolerate medication.[3]

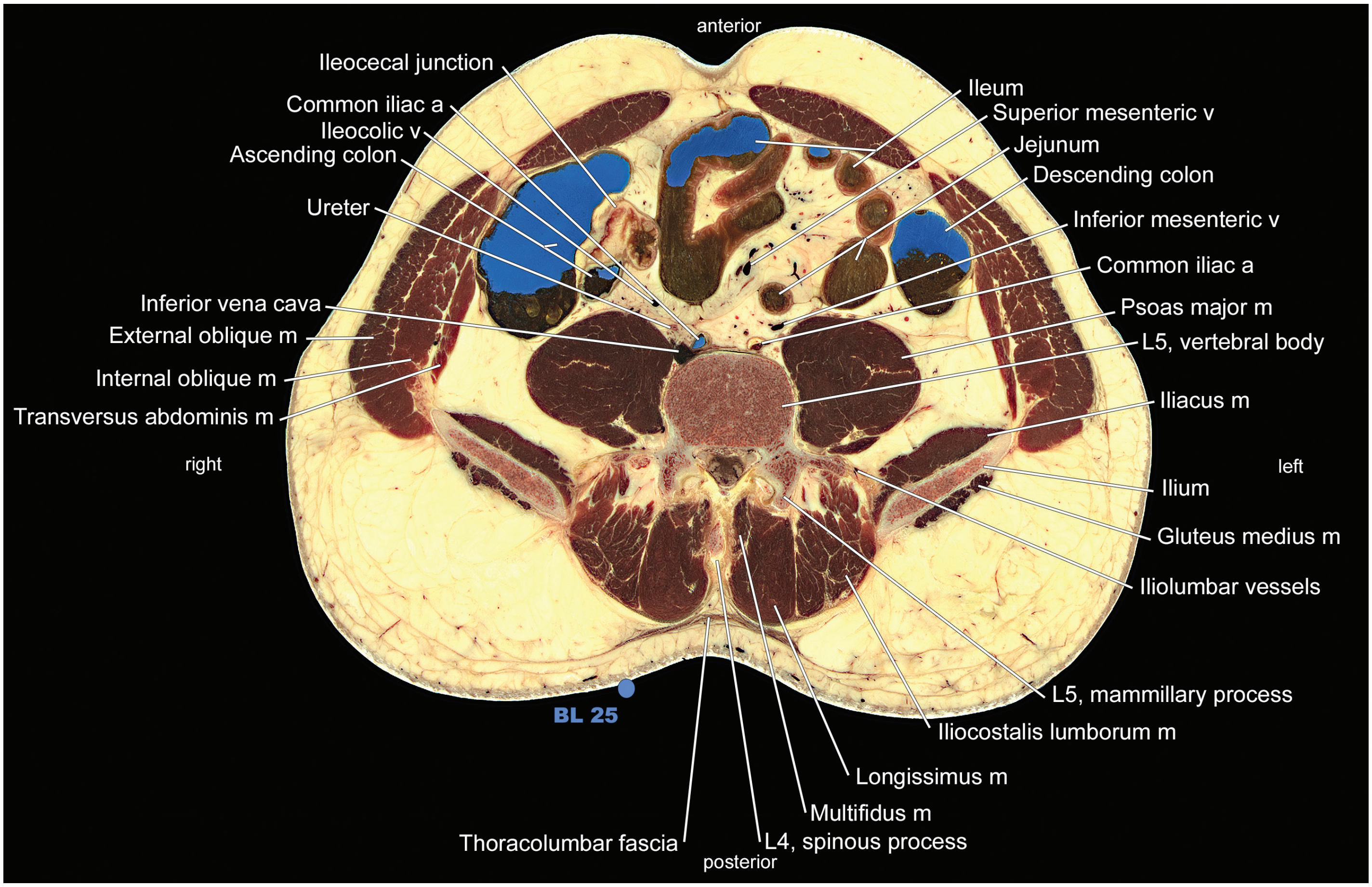

anterior
Ileocecal junction
Common iliac a
Ileocolic v
Ascending colon
Ureter
Inferior vena cava
External oblique m
Internal oblique m
Transversus abdominis m
right
Ileum
Superior mesenteric v
Jejunum
Descending colon
Inferior mesenteric v
Common iliac a
Psoas major m
L5, vertebral body
Iliacus m
left
Ilium
Gluteus medius m
Iliolumbar vessels
L5, mammillary process
Iliocostalis lumborum m
BL 25
Longissimus m
Multifidus m
Thoracolumbar fascia
L4, spinous process
posterior

Figure 7-53. The psoas muscle serves as a dominant hip and spine flexor that can entrap lumbar nerve branches coursing through it.[22] It should not, however, serve as a needling target for acupuncture. The medical literature contains reports of injury developing after acupuncture designed to reach the psoas muscle. Other methods such as laser therapy, careful massage, and stretching can address iliopsoas muscle shortening. Acupuncture to the lumbar epaxial muscles aids in reducing lumbar spinal cord wind-up and indirectly treats neuropathy in the lumbar spinal nerve branches.

- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[4]
- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[5]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain**: KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[6]
- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) **improved the orthopedic management of chronic low back pain.**[7]
- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[8]
- EA applied to BL 23, BL 24, BL 25, and BL 26 outperformed TENS for the treatment of **low back pain.**[9]
- EA at BL 23, BL 25, BL 40, and SP 6, combined with back exercises provided more relief of **chronic low back pain** and improvement in functional capacity compared to exercise alone; the benefits were maintained at a 3-month follow-up.[10]
- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[11]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[12]
- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain**, even at a 3 month follow-up.[13]

References

1. Zhang Y and Yang Z. Ulcerative colitis treated by acupuncture at Jiaji points (EX-B2) and tapping with plum-blossom needle at Sanjiaoshu (BL 22) and Dachangshu (BL 25) – a report of 43 cases. *Journal of Traditional Chinese Medicine.* 2005;25(2):83-84.

2. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. *Journal of Traditional Chinese Medicine.* 1998;18(3):188-191.

3. Quatan N, Bailey C, Larking A, Boyd PJ, and Watkin N. Sticks and stones: use of acupuncture in extracorporeal shockwave lithotripsy. Journal of Endourology. 2003;17(10):867-870.

4. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology.* 1992;147:16-18.

5. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine.* 2005;25(3):177-181.

6. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.

7. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.

8. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain*. 2001;17:296-305.

9. Tsukayama H, Yamashita H, Amagai H, and Tanno Y. Randomised controlled trial comparing the effectiveness of electroacupuncture and TENS for low back pain: a preliminary study for a pragmatic trial. *Acupuncture in Medicine.* 2002;20(4):175-180.

10. Yeung CKN, Leung MCP, and Chow DHK. The use of electro-acupuncture in conjunction with exercise for the treatment of chronic low-back pain. *Journal of Alternative and Complementary Medicine*. 2003;9(4):479-490.

11. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology*. 2003;42:1508-1517.

12. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed*. 2000;28(1):25-33.

13. Molsberger AF, Mau J, Pawelec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain*. 2002;99:579-587.

14. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat*. 2008;30:125-129.

15. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat*. 2008;30:125-129

16. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat*. 2012;221(6):507-536.

17. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech*. 2013;26(4):E124-E129.

18. Koo EH, Choi SS, Chung DH, et al. Multiple psoas abscess formation after pharmacopuncture – a case report. *Korean J Pain*. 2010;23(4):270-273.

19. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. *American Journal of Chinese Medicine.* 2008;36(3):473-479.

20. Lolis E, Panagouli E, and Venieratos D. Study of the ascending lumbar and iliolumbar veins: Surgical anatomy, clinical implications and review of the literature. *Annals of Anatomy*. 2011;193:516-529.

21. Barrey C, Ene B, Louis-Tisserand G, et al. Vascular anatomy in the lumbar spine investigated by three-dimensional computed tomography angiography: the concept of a vascular window. *World Neurosurg*. 2012; http://dx.doi.org/10.1016/j.wneu.2012.03.019.

22. Kirchmair L, LIrk P, Colvin J, et al. Lumbar plexus and psoas major muscle: not always as expected. *Reg Anesth Pain Med*. 2008;33:109-114.

BL 26

Guan Yuan Shu "Pass Head Shu"

On the lumbar vertebral region, 1.5 cun lateral to the caudal border of the L5 spinous process. Locate along the sacroiliac groove.

CAUTION: Lumbosacral BL and GV points may affect uterine activity during pregnancy.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[4,5]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[6]

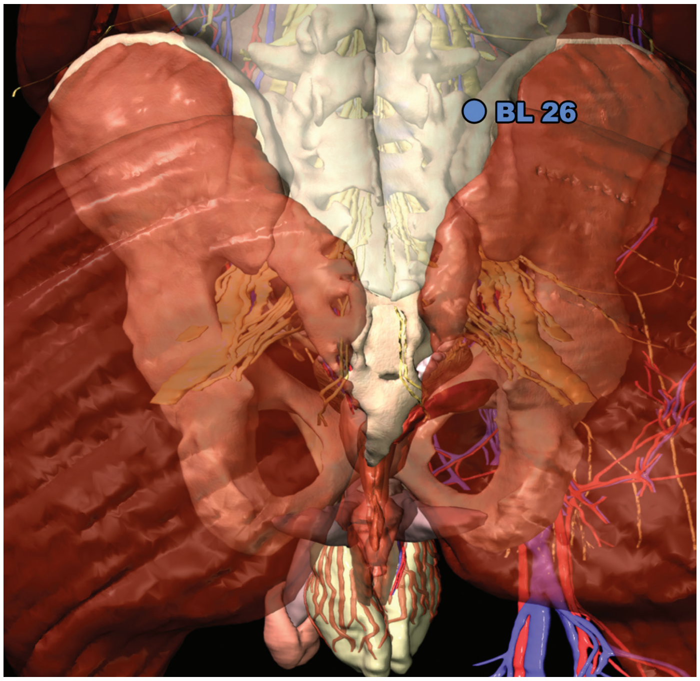


Figure 7-54. BL 26 lives near the sacroiliac joint, explaining its frequent application for low back pain and sacroiliac dysfunction.

Muscles

- **Erector spinae muscle group:** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Pain in the sacroiliac joint as well as pain that extends from the thoracolumbar region along the BL channel to the buttocks may originate in trigger points in the iliocostalis and longissimus lumborum, from BL 19 to BL 23. These trigger points may also issue referred pain around the trunk in a dermatomal fashion. Trigger points in the multifidus at or near BL 26 send pain locally, along the medial gluteal region, or perianal locations.

Iliopsoas trigger points also produce pain in the lumbar paraspinal group that outlines the muscle itself, as far caudal as the SI joint and cranial gluteal region. Other muscles that refer pain to the sacroiliac joint include the quadratus lumborum, gluteus maximus, gluteus medius, and gluteus minimus, and the piriformis.

In addition, rectus abdominis trigger points in the caudal attachment zones may cause pain to refer strongly to the lumbopelvic regions at the same level, including the sacroiliac joint. As such, practitioners treating patients complaining of sacroiliac pain should perform a comprehensive myofascial palpation evaluation in order to identify the true sources of pain and not just "chase" points along the joint line.

Nerves

- **T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies

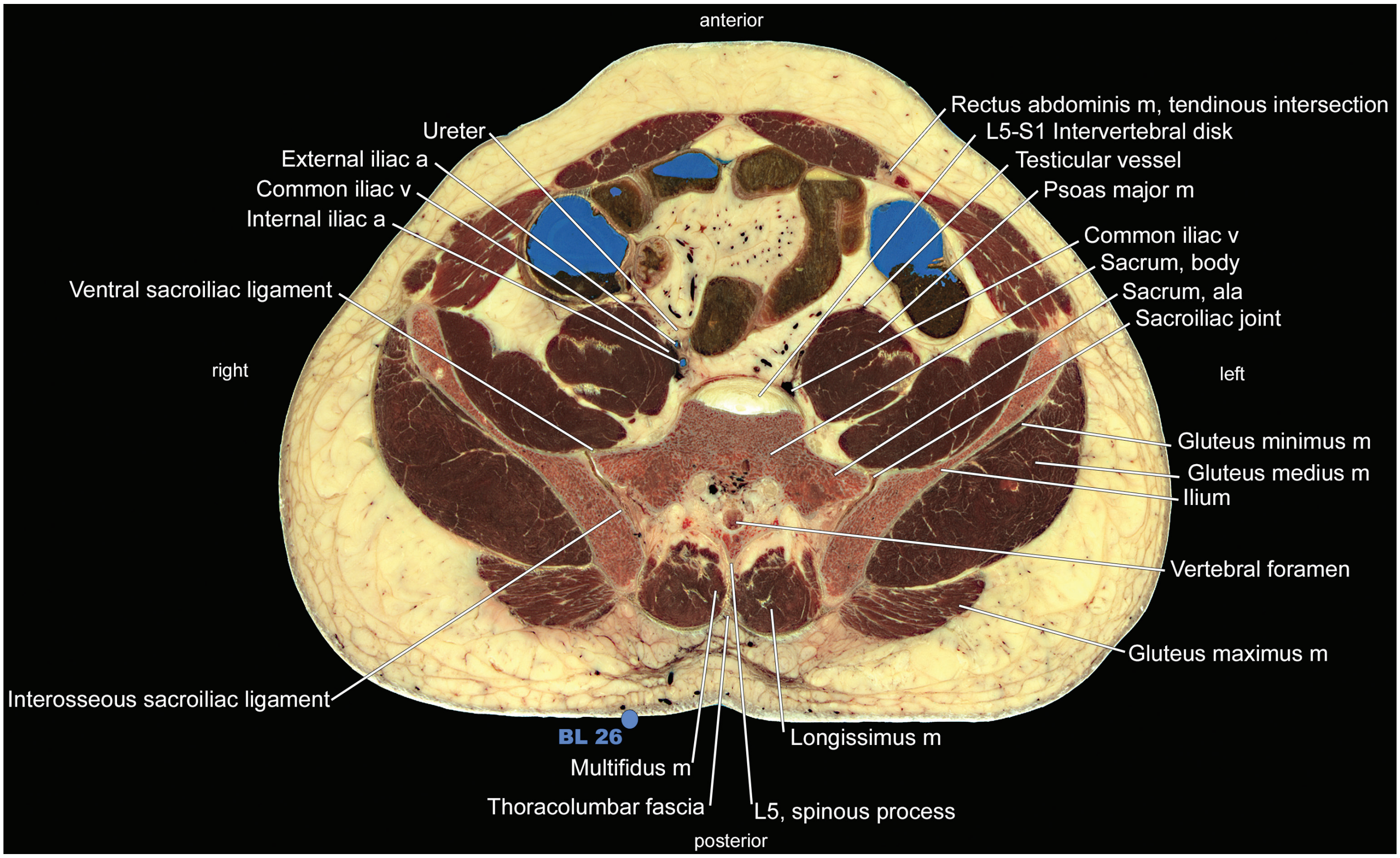

anterior
Ureter
External iliac a
Common iliac v
Internal iliac a
Ventral sacroiliac ligament
right
Rectus abdominis m, tendinous intersection
L5-S1 Intervertebral disk
Testicular vessel
Psoas major m
Common iliac v
Sacrum, body
Sacrum, ala
Sacroiliac joint
left
Gluteus minimus m
Gluteus medius m
Ilium
Vertebral foramen
Gluteus maximus m
Interosseous sacroiliac ligament
BL 26
Multifidus m
Thoracolumbar fascia
Longissimus m
L5, spinous process
posterior

Figure 7-55. BL 26, as "Pass Head Shu" connotes the course a neonate travels during parturition.

the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.

- **L3 spinal nerve:** Comprises part of the lateral femoral cutaneous, the femoral, the anterior femoral cutaneous, and the obturator nerves. The lateral femoral cutaneous nerve supplies the skin on the anterior and lateral regions of the thigh.

The femoral nerve supplies the anterior thigh muscles, the hip and knee joints, and the skin on the anteromedial surface of the thigh. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh as well.

The obturator nerve innervates the adductor longus, adductor brevis, gracilis, and pectineus muscles, as well as the obturator externus and adductor magnus muscles.

- **L4 spinal nerve:** The dorsal primary ramus supplies the muscles and skin of the back. L4 contributes to the obturator, anterior femoral cutaneous, and the femoral nerves, as described in the preceding paragraph. L4 forms part of the lumbosacral trunk, and contributes to the sciatic nerve, along with L5-S3. The sciatic nerve innervates the hamstring muscles and provides articular branches to the hip and knee joints.
- **L5 spinal nerve:** The dorsal primary ramus supplies the muscles and skin of the back. L5 forms part of the lumbosacral trunk, and contributes to the sciatic nerve, along with L4-S3. The sciatic nerve innervates the hamstring muscles and provides articular branches to the hip and knee joints.
- **Medial superior cluneal nerve (L1-L3, terminal ends of dorsal rami):** The superior cluneal nerves supply the skin of the upper buttocks.

Clinical Relevance: Numerous nerves supply various structures within reach of an acupuncture needle entering BL 26. The innervation of the sacroiliac joint remains unclear, but likely involves a variety of lumbosacral spinal nerve branches.[7]

The medial branch of the superior cluneal nerve can experience entrapment near the iliac crest as it courses through a tunnel approximately 7 cm away from midline. When entrapment occurs, one finds thickened, tender area on palpation that feels like a trigger point would.[8] Patients with medial superior cluneal nerve entrapment (MSCNE) syndrome complain of pain at the medial portion of the iliac crest in either the gluteal or lumbosacral region. MSCNE syndrome is often confused with facet syndrome, lower lumbar disk disease, or an iliolumbar syndrome involving the iliolumbar ligament. The site where this occurs is close to both BL 26 and BL 27. Pain from MSCNE neuropathy radiates from the low back to the caudal thigh, following the BL channel. Fully and simultaneously flexing the ipsilateral hip and knee joints provides a provocation to the entrapment and assists in pinpointing MSCNE as the diagnosis.[9]

Damage to the superior cluneal nerves may occur during bone harvest of the iliac crest, warranting acupuncture and related techniques to reduce neuropathic pain and deafferentation.

Vessels

- **Fifth lumbar artery (branch of the median sacral artery):** Supplies the lower lumbar and lumbosacral area, including the vertebral body and vertebral end plate.
- **Fifth lumbar vein:** The lumbar veins drain the posterior body

wall and the lumbar epidural vertebral venous plexuses.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Sacroiliac pain:** BL 26, BL 27, BL 54, GB 30, BL 40.
- **Constipation:** BL 26, BL27, BL 28, ST 36, ST 37.
- **Micturition disorders:** BL 26, BL 23, BL 27, BL 28, KI 3, SP 6.

Evidence-Based Applications

- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[1]
- EA applied to BL 23, BL 24, BL 25, and BL 26 outperformed TENS for the treatment of **low back pain.**[2]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[3]

References

1. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.
2. Tsukayama H, Yamashita H, Amagai H, and Tanno Y. Randomised controlled trial comparing the effectiveness of electroacupuncture and TENS for low back pain: a preliminary study for a pragmatic trial. *Acupuncture in Medicine.* 2002;20(4):175-180.
3. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed.* 2000;28(1):25-33.
4. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. *Surg Radiol Anat.* 2008;30:125-129
5. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
6. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
7. Simopoulos TT, Manchikanti L, Singh V, et al. A systematic evaluation of prevalence and diagnostic accuracy of sacroiliac joint interventions. *Pain Physician.* 2012;15:E305-E344.
8. Ermis MN, Yildirim D, Durakbasa MO, et al. Medial superior cluneal nerve entrapment neuropathy in military personnel; diagnosis and etiologic factors. *Journal of Back and Musculoskeletal Rehabilitation.* 2011;24:137-144.
9. Aly TA, Tanaka Y, Arzawa T, et al. Medial superior cluneal nerve entrapment neuropathy in teenagers: a report of two cases. *Tohoku J Exp Med.* 2002;197;229-231.

BL 27

Xiao Chang Shu "Small Intestine Shu"

At the level of S1 and the first dorsal sacral foramen, 1.5 cun lateral to the midline. Find at the sacroiliac joint line.

CAUTION: Failure to follow clean needling technique in acupuncture can lead to infectious consequences. Pursuant to deep needling of BL channel points over the sacroiliac joint (BL 27-30), septic sacroiliitis can result.[2,3]

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[4,5]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[6] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.[7]

Tendons

- **Erector spinae tendon:** The erector spinae tendon attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.

Clinical Relevance: Muscle shortening in the erector spinae group accentuates tension in the tendinous attachment on the sacrum, causing patients to complain of low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines.

Nerves

- **Middle cluneal nerves (S1-S3):** Supply the skin of the gluteal region. After the nerves exit their respective foramina, they traverse the erector spinae and overlying fascia to enter subcutaneous tissue superficial to the gluteus maximus muscle. The more cranial branches of the middle cluneal nerves often communicate with the medial superior cluneal nerve.[8]
- **Medial superior cluneal nerve (L1-L3, terminal ends of dorsal rami):** The superior cluneal nerves supply the skin of the upper buttocks.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S1 spinal nerve:** Contributes to several nerves, including the sciatic (L4-S3), the superior gluteal (L4-S1), and the inferior gluteal (L5-S2) nerves, the nerve to the piriformis (S1-S2), the nerve to the quadratus femoris and inferior gemellus (L4-S1), and the nerve to the obturator internus and superior gemellus (L5-S2).
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: The medial branch of the superior cluneal nerve can experience entrapment near the iliac crest as it

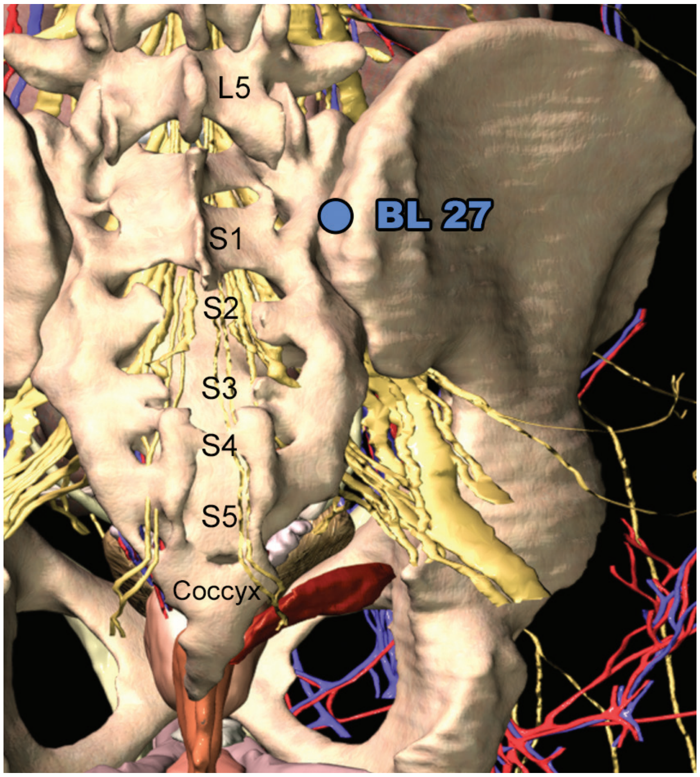


Figure 7-56. As the "Small Intestine Shu", BL 27 relates more to the sacral parasympathetic nuclei than to sympathetic nerve supply from the thoracolumbar region, since the small intestine receives sympathetic neurons from T5 to T12.[11]

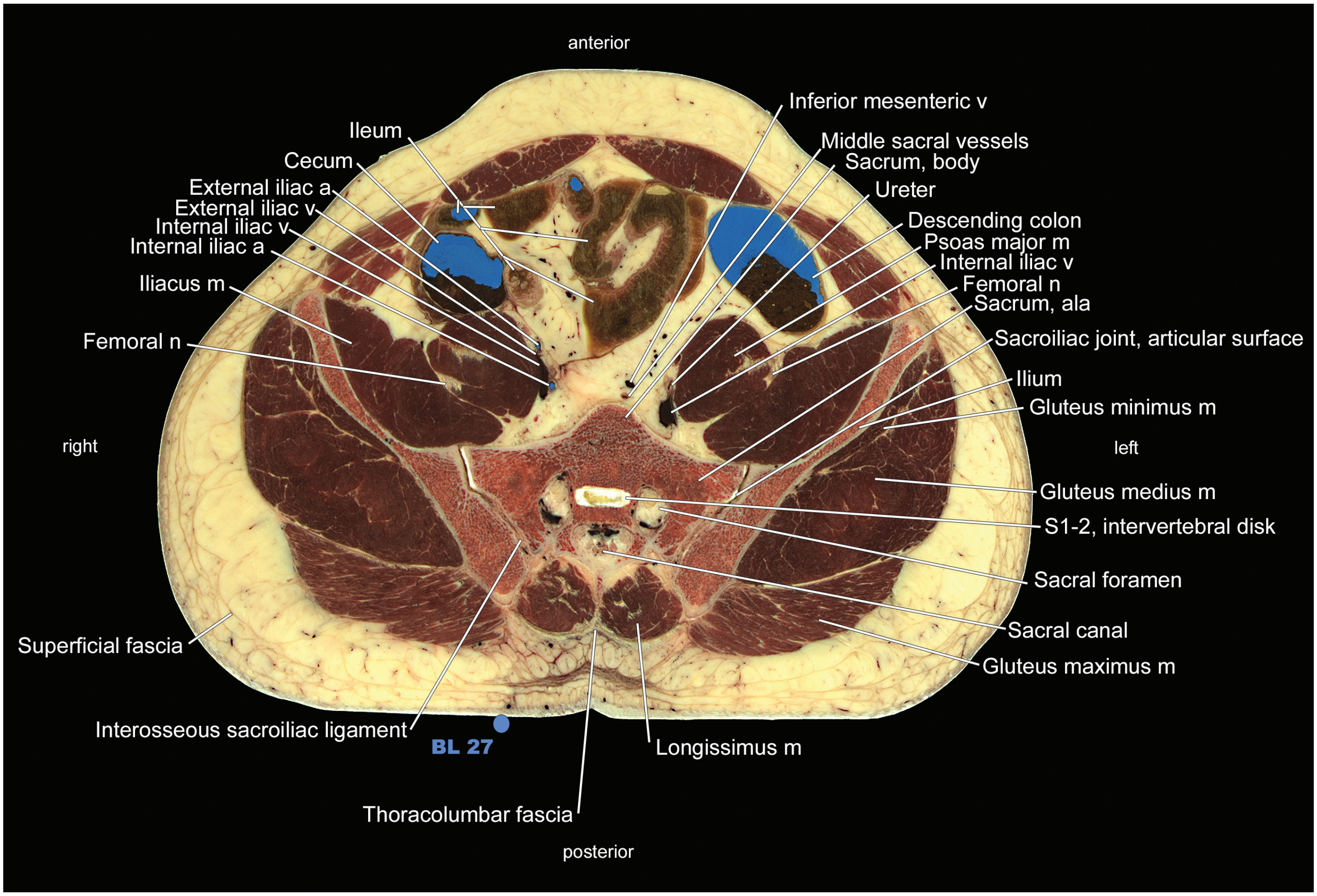

anterior
Inferior mesenteric v
Ileum
Middle sacral vessels
Sacrum, body
Cecum
Ureter
External iliac a
External iliac v
Descending colon
Internal iliac v
Psoas major m
Internal iliac a
Internal iliac v
Femoral n
Iliacus m
Sacrum, ala
Femoral n
Sacroiliac joint, articular surface
Ilium
Gluteus minimus m
right
left
Gluteus medius m
S1-2, intervertebral disk
Sacral foramen
Sacral canal
Superficial fascia
Gluteus maximus m
Interosseous sacroiliac ligament
BL 27
Longissimus m
Thoracolumbar fascia
posterior

Figure 7-57A. Like BL 26 through BL 30 associate with the sacroiliac joint. Note, as well, that at the level of this "Small Intestine Shu" point, the ileum (part of the small intestine) remains in the picture.

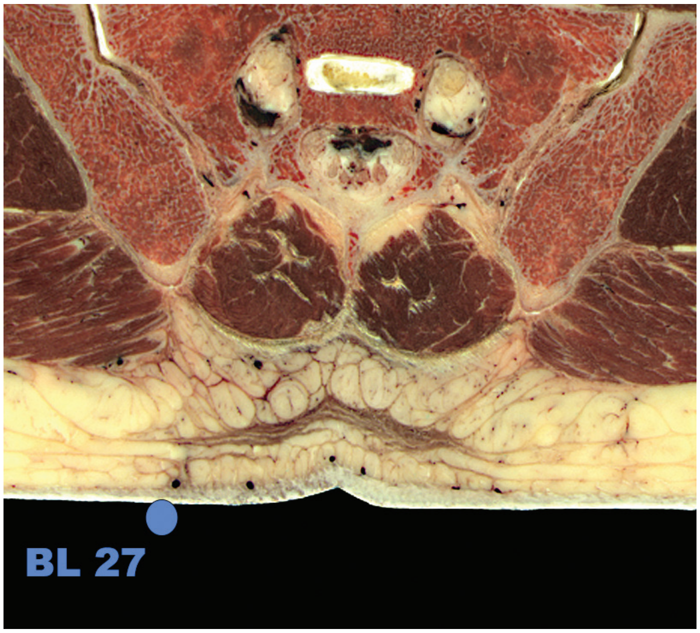


Figure 7-57B. Note how a gap exists in the fascia and subcutaneous tissue in this close-up view of Figure 7-57A. Morphologic changes called "sagging" in the thoracolumbar fascia at more cranial levels have been found on magnetic resonance imaging, seen as an abrupt bulging in the parasagittal planes of the dorsal layer and associated with pathologic changes of the thoracolumbar fascia. These degradations may indicate functional failure of the fascia and likelihood of progressive spinal instability.[12]

courses through a tunnel approximately 7 cm away from midline. When entrapment occurs, one finds thickened, tender area on palpation that feels like a trigger point would.[9] Patients with medial superior cluneal nerve entrapment (MSCNE) syndrome complain of pain at the medial portion of the iliac crest in either the gluteal or lumbosacral region. MSCNE syndrome is often confused with facet syndrome, lower lumbar disk disease, or an iliolumbar syndrome involving the iliolumbar ligament. The site where this occurs is close to both BL 26 and BL 27. Pain from MSCNE neuropathy radiates from the low back to the caudal thigh, following the BL channel. Fully and simultaneously flexing the ipsilateral hip and knee joints provides a provocation to the entrapment and assists in pinpointing MSCNE as the diagnosis.[10]

Damage to the superior cluneal nerves may occur during bone harvest of the iliac crest, warranting acupuncture and related techniques to reduce neuropathic pain and deafferentation.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Micturition disorders:** Dysuria, voiding dysfunction, enuresis: BL 27, BL 28, BL 32, KI 3, SP 6.
- **Low back pain:** Take BL 27 if tender and/or if one suspects sacroiliac-based pain. Add local trigger points as necessary, GB 30, BL 40.

Evidence-Based Applications

- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[1]

References

1. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.
2. Lau SM, Chou CT, and Huang CM. Unilateral sacroiliitis as an unusual complication of acupuncture. *Clin Rheumatol.* 1998;17(4):357-358.
3. Daivajna S, Jones A, O'Malley M, et al. Unilateral septic arthritis of a lumbar facet joint secondary to acupuncture treatment. *Acupuncture in Medicine.* 2004;22(3):152-155.
4. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
5. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
6. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
7. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.
8. Tubbs RS, Levin MR, Loukas M, et al. Anatomy and landmarks for the superior and middle cluneal nerves: application to posterior iliac crest harvest and entrapment syndromes. *J Neurosurg Spine.* 2010;13:356-359.
9. Ermis MN, Yildirim D, Durakbasa MO, et al. Medial superior cluneal nerve entrapment neuropathy in military personnel; diagnosis and etiologic factors. *Journal of Back and Musculoskeletal Rehabilitation.* 2011;24:137-144.
10. Aly TA, Tanaka Y, Arzawa T, et al. Medial superior cluneal nerve entrapment neuropathy in teenagers: a report of two cases. *Tohoku J Exp Med.* 2002;197;229-231.
11. Cabioglu MT and Arslan G. Neurophysiologic basis of the Back-Shu and Huatuo-Jiaji points. American Journal of Chinese Medicine. 2008;36(3):473-479.
12. Jeong YM, Shin MJ, See SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment diseases? *J Spinal Disord Tech.* 2013;26(4):E124-E129.

BL 28

Pang Guang Shu "Bladder Shu"

At the level of S2 and the second dorsal sacral foramen, 1.5 cun lateral to the midline. View the interplay of muscle borders, sacroiliac joint, and thoracolumbar fascia at this level in Figure 7-59. Locate near the sacroiliac joint.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum. Locate the thoracolumbar fascia on Figure 7-59.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[9,10]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[11] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.

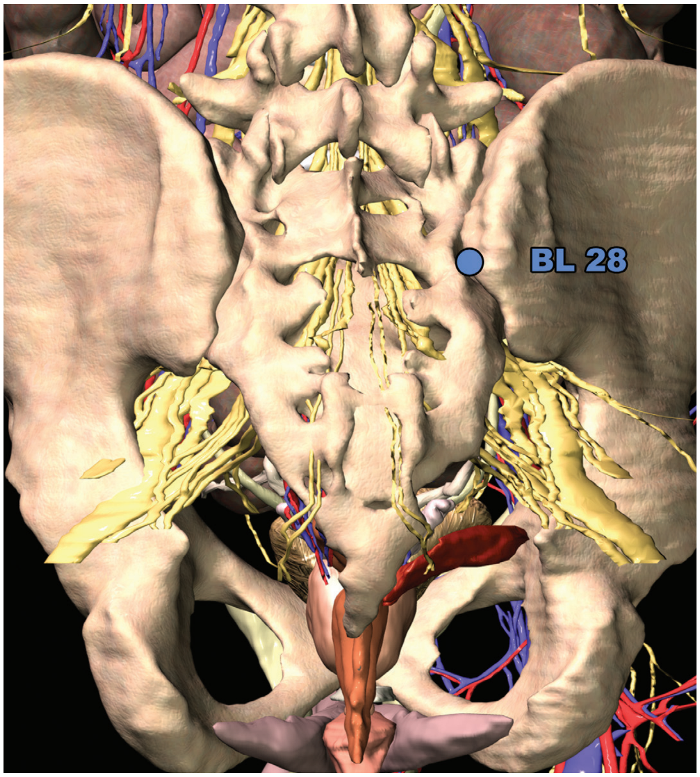


Figure 7-58. BL 28, "Bladder Shu", follows the BL line along the sacroiliac joint. Its dermatomal relationship to S2 overlaps the parasympathetic supply to the bladder that flows from the S2 through the S4 spinal cord segments. As such, it affects parasympathetic and somatic nerve control to the detrusor muscle of the bladder and external urethral sphincter, respectively. Of the 67 points constituting the BL channel, BL 28 represents the one point closely associated with its namesake organ. From a myofascial perspective, this area of gluteus maximus attachment can harbor trigger points that refer to the hip, gluteal crease, or coccyx.

Muscles and Tendons

- **Longissimus muscle:** Visible in Figure 7-59, the longissimus muscle blends with the iliocostalis lumborum and fuses with the thoracolumbar fascia.
- **Erector spinae tendon:** The erector spinae tendon attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.
- **Gluteus maximus muscle:** Extends the thigh and assists in lateral rotation.

Clinical Relevance: Muscle shortening in the erector spinae group accentuates tension in the tendinous attachment on the sacrum, causing patients to complain of low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines. Trigger points in the gluteus maximus muscle may refer to the hip, coccyx, or gluteal crease and also accentuate back pain. In the vicinity of BL 28, gluteus maximus trigger point pathology issues referred pain along the sacroiliac joint toward the intergluteal cleft (BL 35), down to the gluteal crease (BL 36) and proximal thigh (BL 37).

Nerves

- **Middle cluneal nerve (S1-S3):** Supplies the skin of the gluteal region.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior

femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.

- **S2 spinal nerve:** Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S2 contributes to the pudendal nerve (along with S3 and S4), which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. S2 also provides input to the sciatic nerve (L4-S3), the inferior gluteal nerve (see below), the nerve to the piriformis (S1,S2), the nerve to the obturator internus and the superior gemellus (L5-S2), the posterior femoral cutaneous nerve (S2,S3), and the perforating cutaneous nerve (S2,S3).
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: Middle cluneal nerve entrapment may cause low back pain, whether due to tension in the erector spinae group compressing the nerves or from gluteus maximus overload. Palpate for trigger points in the gluteus maximus, gluteus medius, and piriformis; deactivate accordingly.

BL 28 relates to the bladder organ through reflexes coursing through sacral spinal segments. Somatovisceral linkages connect stimulation at this point with the pudendal and pelvic splanchnic nerves, supporting communication between the central nervous system, the bladder, and its sphincters. This explains why BL 28 so often appears in point formulae for voiding dysfunction.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential PointCombinations

- **Genitourinary disorders, including prostatitis, erectile dysfunction, urinary retention or incontinence, genital sores or swelling, voiding dysfunction:** BL 28, BL 31, BL 32, BL 33, BL 34, BL 23, SP 6, KI 3, GV 20. For urinary retention, also consider CV 2, CV 3, CV 4, SP 9, BL 23, BL 28, BL 32, and BL 39.[13]
- **Low back pain:** BL 28, other tender trigger points, BL 23, GV 4. Examine the longissimus and gluteus maximus muscular attachments in the vicinity of BL 28.
- **Pelvic limb weakness and pain:** BL 28, BL 23, identify sources of weakness and pain, select points according to neuroanatomic distribution and spinal segmental nerve supply.
- **Hip problems and restriction:** BL 28, GB 29, GB 30, identify cause of hip pain, restriction, or dysfunction.

Evidence-Based Applications

- Neuroanatomically, acupuncture at BL 28 may support **sexual performance** through its influence on the pelvic nerve and inferior hypogastric ganglion.[1]
- Acupuncture at SP 6, BL 28, BL 39, and CV 4 provided significant improvement in women diagnosed as having **overactive bladder with urge incontinence**.[2]
- Acupuncture at BL 23, BL 28, and GV 4 or CV 4, CV 6, and SP 6 benefited patients with diurnal symptoms associated with **idiopathic bladder instability**.[3]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis** in women.[4]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[5]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[6]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combination with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome**, thereby offering an alternative to pharmacologic induction of ovulation.[7]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency** after transurethral resection of the prostate.[8]
- Electroacupuncture applied to SP 6, BL 28, and BL 32, five times weekly for 2 weeks increased spontaneous voiding volume and decreased postvoid residual urine volume in patients with acute **stroke.**[14]

References

1. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
2. Emmons SL and Otto L. Acupuncture for overactive bladder – a randomized controlled trial. *Obstetrics & Gynecology.* 2005;106:138-143.
3. Philp T, Shah JR, and Worth PHL. Acupuncture in the treatment of bladder instability. *British Journal of Urology.* 1988;61:490-493.
4. Alraek T and Baerheim A. "An empty and happy feeling in the bladder…": health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine.* 2001;9(4):219-223.
5. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
6. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care.* 1998;16:37-39.
7. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome.

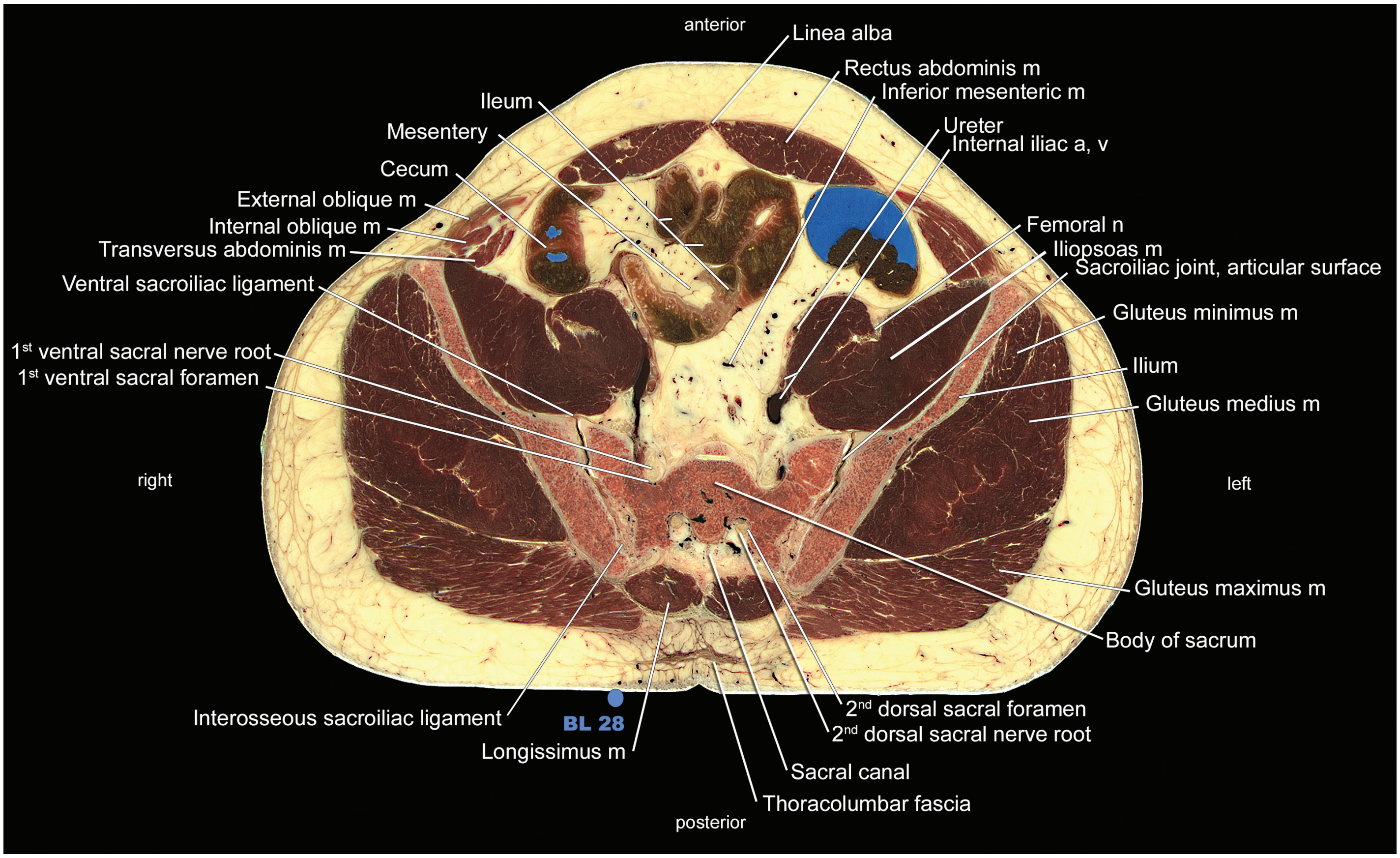

anterior
Linea alba
Rectus abdominis m
Inferior mesenteric m
Ileum
Mesentery
Ureter
Internal iliac a, v
Cecum
External oblique m
Internal oblique m
Transversus abdominis m
Femoral n
Iliopsoas m
Sacroiliac joint, articular surface
Ventral sacroiliac ligament
Gluteus minimus m
1st ventral sacral nerve root
1st ventral sacral foramen
Ilium
Gluteus medius m
right
left
Gluteus maximus m
Body of sacrum
2nd dorsal sacral foramen
Interosseous sacroiliac ligament
BL 28
2nd dorsal sacral nerve root
Longissimus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 7-59. Pain at BL 28 may result from myofascial dysfunction in the gluteus maximus or longissimus attachments onto the sacrum. In addition, a practitioner may find tenderness to palpation in patients with bladder disorders by dint of viscerosomatic reflexes.

Acta Obstet Gynecol Scand. 2000;79:180-188.

8. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.
9. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
10. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
11. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
12. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.
13. Zhang D. Thirty-six cases of urinary retention treated by acupuncture. *J Tradit Chin Med.* 2008;28(2):83-85.
14. Yu K-W, Lin C-L, Hung C-C, et al. Effects of electroacupuncture on recent stroke inpatients with incomplete bladder emptying: a preliminary study. *Clin Interv Aging.* 2012;7:469-474.

BL 29

Zhong Lu Shu "Central Backbone Shu"

At the level of S3 and the third dorsal sacral foramen, 1.5 cun lateral to the midline. Locate near the sacroiliac joint.

Tendons and Muscles

- **Erector spinae tendon:** The erector spinae tendon attaches to the median sacral crest, to the spinous processes of the lumbar and the eleventh and twelfth thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.
- **Gluteus maximus muscle:** Extends thigh and assists in lateral rotation.
- **Piriformis muscle:** Attaches primarily to the inner surface of the sacrum; its tendon inserts onto the greater trochanter of the femur. The piriformis laterally rotates the thigh in the non-weightbearing limb with the hip extended. Aids in abduction when the hip is flexed at a ninety degree angle.

Clinical Relevance: Muscle shortening in the erector spinae group accentuates tension in the tendinous attachment on the sacrum, causing patients to complain of low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines. Trigger points in the gluteus maximus muscle may refer to the hip, coccyx, or gluteal crease and also accentuate back pain. In the vicinity of BL 29, gluteus maximus trigger point pathology issues referred pain along the sacroiliac joint toward the intergluteal cleft (BL 35), down to the gluteal crease (BL 36) and proximal thigh (BL 37). Piriformis trigger points at BL 29 refer pain strongly to the local region and more diffusely to the ipsilateral buttock and caudal thigh.

Nerves

- **Middle cluneal nerve (S1-S3):** Supplies the skin of the gluteal region.
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S1-S2 spinal nerves:** Supply the piriformis muscle.
- **S3 spinal nerve:** Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S3 contributes to the pudendal nerve (along with S2 and S4), which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. S3 also supplies the sciatic nerve (L4-S3), the nerves to the levator ani and coccygeus (S3,S4), the posterior femoral cutaneous nerve (S2,S3), and the perforating cutaneous nerve (S2,S3).

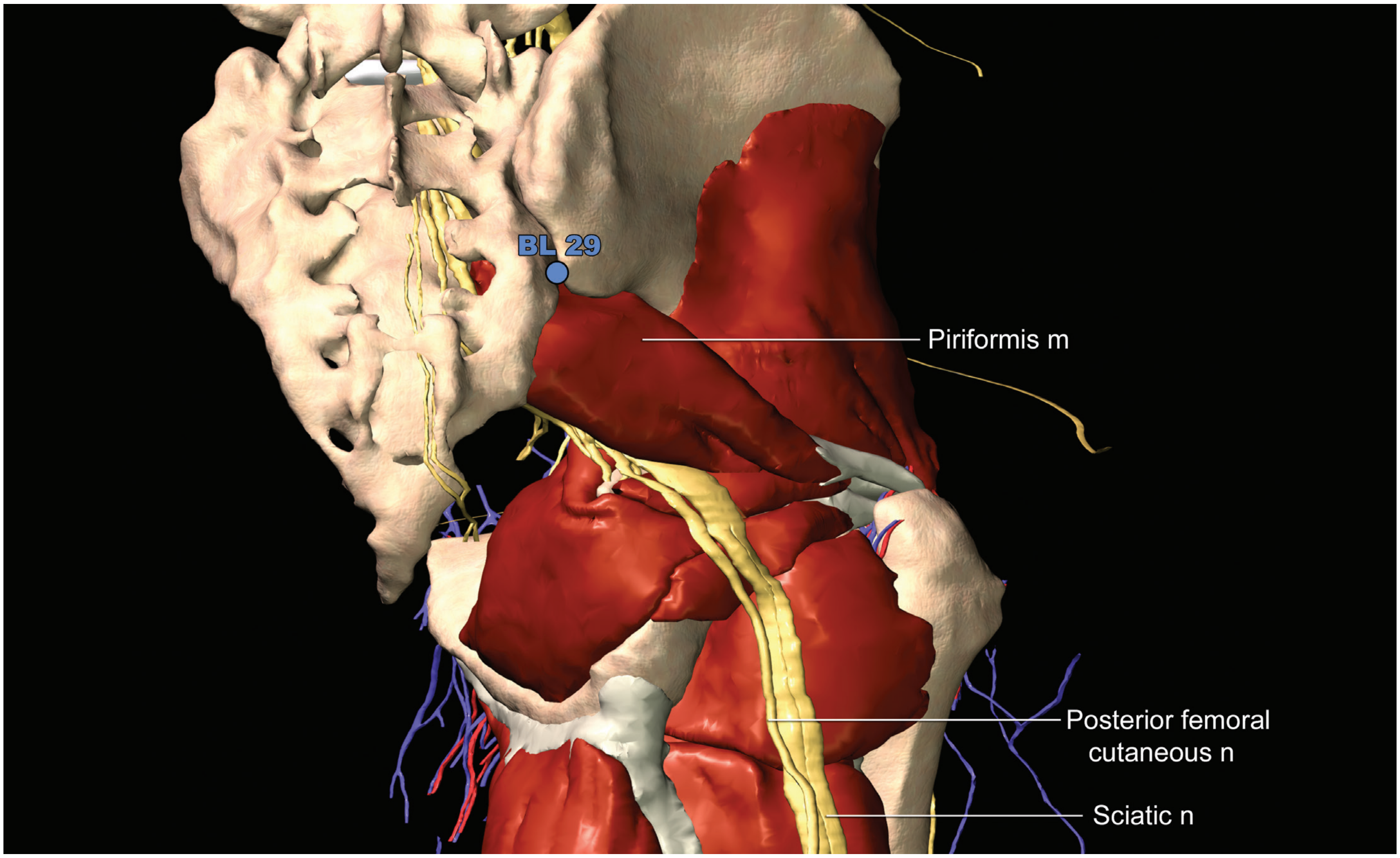


Figure 7-60. BL 29 constitutes the site of a significant attachment trigger point site for the piriformis muscle. Note the intersecting sacroiliac joint, piriformis muscle, and sciatic nerve.

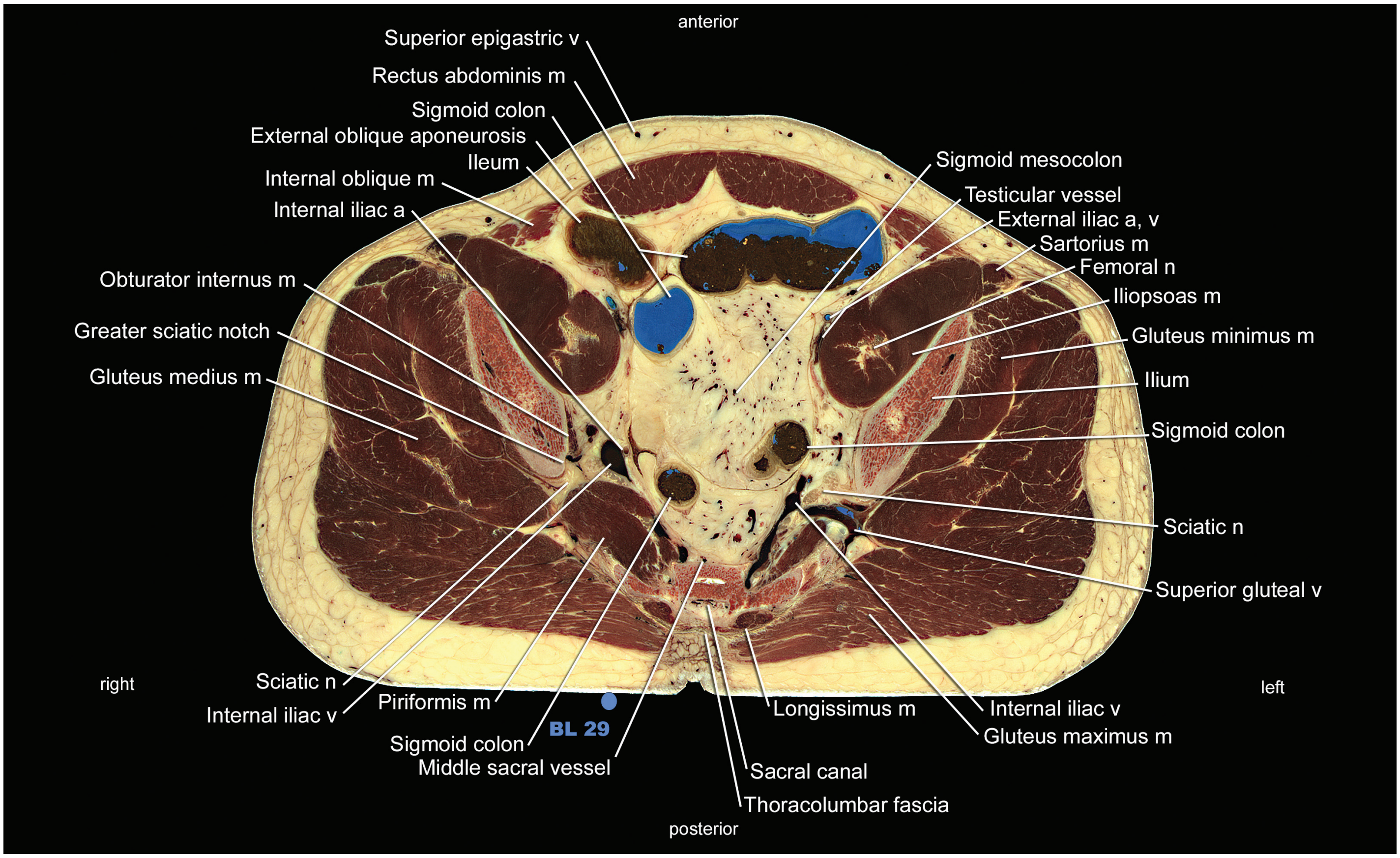

anterior
Superior epigastric v
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
Internal iliac a
Obturator internus m
Greater sciatic notch
Gluteus medius m
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
Sigmoid colon
Sciatic n
Superior gluteal v
right
left
Sciatic n
Internal iliac v
Piriformis m
BL 29
Sigmoid colon
Middle sacral vessel
Longissimus m
Internal iliac v
Gluteus maximus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 7-61A. Both BL 29, "Central Backbone Shu", and BL 33, "Central Bone Hole", are located at the level of S3. The name "Zhong Lu" implicates the action of this acupuncture point on the erector spinae,[2] seen in Figure 7-61A. Trigger points in the gluteus maximus and piriformis muscles often contribute to pain in the back and pelvis.

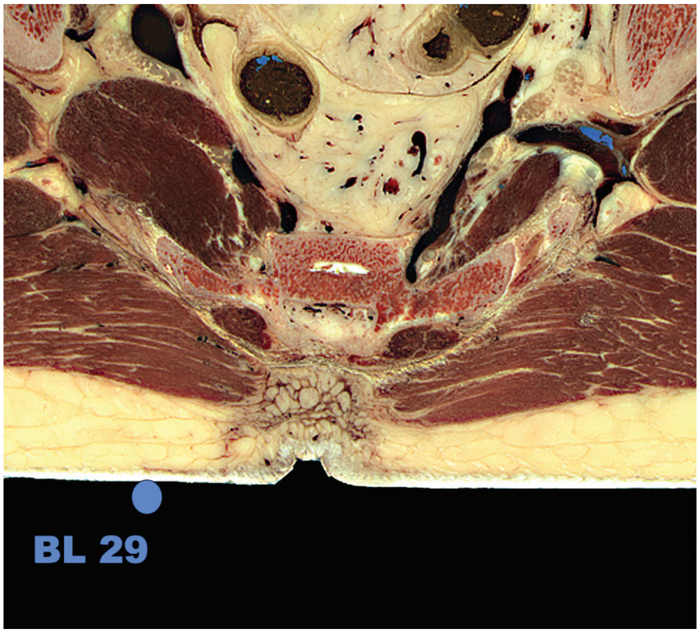


Figure 7-61B. This close-up of BL 29 and its cross sectional anatomical relationships reveals how a needle would sequentially impact the skin, subcutaneous tissue, gluteus maximus, and, depending on the angle of insertion, either the tail of the erector spinae, the sacroiliac joint, or fibers of the piriformis muscle.

- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: Middle cluneal nerve entrapment may cause low back pain, whether due to tension in the erector spinae group compressing the nerves or from gluteus maximus overload. Palpate for trigger points in the gluteus maximus, gluteus medius, and piriformis; deactivate accordingly.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Local and radiating pain, sciatica:** BL 29, BL 30, BL 54, GB 30.
- **Hemorrhoids:** BL 29, BL 30, BL 35, GV 1.
- **Piriformis myofascial dysfunction causing sciatica:** BL 29, BL 30, GB 30, GB 29, massage and laser therapy to the region. BL 40, BL 36.

Evidence-Based Applications

- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain**: KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[1]

References

1. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture*. 2004;15(3):17-18.
2. Quirico PE. Teaching Atlas of Acupuncture. Volume 2. Clinical Indications. Stuttgart: Thieme, 2007. P. 86.

BL 30

Bai Huan Shu "White Ring Shu"

At the level of the S4 and the fourth dorsal sacral foramen, 1.5 cun lateral to the midline, at the level of the sacral hiatus (GV 2).

Ligaments

- **Sacrotuberous ligament:** Provides support and resiliency to the sacroiliac region. Demonstrates broad attachments to the ilium, sacrum, coccyx, and ischium.[1] The ligament closely associates with the long head of the biceps femoris muscle as well as other ligaments and muscles.
- **Sacrospinous ligament:** Provides support and resiliency to the sacroiliac region. Inserts on the medial edge

Clinical Relevance: The sacrospinous ligament can compress either the pudendal or sciatic nerve, causing pain, neuropraxia, and pelvic or pelvic limb dysfunction.[2] Acupuncture, massage, and/or laser therapy will aid in releasing tension on the nerves and assist in resolution of the entrapment.

Tendons and Muscles

- **Erector spinae tendon:** The erector spinae tendon attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.
- **Gluteus maximus muscle:** Extends the thigh and assists in lateral rotation.
- **Piriformis muscle:** Attaches primarily to the inner surface of the sacrum; its tendon inserts onto the greater trochanter of the femur. The piriformis laterally rotates the thigh in the non-weightbearing limb with the hip extended. Aids in abduction when the hip is flexed at a ninety degree angle.

Clinical Relevance: Muscle shortening in the erector spinae group accentuates tension in the tendinous attachment on the sacrum, causing patients to complain of low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines. Trigger points in the gluteus maximus muscle may refer to the hip, coccyx, or gluteal crease and also accentuate back pain. In the vicinity of BL 29, gluteus maximus trigger point pathology issues referred pain along the sacroiliac joint toward the intergluteal cleft (BL 35), down to the gluteal crease (BL 36) and proximal thigh (BL 37). Piriformis trigger points at BL 29 refer pain strongly to the local region and more diffusely to the ipsilateral buttock and caudal thigh.

Nerves

- **Middle cluneal nerve (S1-S3):** Supplies the skin of the gluteal region.

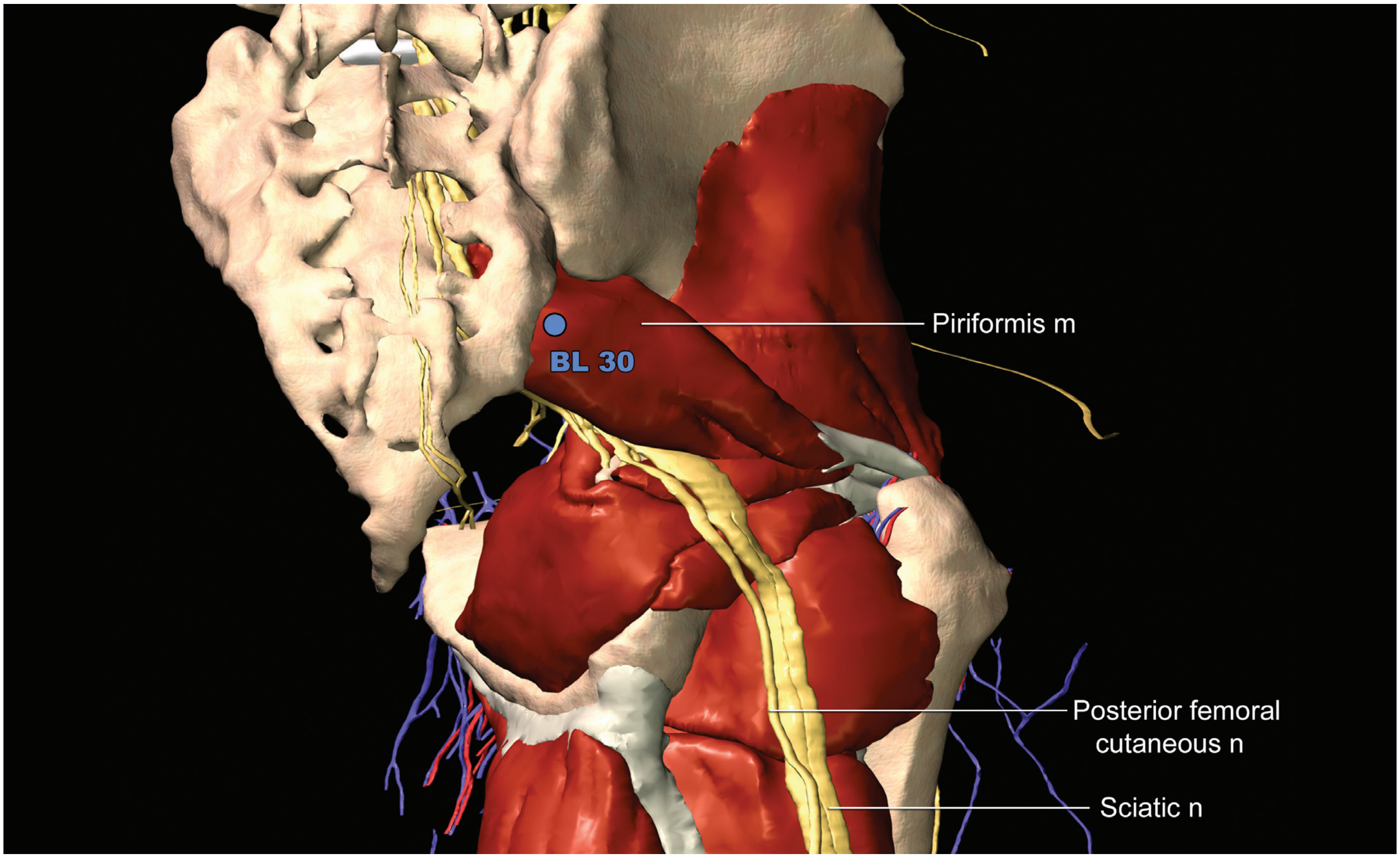


Figure 7-62. BL 30, lands squarely in the middle of the piriformis muscle, near to where it inserts onto the sacrum, highlighting its significance for piriformis dysfunction and sciatic nerve compression.

- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S1-S2 spinal nerves:** Supply the piriformis muscle.
- **S4 spinal nerve**: Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S4 contributes to the pudendal nerve (S2-S4), which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. S4 also supplies fibers to the nerves to the levator ani and coccygeus (S3,S4).
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.
- **Pudendal nerve (S2-S4):** The chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. The pudendal nerve passes between the piriformis muscle and the coccygeus muscle. It branches into the inferior hemorrhoidal nerve, the perineal nerve, and the dorsal nerve of the penis or clitoris. The inferior hemorrhoidal nerve communicates with the perineal branch of the posterior femoral cutaneous nerve and the posterior scrotal nerves. The perineal nerve's deep branch supplies the bulbocavernosus muscle, the corpus cavernosum urethrae, and the mucous membrane of the urethra. The dorsal nerve of the penis gives off a branch supplying the corpus cavernosum of the penis and ends on the glans.

Clinical Relevance: Middle cluneal nerve entrapment may cause low back pain, whether due to tension in the erector

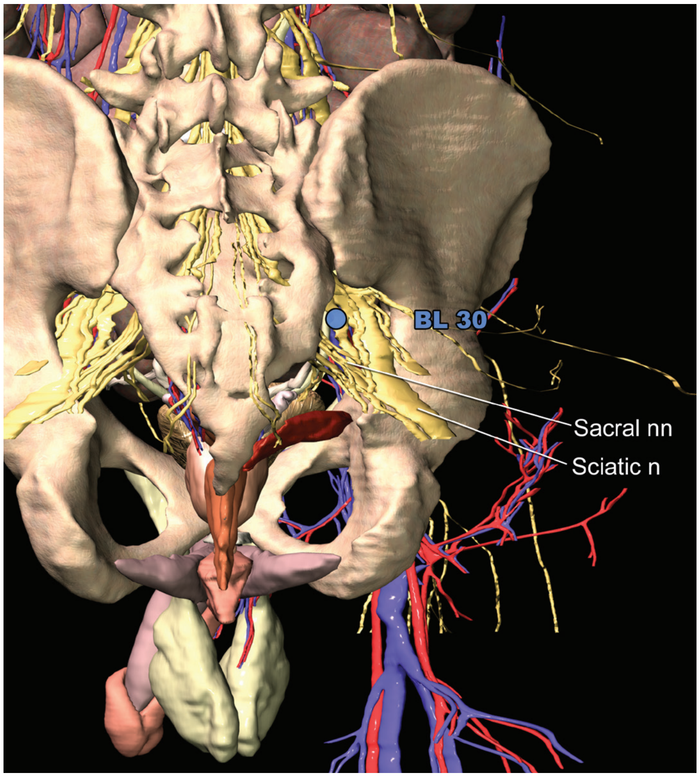

BL 30
Sacral nn
Sciatic n

Figure 7-63. This image reveals the network of nerves deep to the piriformis muscle. The name for BL 30 of "White Ring Shu" refers to the site where ancient acupuncturists thought seminal fluid was stored, perhaps referring to the prostate gland.

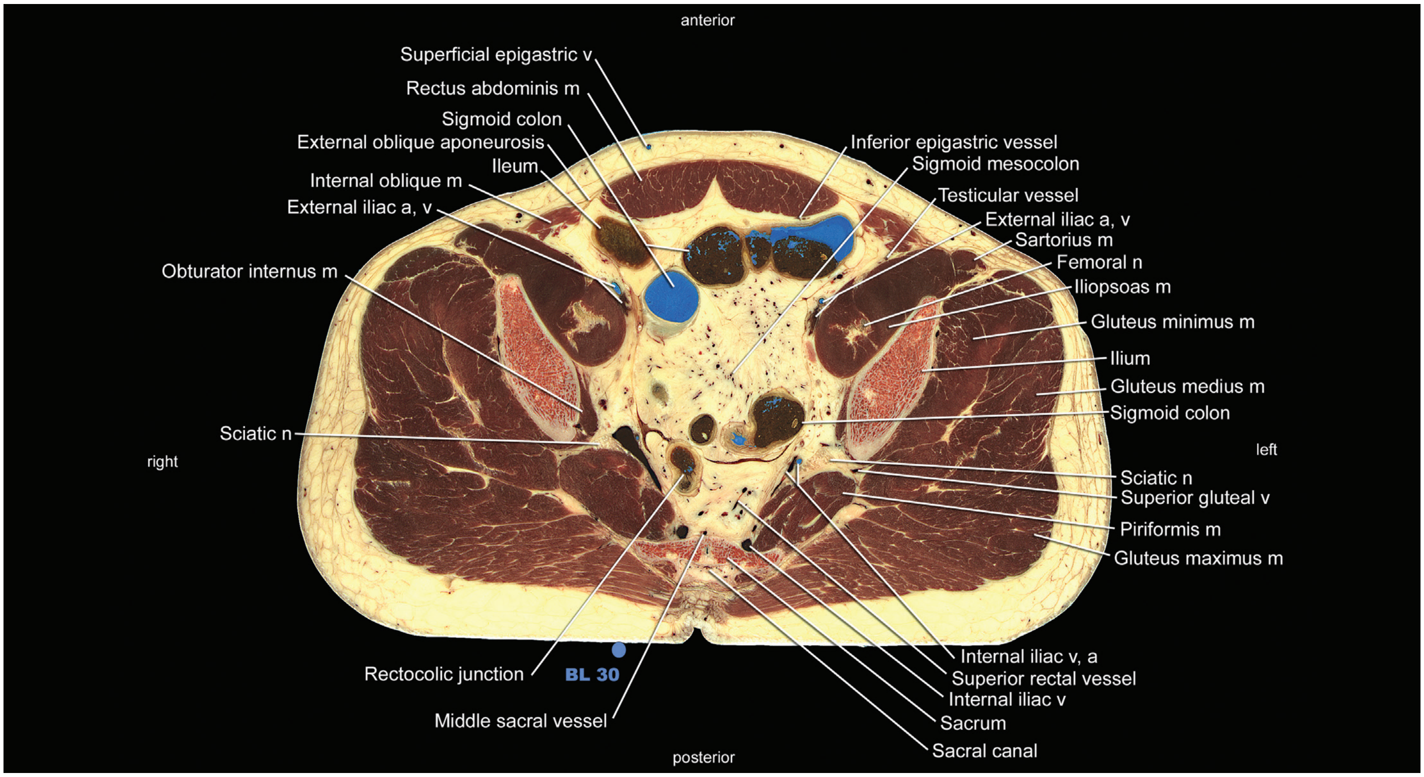

anterior
Superficial epigastric v
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
External iliac a, v
Obturator internus m
Sciatic n
right
Rectocolic junction
BL 30
Middle sacral vessel
posterior
Inferior epigastric vessel
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
Gluteus medius m
Sigmoid colon
left
Sciatic n
Superior gluteal v
Piriformis m
Gluteus maximus m
Internal iliac v, a
Superior rectal vessel
Internal iliac v
Sacrum
Sacral canal

Figure 7-64. This cross section exposes the structures vulnerable to compression by the piriformis muscle, including the sciatic nerve, the superior gluteal vein, and the internal iliac artery and vein.

spinae group compressing the nerves or from gluteus maximus overload. Palpate for trigger points in the gluteus maximus, gluteus medius, and piriformis; deactivate accordingly.

Pudendal nerve entrapment leads to pain in the rectum, scrotum/labia, or penis/clitoris. Pain worsens when seated and subsides when standing or lying down.[3] The two principal sites of pudendal nerve entrapment involve 1) between the sacrotuberous and sacrospinous ligaments and 2) in the pudendal canal.

Vessels

- **Inferior gluteal artery:** Supplies the pelvic diaphragm (which includes the coccygeus and levator ani muscles), the piriformis, quadratus femoris, proximal hamstring, and gluteus maximus muscles as well as the sciatic nerve.
- **Inferior gluteal vein:** Drains blood from the gluteal region.
- **Internal pudendal artery:** The main artery to the perineum (includes muscles and skin of urogenital and anal triangles and the erectile bodies).
- **Internal pudendal vein:** Drains blood from the external genitalia.

Clinical Relevance: Soft tissue dysfunction in this region, along with heightened tension in the ligamentous attachments to the sacrum, may compress vessels as well as nerves. Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Prostate problems:** BL 30, BL 34, BL 35, GV 1.
- **Local and radiating pain, sciatica:** BL 30, BL 29, BL 54, GB 30.
- **Hemorrhoids, rectal prolapse:** BL 30, BL 35, GV 1.
- **Urogenital and anorectal pain:** BL 30, BL 35, local trigger points and myofascial release.
- **Piriformis myofascial dysfunction causing sciatica:** BL 29, BL 30, GB 30, GB 29, massage and laser therapy to the region. BL 40, BL 36.

References

1. Woodley SJ, Kennedy E, and Mercer SR. Anatomy in practice: the sacrotuberous ligament. *New Zealand Journal of Physiotherapy*. 2005;33(3):91-94.
2. Goddyn C, Passuti N, Leconte R, et al. Sciatic nerve compression related to ossification of the sacrospinous ligament secondary to pelvic balance abnormalities. *Orthopaedics & Traumatology: Surgery & Research*. 2009;95:645-648.
3. Ramsden CE, McDaniel MC, Harmon RL, et al. Pudendal nerve entrapment as source of intractable perineal pain. *Phys Med Rehabil*. 2003;82:479-484.

BL 31

Shang Liao "Upper Bone Hole"

Over the 1st dorsal sacral foramen, approximately midway between the midline (GV) and the posterior superior iliac spine (PSIS). The PSIS shows prominently in Figure 7-65 as the bony prominence to the right of BL 31, near the caudal end of the iliac crest.

While BL 31-34 relate to the dorsal sacral foramina, BL 27, BL 28, BL 29, and BL 30 follow the sacroiliac joint.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[3,4]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[5] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.[6]

Muscles

- **Longissimus muscle:** The longissimus attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.

Clinical Relevance: Muscle shortening in the erector spinae group, including the longissimus, accentuates tension affecting its tendinous attachment on the sacrum. This can cause low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines.

Nerves

- **Middle cluneal nerves (S1-S3):** Supply the skin of the gluteal region. After the nerves exit their respective foramina, they traverse the erector spinae and overlying fascia to enter subcutaneous tissue superficial to the gluteus maximus muscle. The more cranial branches of the middle cluneal nerves often communicate with the medial superior cluneal nerve.[7]
- **Medial superior cluneal nerve (L1-L3, terminal ends of dorsal rami):** The superior cluneal nerves supply the skin of the upper buttocks.
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S1 spinal nerve:** Contributes to several nerves, including the sciatic (L4-S3), the superior gluteal (L4-S1), and the inferior gluteal (L5-S2) nerves, the nerve to the piriformis (S1-S2), the nerve to the quadratus femoris and inferior gemellus (L4-S1), and the nerve to the obturator internus and superior gemellus (L5-S2).
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: Nerve entrapments in this region can produce pain that patients interpret as either of musculoskeletal or pelvic organ origin. Usually, freeing the nerve requires a multiplicity of needling sites along with massage and/or laser therapy to return slack to the tissues compressing the nerves.

Neuromodulation for reproductive problems and voiding dysfunction implements points over the sacrum (BL 27-34) to influence organ function in the pelvis through somatovisceral reflexes. Abnormalities in these same organs may sensitize the dorsal sacral spinal nerves, causing tenderness to palpation.

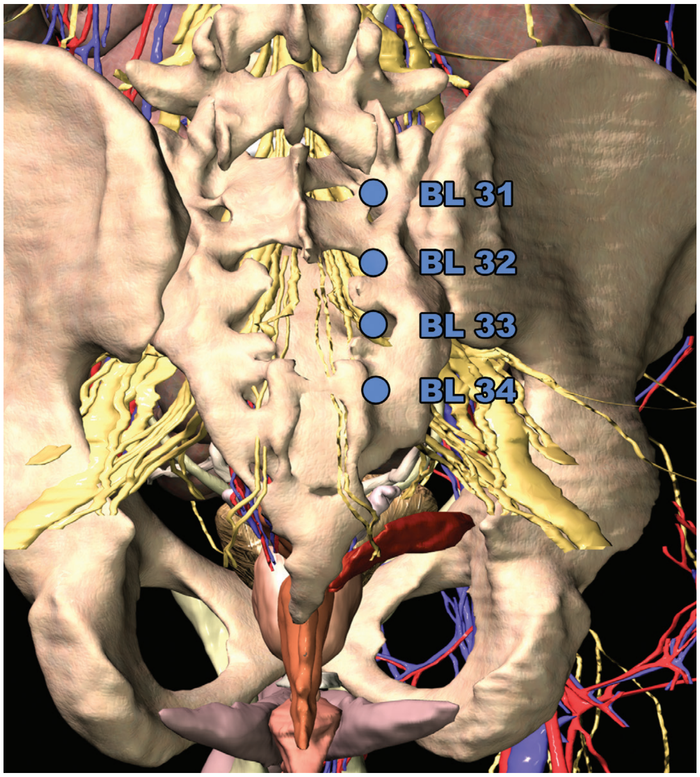


Figure 7-65. The four dorsal sacral foramina on each side of the sacrum (that transmit dorsal sacral spinal nerves) form the "upper", "second", "central", and "lower" "bone holes" pertaining to BL 31, BL 32, BL 33, and BL 34, respectively. Together, all eight foramina, or "bone holes" are called "Baliao", or "eight holes" beneficial for various urinary and reproductive disorders in conjunction with tibial nerve stimulation.[9]

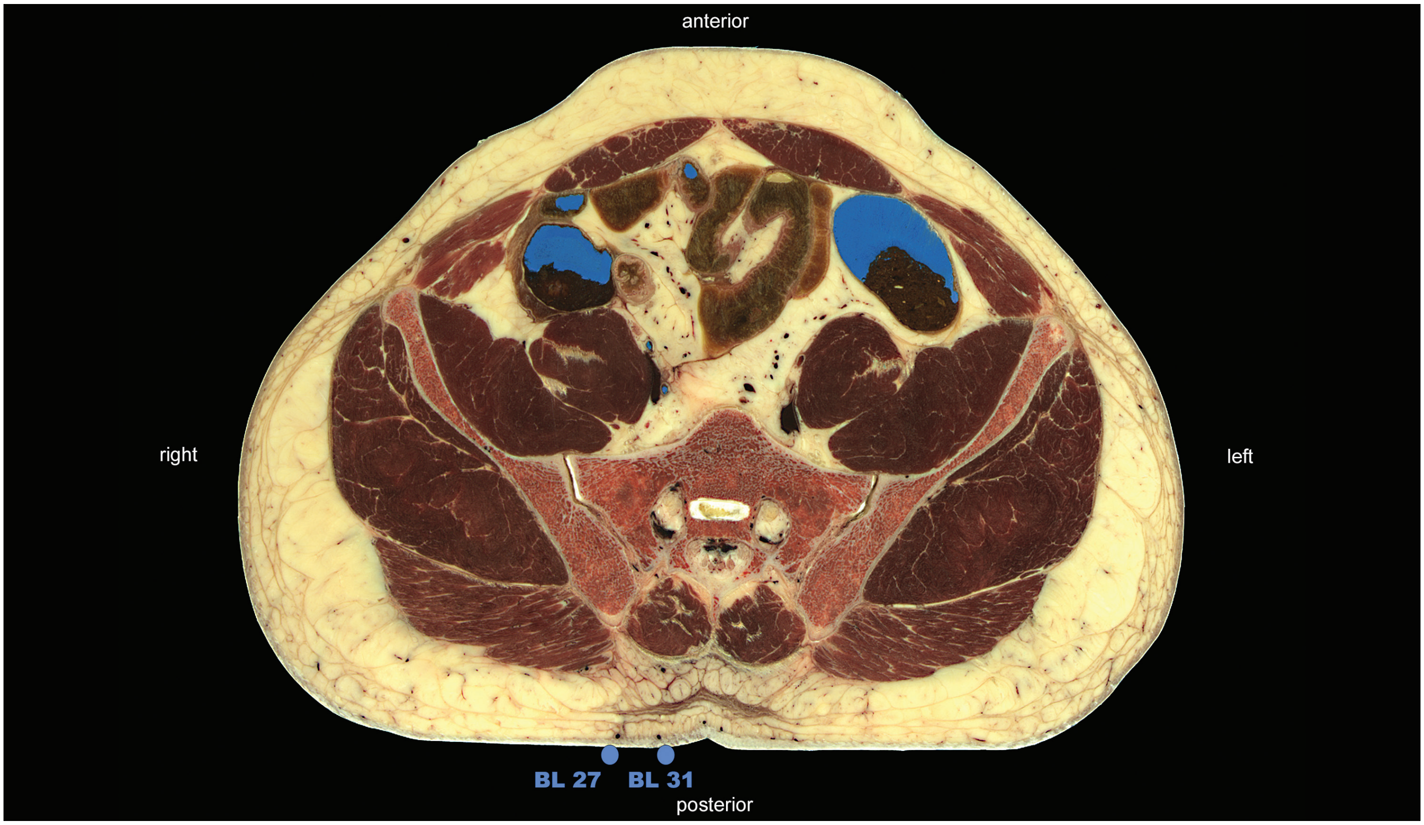


Figure 7-66. BL 31 lies medial to BL 27, over the first sacral foramen, the "Upper Bone Hole". This cross-section highlights the differences between these two parallel segments of the BL channel that cover the sacrum. At this level, the lines course closer together and they move closer to the midline. In a counterintuitive fashion, BL 31-34 form the "inner" BL line in that they sit upon the erector spinae group while BL 27-30 assemble along the lateral border.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and supporting tissue recovery.

Indications and Potential Point Combinations

- **Local back and hip pain and biomechanical dysfunction:** BL 31, local trigger points, BL 23, BL 40, GB 30, BL 54.
- **Gynecologic disorders:** irregular menses, uterine prolapse, leucorrhea: BL 31, BL 32, GV 4, SP 6.
- **Voiding dysfunction; urinary or fecal incontinence or retention:** BL 31, BL 32, BL 33, KI 3, SP 6.
- **Prostatitis:** BL 31, BL 30, BL 34, GV 2.
- **Erectile dysfunction:** BL 31, BL 32, BL 33, BL 34, CV 4.
- **Lumbar intervertebral disk disease:** BL 23, BL 25, BL 31, BL 32, BL 33, BL 44, and BL 54.[8]

Evidence-Based Applications

- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[1]
- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain,** even at a 3 month follow-up.[2]

References

1. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System.* 2000;79:173-180.
2. Mohlsberger AF, Mau J, Pawelec DB, et al. Does acupuncture improve the orthopedic management of chronic low back pain -- a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99(3):579-587.
3. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
4. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
5. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
6. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.
7. Tubbs RS, Levin MR, Loukas M, et al. Anatomy and landmarks for the superior and middle cluneal nerves: application to posterior iliac crest harvest and entrapment syndromes. *J Neurosurg Spine.* 2010;13:356-359.
8. Li YQ and Liu YQ. Therapeutic effect of acupuncture on postoperative recovery of prolapse of lumbar intervertebral disc. *Zhongguo Zhen Jiu.* 2006;26(8):566-568.
9. Wang XY. Effect of acupuncture on bladder function in patients with radical hysterectomy. *Zhen Ci Yan Jiu.* 2007;32(2):132-135.

BL 32

Ci Liao "Second Bone Hole"

Over the 2nd dorsal sacral foramen,[13] approximately midway between the midline (GV) and BL 28. (Refer to Figure 7-68 for relative locations of BL 32 and BL 28.)

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[14,15]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[16] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.[17]

Muscles

- **Longissimus muscle:** The longissimus attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.

Clinical Relevance: Muscle shortening in the erector spinae group, including the longissimus, accentuates tension affecting its tendinous attachment on the sacrum. This can cause low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines.

Nerves

- **Middle cluneal nerves (S1-S3):** Supply the skin of the gluteal region. After the nerves exit their respective foramina, they traverse the erector spinae and overlying fascia to enter subcutaneous tissue superficial to the gluteus maximus muscle. The more cranial branches of the middle cluneal nerves often communicate with the medial superior cluneal nerve.[18]
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S2 spinal nerve:** Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S2 contributes to the pudendal nerve (along with S3 and S4), which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. S2 also provides input to the sciatic nerve (L4-S3), the inferior gluteal nerve (see below), the nerve to the piriformis (S1,S2), the nerve to the obturator internus and the superior gemellus (L5-S2), the posterior femoral cutaneous nerve (S2,S3), and the perforating cutaneous nerve (S2,S3).

Clinical Relevance: Nerve entrapments in this region can produce pain that patients interpret as either of musculoskeletal or pelvic organ origin. Usually, freeing the nerve requires a multiplicity of needling sites along with massage and/or laser therapy to return slack to the tissues compressing the nerves.

Neuromodulation for reproductive problems and voiding dysfunction implements points over the sacrum (BL 27-34) to influence organ function in the pelvis through somatovisceral reflexes. Abnormalities in these same organs may sensitize the dorsal sacral spinal nerves, causing tenderness to palpation.

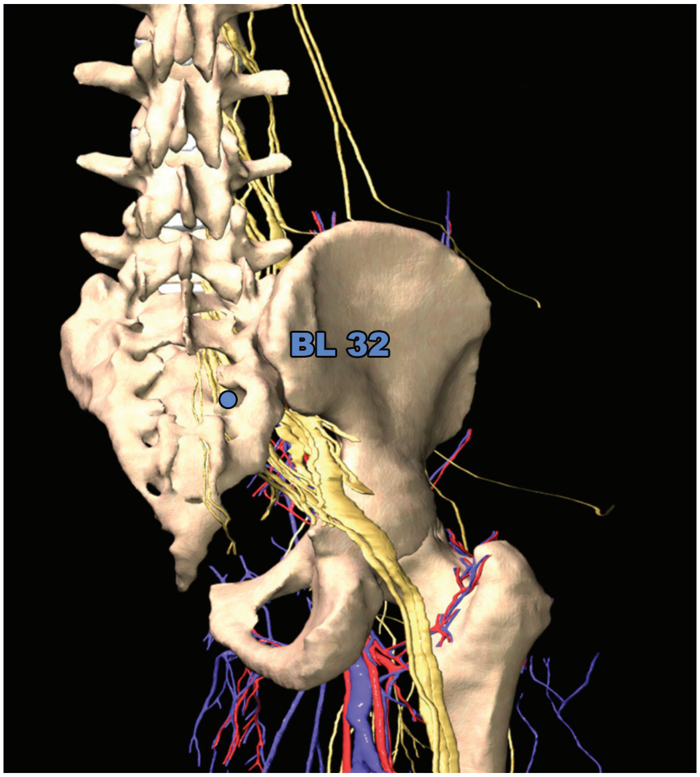


Figure 7-67. BL 32, over the "Second Bone Hole", or 2nd sacral foramen, influences several pelvic organ-related activities, including micturition, reproduction-related conditions, and defecation by dint of its association with the S2 spinal nerve and sacral spinal cord segments. The posterior superior iliac spine (PSIS) provide reliable topographical landmark by which to identify the S2 spinous process in most adult humans.[22]

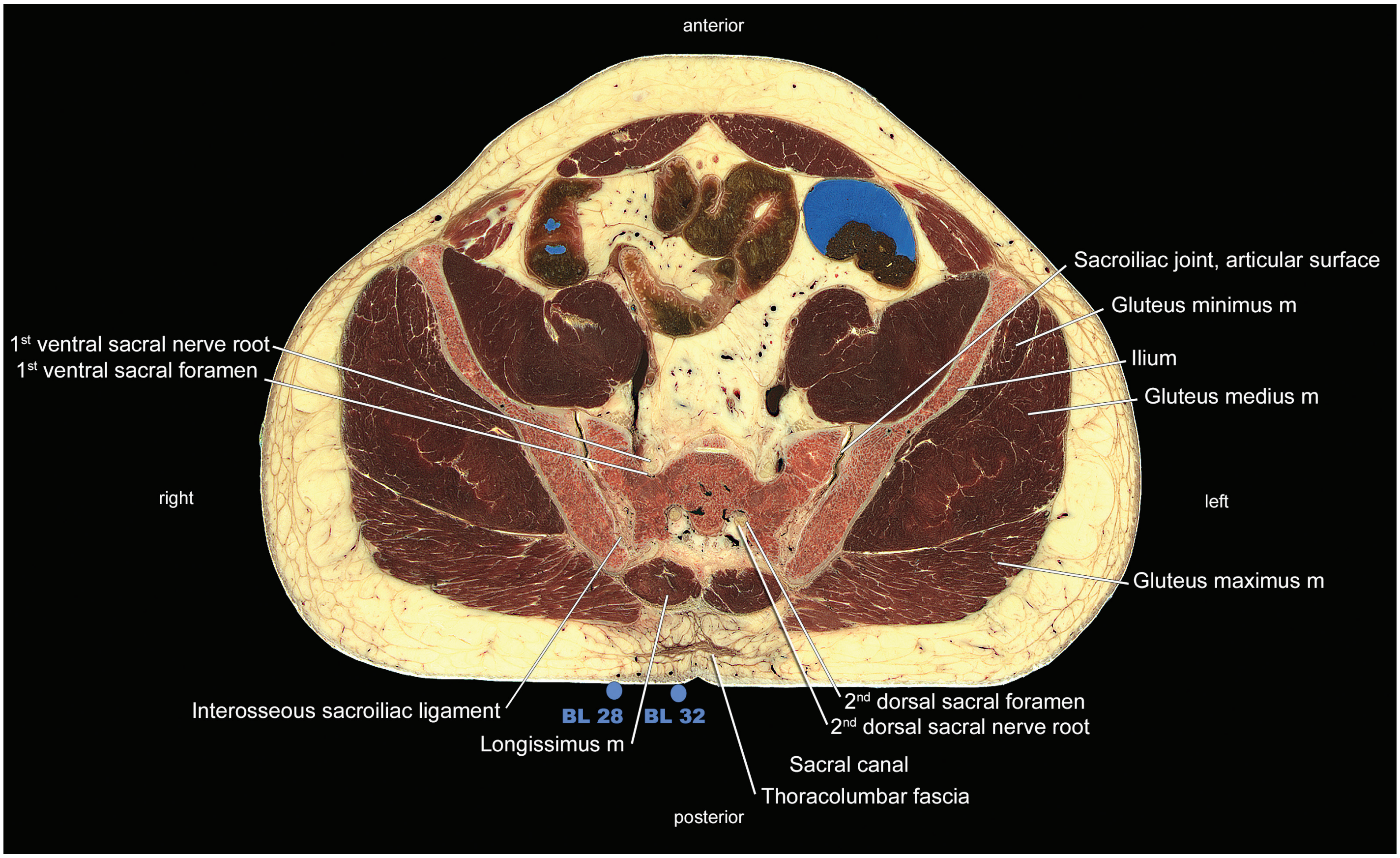

anterior
Sacroiliac joint, articular surface
Gluteus minimus m
1st ventral sacral nerve root
1st ventral sacral foramen
Ilium
Gluteus medius m
right
left
Gluteus maximus m
Interosseous sacroiliac ligament
BL 28
BL 32
2nd dorsal sacral foramen
2nd dorsal sacral nerve root
Longissimus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 7-68. Note the relationship between BL 32 and the 2nd dorsal sacral foramen and nerve root, the neuroanatomic target that engenders reflexes with nerves controlling reproductive and voiding activities. Furthermore, this cross section allows us to appreciate the size of the sacroiliac joint; the distinctive layers of the gluteus minimus, medius, and maximus; and the mass of the iliopsoas muscle ventral to the wings of the ilia.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and supporting tissue recovery.

Indications and Potential Point Combinations

- **Genitourinary disorders, including prostatitis, erectile dysfunction, urinary retention/detrusor hyperreflexia[19] or incontinence, voiding dysfunction:** BL 32, BL 23, BL 28, CV 2, CV 3, SP 6, KI 3.
- **Low back pain:** BL 32, appropriate trigger points and spinal segmental nerve supply.
- **Pelvic limb weakness and pain:** BL 32, BL 23, BL 40, Bafeng (web spaces between the toes), other points related to cause of myofascial pain or neurologic weakness.
- **Hip problems and restriction:** BL 32, BL 28, BL 54, GB 29, GB 30.
- **Uterine discomfort or dysfunction:[20,21]** BL 32, SP 6, GV 2, GV 3, KI 3.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[1]
- Electroacupuncture at CV 3, CV 4, and BL 32 benefited patients with **spinal cord injuries** by shortening the time to achieve a balanced bladder, as long as the treatments occurred within three weeks after injury.[2]
- Neuroanatomically, acupuncture at BL 32 may support **sexual performance** through its influence on the pelvic nerve and inferior hypogastric ganglion.[3]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency after transurethral resection of the prostate**.[4]
- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[5]
- Acupuncture at CV 3, CV 6, GV 4, BL 23, BL 32, LI 4, ST 36, and KI 3 served to neuromodulate recto-anal function in women with **fecal incontinence**.[6]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction**.[7]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in **improvement in sperm quality**, specifically in the ultrastructural integrity of spermatozoa.[8]

- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes**.[9]
- Acupuncture at BL 32, TH 6, and ST 36 improved constipation due to **diabetes mellitus** in a report on a series of cases.[10]
- Acupuncture at BL 23, BL 24, BL 32, BL 39, and BL 54 offered improvement in five out of six urodynamic measures assessed in patients with **diabetic bladder dysfunction.**[11]
- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain**, even at a 3 month follow-up.[12]

References

1. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.

2. Cheng P-T, Wong M-K, and Chang P-L. A therapeutic trial of acupuncture in neurogenic bladder of spinal cord injured patients – a preliminary report. *Spinal Cord.* 1998;36:476-480.

3. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05

4. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.

5. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System.* 2000;79:173-180.

6. Scaglia M, Delaini GG, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Autonomic Neuroscience: Basic and Clinical.* 2009;145:89-92.

7. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.

8. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility.* 2005;84(1):141-147.

9. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. Menopause: *The Journal of the North American Menopausal Society.* 1995;2(1):3-12.

10. Xiong X-H and Deng De-Ming. Acupuncture treatment of constipation due to diabetes mellitus: an observation of 21 cases. *International Journal of Clinical Acupuncture.* 1995;6(1):19-21.

11. Tong Y, Jia Q, Sun Y, et al. Acupuncture in the treatment of diabetic bladder dysfunction. *Journal of Alternative and Complementary Medicine.* 2009;15(8):905-909.

12. Molsberger AF, Mau J, Pawelec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. Pain. 2002;99:579-587.

13. Wang R, Song YF, Zhang WJ, et al. The location of Ciliao (BL 32) acupoint by three-dimensional reconstruction of computed tomography in women. *Zhen Ci Yan Jiu.* 2010;35(4):307-310.

14. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129

15. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.

16. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.

17. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.

18. Tubbs RS, Levin MR, Loukas M, et al. Anatomy and landmarks for the superior and middle cluneal nerves: application to posterior iliac crest harvest and entrapment syndromes. *J Neurosurg Spine.* 2010;13:356-359.

19. Yu JN, Ma XJ, Liu ZS, et al. Effect of electroacupuncture at "Ciliao" (BL 32) on c-fos expression in the sacral segment of spinal cord in rats with detrusor hyperreflexia. *Zhen Ci Yan Jiu.* 2010;35(3):204-207, 221.

20. Gao WJ and Weng CY. The analgesic mechanism of BL-32 acupoint in electro-acupuncture anesthesia of uterine operations. *Zhen Ci Yan Jiu.* 1988;13(4):340-344.

21. Gao WJ and Weng CY. A preliminary investigation of the segmental distribution of afferent fibers in acupoint Ziljao (BL-32) and uterus with HRP method. *Zhen Ci Yan Jiu.* 1988;13(2):144-149.

22. McGaugh JM, Brismee JM, Dedrick GS, et al. Comparing the anatomical consistency of the posterior superior iliac spine to the iliac crest as reference landmarks for the lumbo-pelvic spine: a retrospective radiological study. *Clinical Anatomy.* 2007;20:819-825.

BL 33

Zhang Liao "Central Bone Hole"

Over the 3rd dorsal sacral foramen, approximately midway between the midline (GV) and BL 29.

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[3,4]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

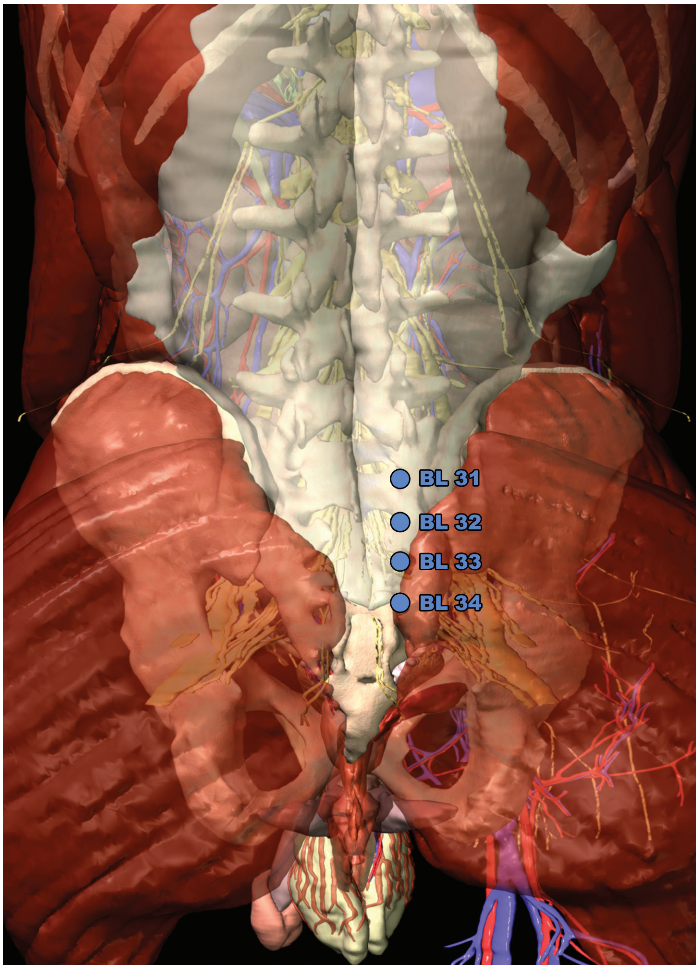


Figure 7-69. This image reveals the relationship between the "Bone Hole" points (BL 31 through BL 34) and the massive gluteus maximus muscle. BL 33, the "Central Bone Hole" receives its name for its location roughly at the midpoint of the sacrum. Muscles outside the sacrum can refer pain to this central bony structure, including the gluteus medius and maximus, the rectus abdominis, obturator internus, quadratus lumborum, sphincter ani, levator ani, and coccygeus.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[5] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.[6]

Muscles

- **Longissimus muscle:** The longissimus attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.
- **Gluteus maximus muscle:** Extends thigh and assists in lateral rotation.

Clinical Relevance: Muscle shortening in the erector spinae group, including the longissimus, accentuates tension affecting its tendinous attachment on the sacrum. This can cause low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines.

Trigger points in the gluteus maximus, i.e., at BL 33, cause pain to refer along the sacroiliac junction, to the intergluteal cleft, and then around the horizontal gluteal crease and proximal caudal thigh. In acupuncture terminology, BL 33 refers pain craniad to BL 26, caudomediad to BL 35, laterad to BL 36 and GB 29, and distad to BL 37.

Nerves

- **Middle cluneal nerves (S1-S3):** Supply the skin of the gluteal region. After the nerves exit their respective foramina, they traverse the erector spinae and overlying fascia to enter subcutaneous tissue superficial to the gluteus maximus muscle. The more cranial branches of the middle cluneal nerves often communicate with the medial superior cluneal nerve.[7]
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S3 spinal nerve:** Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S3 contributes to the pudendal nerve (along with S2 and S4), which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter. S3 also supplies the sciatic nerve (L4-S3), the nerves to the levator ani and coccygeus muscles (S3,S4), the posterior femoral cutaneous nerve (S2,S3), and the perforating cutaneous nerve (S2,S3).

Clinical Relevance: Nerve entrapments in this region can produce pain that patients interpret as either of musculoskeletal

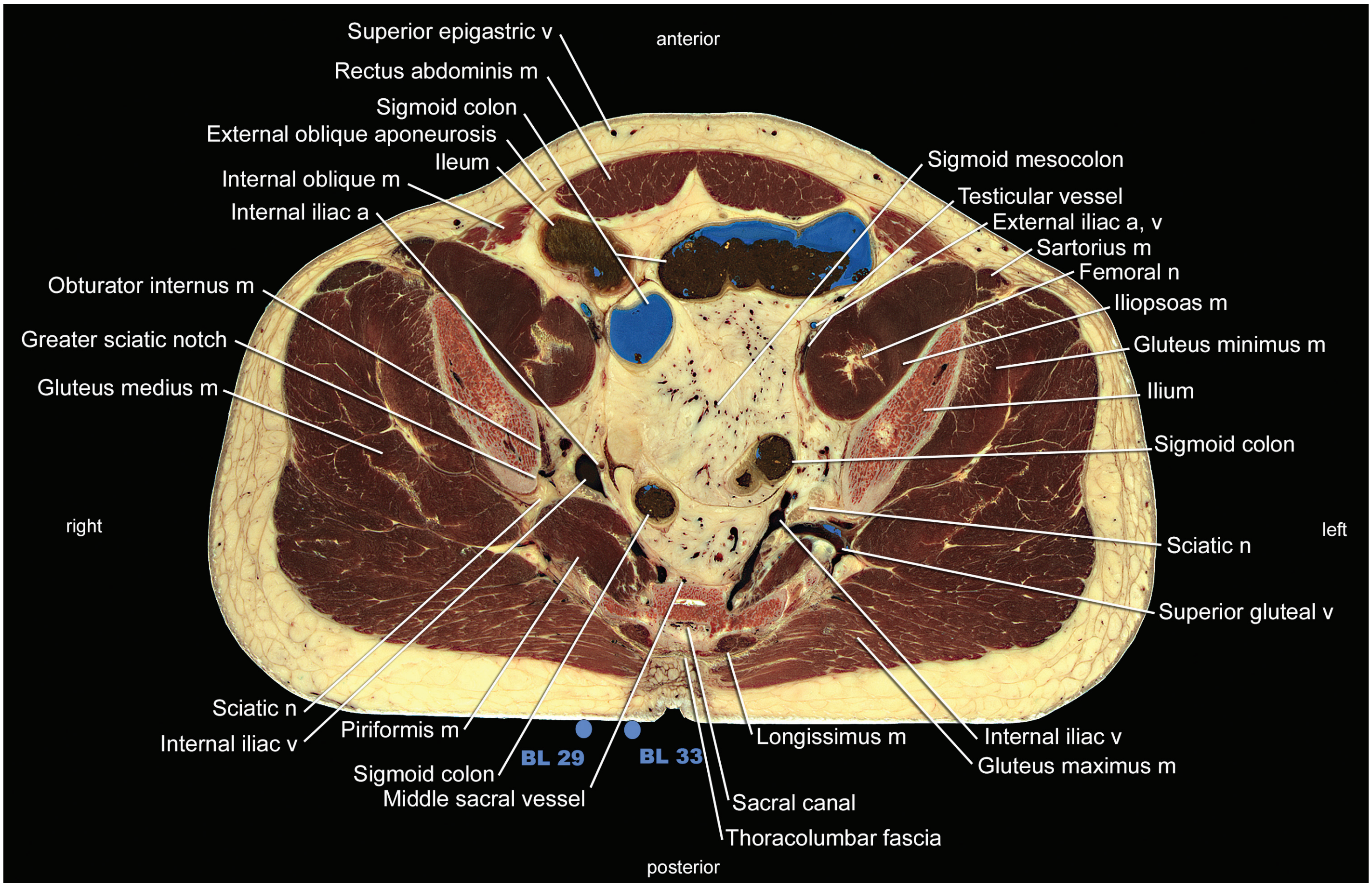

Superior epigastric v
anterior
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
Internal iliac a
Obturator internus m
Greater sciatic notch
Gluteus medius m
right
Sciatic n
Internal iliac v
Piriformis m
Sigmoid colon
Middle sacral vessel
BL 29
BL 33
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
Sigmoid colon
left
Sciatic n
Superior gluteal v
Longissimus m
Internal iliac v
Gluteus maximus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 7-70A. This image reveals the way in which a needle entering BL 33 might first encounter the gluteus maximus, then the tough thoracolumbar fascia, and finally the tail of the longissimus muscle, depending on its angle of insertion and final depth. Too, this cross-section depicts the way in which the piriformis muscle could entrap the sciatic nerve against the greater sciatic notch, in cases of myofascial dysfunction.

or pelvic organ origin. Usually, freeing the nerve requires a multiplicity of needling sites along with massage and/or laser therapy to return slack to the tissues compressing the nerves.

Neuromodulation for reproductive problems and voiding dysfunction implements points over the sacrum (BL 27-34) to influence organ function in the pelvis through somatovisceral reflexes. Abnormalities in these same organs may sensitize the dorsal sacral spinal nerves, causing tenderness to palpation.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and supporting tissue recovery.

Indications and Potential Point Combinations

- **Genitourinary disorders, including prostatitis, erectile dysfunction, urinary retention or incontinence, voiding dysfunction:** BL 33, BL 32, BL 23, BL 28, CV 2, CV 3, SP 6, KI 3.

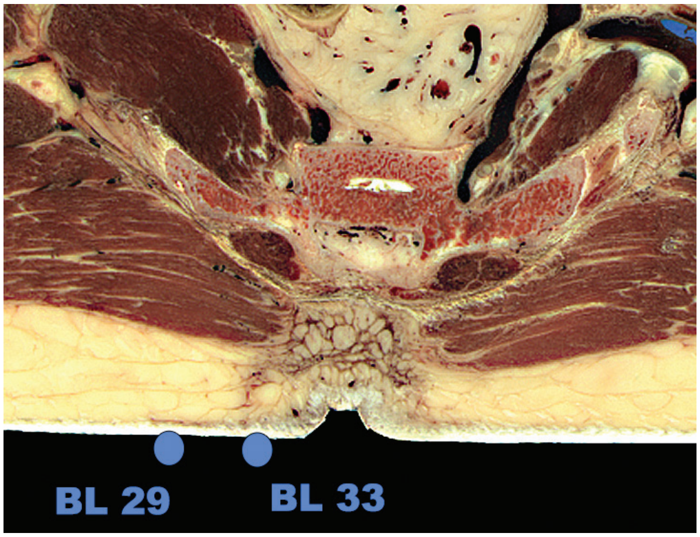


Figure 7-70B. Visualizing the layered anatomy beneath a point allows one to connect the palpatory feedback delivered through the needle as the tip meets each new layer and tissue type.

- **Hemorrhoids:** BL 33, BL 29, BL 30, BL 35, GV 1.
- **Low back pain:** BL 33, BL 32, appropriate trigger points and spinal segmental nerve supply.
- **Local and radiating pain, sciatica:** BL 33, BL 29, BL 30, BL 54, BL 40, BL 60, KI 3, GB 30.
- **Pelvic limb weakness and pain:** BL 33, BL 32, BL 23, BL 40, Bafeng (web spaces between the toes), other points related to cause of myofascial pain or neurologic weakness.
- **Hip problems and restriction:** BL 33, BL 32, BL 28, BL 54, GB 29, GB 30.

Evidence-Based Applications

- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[1]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[2]
- Needling BL 33 to the sacral periosteum over the 3rd dorsal sacral foramen and stimulating manually for 20 minutes led to a statistically significant improvement in symptoms and quality of life for men clinically diagnosed with chronic **prostatitis/chronic pelvic pain syndrome** (CP/CPPS).[8]
- Acupuncture with manual needle rotation at BL 33 for 10 minutes improved nocturnal bladder capacity and reduced episodes of occurrence in patients with mono-symptomatic **nocturnal enuresis.**[9]
- Acupuncture at BL 33 significantly reduced pain and intrapelvic venous congestion in male patients with **chronic pelvic pain.**[10]

References

1. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System.* 2000;79:173-180.
2. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
3. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
4. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
5. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
6. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.
7. Tubbs RS, Levin MR, Loukas M, et al. Anatomy and landmarks for the superior and middle cluneal nerves: application to posterior iliac crest harvest and entrapment syndromes. *J Neurosurg Spine.* 2010;13:356-359.
8. Tugcu V, Tas S, Eren G, et al. Effectiveness of acupuncture in patients with category IIIB chronic pelvic pain syndrome: a report of 97 patients. *Pain Medicine.* 2010;11:518-523.
9. Honjo H, Kawauchi A, Ukimura O, et al. Treatment of monosymptomatic nocturnal enuresis by acupuncture: a preliminary study. *International Journal of Urology.* 2002;9:672-676.
10. Honjo H, Kamoi K, Naya Y, et al. Effects of acupuncture for chronic pelvic pain syndrome with intrapelvic venous congestion: preliminary results. *Int J Urol.* 2004;11(8):607-612.

BL 34

Xia Liao "Lower Bone Hole"

Over the 4th dorsal sacral foramen, approximately midway between the midline (GV) and BL 30.

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure whose fibers crisscross the sacrum.

Clinical Relevance: The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine.[1,2]

Tension in the fasciae of the back, including the thoracolumbar fascia and the vertebral aponeurosis, increases as a result of muscular contraction from the abdominal wall, the erector spinae, and the gluteal muscles. Fascial tension transmits forces away from the spine and onto the ilium and pelvic limb. This funneling of load helps to protect the sacroiliac joint.

Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[3] Some patients with chronic low back pain exhibit reduced thoracolumbar shear strain or shear plane motion that possibly results from abnormal movement patterns of the trunk or intrinsic connective tissue pathology.[4]

Muscles

- **Longissimus muscle:** The longissimus attaches to the median sacral crest, to the spinous processes of the lumbar and last two thoracic vertebrae, and the supraspinal ligament. Some of its fibers are continuous with the fibers of origin of the gluteus maximus.
- **Gluteus maximus muscle:** Extends thigh and assists in lateral rotation.

Clinical Relevance: Muscle shortening in the erector spinae group, including the longissimus, accentuates tension affecting its tendinous attachment on the sacrum. This can cause low back or sacroiliac pain. Acupuncture, massage therapy, and laser treatment of the back should attend to the entire length of the erector spinae group. Trigger points in the thoracolumbar regions of the iliocostalis lumborum and longissimus thoracis send pain to the buttocks along the BL channel, both inner and outer lines.

Trigger points in the gluteus maximus, i.e., at BL 33, cause pain to refer along the sacroiliac junction, to the intergluteal cleft, and then around the horizontal gluteal crease and proximal caudal thigh. In acupuncture terminology, BL 33 refers pain craniad to BL 26, caudomediad to BL 35, laterad to BL 36 and GB 29, and distad to BL 37.

Nerves

- **Middle cluneal nerves (S1-S3):** Supply the skin of the gluteal region. After the nerves exit their respective foramina, they traverse the erector spinae and overlying fascia to enter subcutaneous tissue superficial to the gluteus maximus muscle. The more cranial branches of the middle cluneal nerves often communicate with the medial superior cluneal nerve.[5]
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **S4 spinal nerve:** Carries a portion of the sacral parasympathetic outflow (S2-S4) to the pelvic viscera via the sacral spinal nerves, otherwise known as the pelvic (or parasympathetic) splanchnic nerves. S4 contributes to the pudendal nerve (S2-S4),[6] which is the chief sensory nerve to the external genitalia and supplies muscular branches to the perineal muscles, the external urethral sphincter, and the external anal sphincter.

S4 also supplies fibers to the nerves to the levator ani and coccygeus (S3,S4). S4 contributes to the coccygeal plexus, which gives rise to the anococcygeal nerve that penetrates the sacrotuberous ligament and innervates the skin in the region of the anus and coccyx.

- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: Nerve entrapments in this region can produce pain that patients interpret as either of musculoskeletal or pelvic organ origin. Usually, freeing the nerve requires a multiplicity of needling sites along with massage and/or laser therapy to return slack to the tissues compressing the nerves.

Neuromodulation for reproductive problems and voiding dysfunction implements points over the sacrum (BL 27-34) to influence organ function in the pelvis through somatovisceral

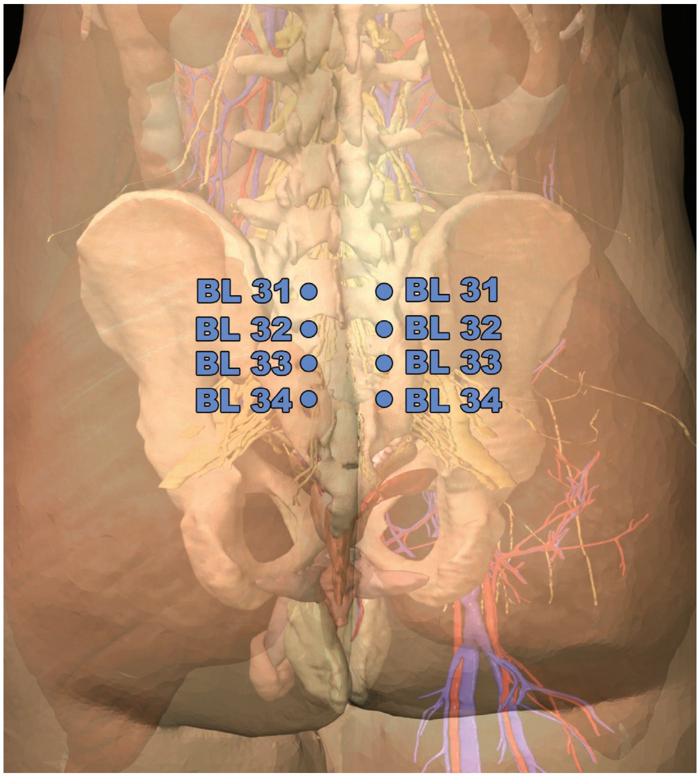


Figure 7-71. BL 34 ("Lower Bone Hole"), corresponds to S4. BL 33 ("Central Bone Hole") belongs to S3; BL 32 ("Second Bone Hole") to S2, and BL 31 ("Upper Bone Hole") to S1.

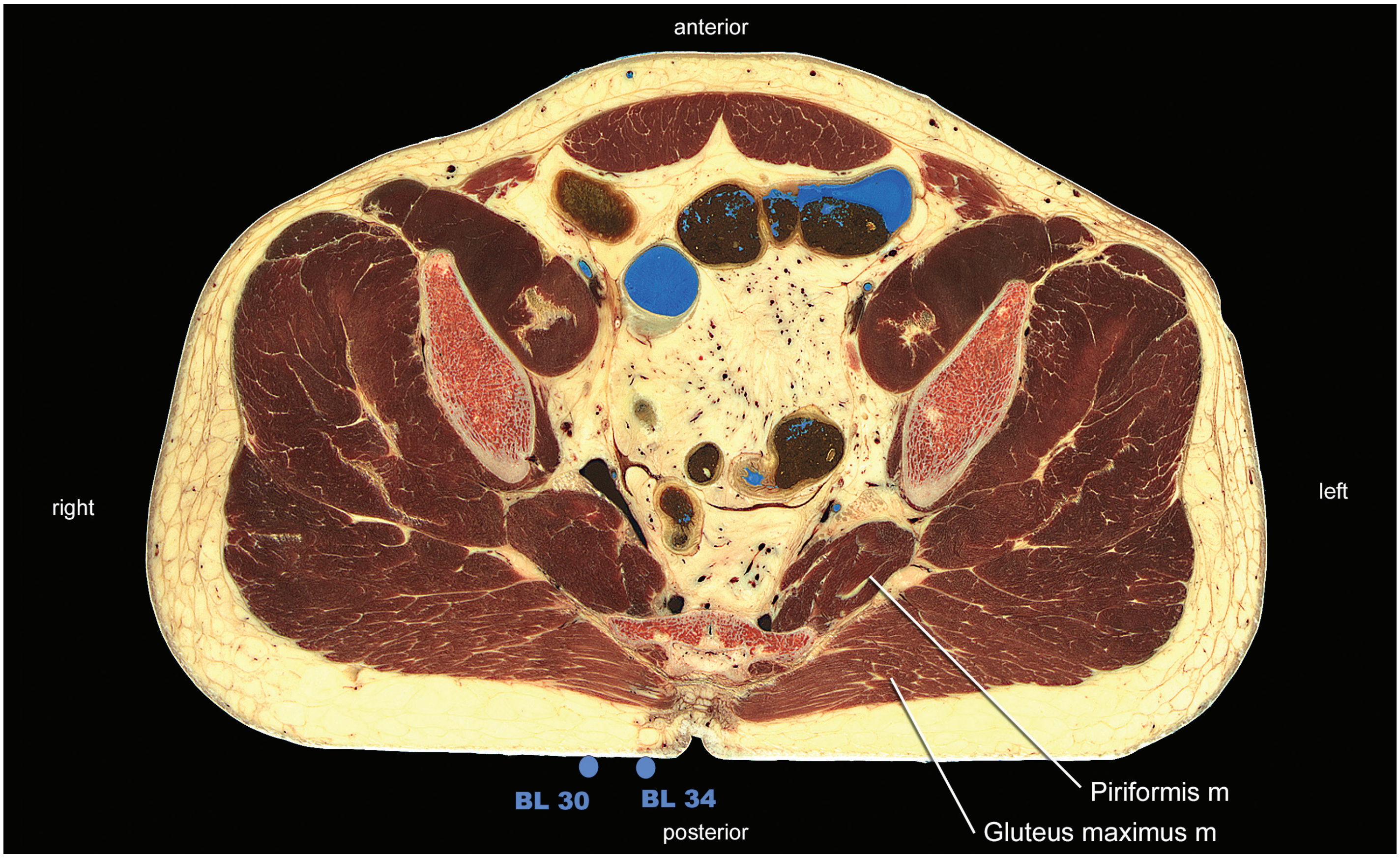


Figure 7-72. In this cross section, the pelvis is merging with the pelvic limbs, showing fewer organs and more skeletal muscle.

reflexes. Abnormalities in these same organs may sensitize the dorsal sacral spinal nerves, causing tenderness to palpation.

Vessels

- **Lateral sacral artery:** Supplies the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.
- **Lateral sacral vein:** Drains the piriformis, the structures in the sacral canal, the erector spinae muscles, and the overlying skin.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and supporting tissue recovery.

Indications and Potential Point Combinations

- **Genitourinary disorders, including prostatitis, erectile dysfunction, urinary retention or incontinence, voiding dysfunction:** BL 33, BL 32, BL 23, BL 28, CV 2, CV 3, SP 6, KI 3.
- **Hemorrhoids:** BL 33, BL 29, BL 30, BL 35, GV 1.
- **Low back pain:** BL 33, BL 32, appropriate trigger points and spinal segmental nerve supply.
- **Local and radiating pain, sciatica:** BL 33, BL 29, BL 30, BL 54, BL 40, BL 60, KI 3, GB 30.
- **Pelvic limb weakness and pain:** BL 33, BL 32, BL 23, BL 40, Bafeng (web spaces between the toes), other points related to cause of myofascial pain or neurologic weakness.
- **Hip problems and restriction:** BL 33, BL 32, BL 28, BL 54, GB 29, GB 30.

References

1. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
2. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
3. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
4. Langevin HM, Fox JR, Koptiuch C, et al. Reduced thoracolumbar fascia shear strain in human chronic low back pain.
5. Tubbs RS, Levin MR, Loukas M, et al. Anatomy and landmarks for the superior and middle cluneal nerves: application to posterior iliac crest harvest and entrapment syndromes. *J Neurosurg Spine.* 2010;13:356-359.
6. Lierse W. Blood vessels and nerves of the human penis. *Urol Int.* 1982;37:145-151

BL 35

Hui Yang "Meeting of Yang"

Below the sacrum, 0.5 cun lateral to the midline, level with the tip of the coccyx.

Ligaments

- **Sacrotuberous ligament:** Provides support and resiliency to the sacroiliac region. Attaches from the dorsal iliac crest, caudal three sacral vertebrae, and coccyx to the medial aspect of the ischial tuberosity.[3] The ligament associates intimately with several ligamentous and muscular structures in the region, as well as a portion of the long head of the biceps femoris muscle.[4]

Clinical Relevance: The pudendal nerve can experience entrapment by the sacrotuberous ligament, causing patients to complain of pain along the course of this nerve. Ossification of the ligament elevates the risk of pudendal nerve entrapment. Pregnancy can cause women to develop strain symptoms in the lumbosacral region and pelvis in the eighth month as well as after parturition.[5] While the most frequently irritated ligaments include the interspinous, iliolumbar, and sacroiliac, the sacrotuberous become strained during pregnancy and cause pelvic pain.

Muscles

- **Gluteus maximus muscle:** Extends the thigh and assists in lateral rotation.

Clinical Relevance: Trigger points in the gluteus maximus, i.e., at BL 35, send pain mediad to the intergluteal crease and anorectal region. Pain in the vicinity of BL 35 can arise from trigger point pathology in the sphincter ani, levator ani, coccygeus, and obturator internus muscles.

Nerves

- **Middle cluneal nerve (S1-S3):** Supplies the skin of the gluteal region.
- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.
- **Anococcygeal nerves (S4, S5):** From the coccygeal plexus, the anococcygeal nerves emerge through the sacrotuberous ligament to supply a small region of skin close to the coccyx.
- **Ganglion impar:** The only unpaired, autonomic ganglion in the body, marking the end of the sympathetic chain. It represents the pelvic portion of the sympathetic trunk, situated ventral to the sacrum and medial to the ventral sacral foramina. It consists of four to five, small, sacral sympathetic ganglia that connect by means of interganglionic cords. The ganglion impar is located about level with the coccyx but may occur anywhere from 10mm to 30 mm ventral to it. In conjunction with the local somatic nerves and the ganglion impar, BL 35 represents a somatosympa-

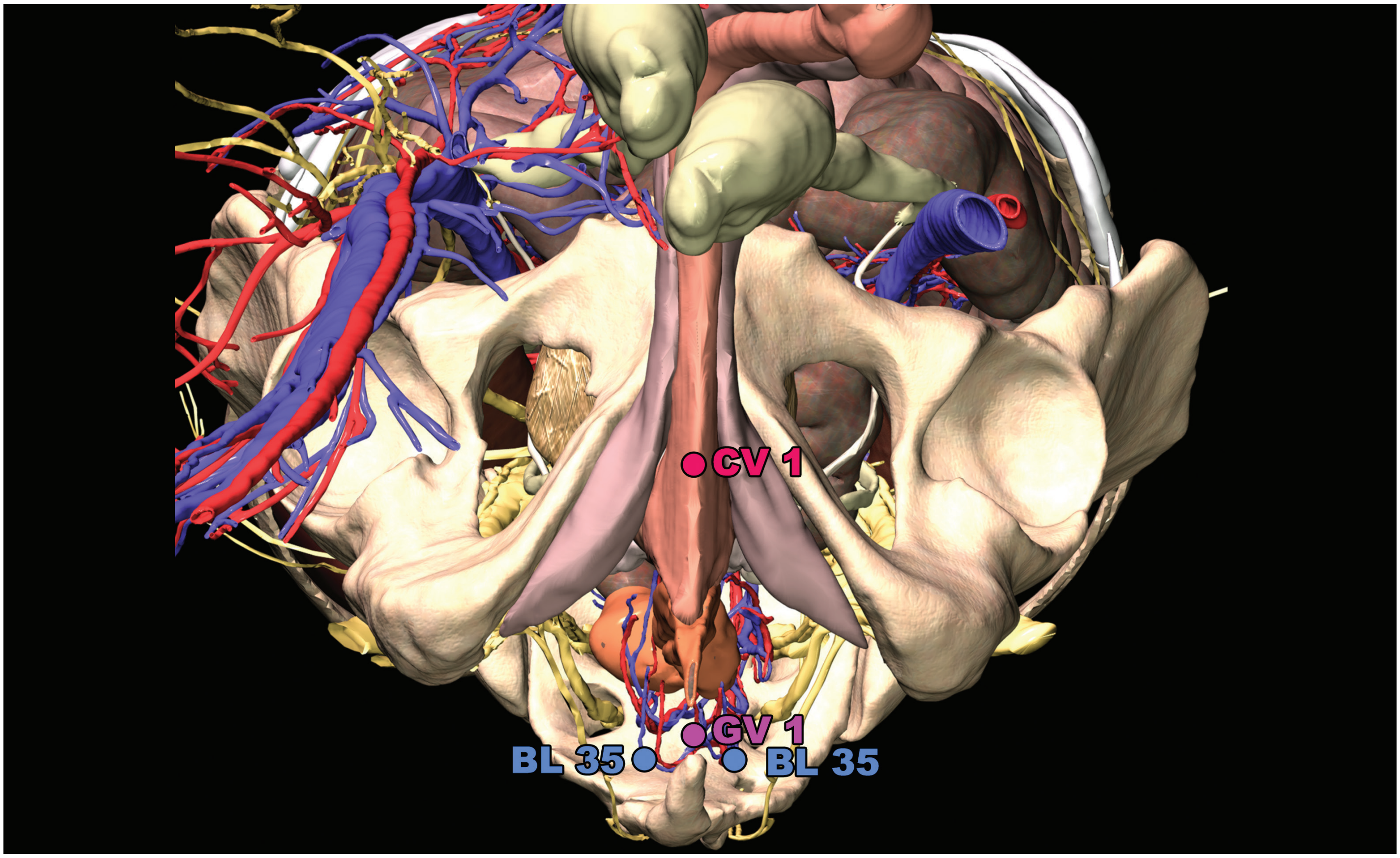


Figure 7-73A. BL 35, "Meeting of Yang", indicates the location near the coccyx where the BL channel greets the GV line just below the tip of the coccyx at GV 1. "Meeting of Yang" may metaphorically suggest the ganglion impar, representing the site at which the the sympathetic chain ganglia join together. This view of the anorectal region (at bottom of image) exposes the ventral spinal nerve rami and local vasculature.

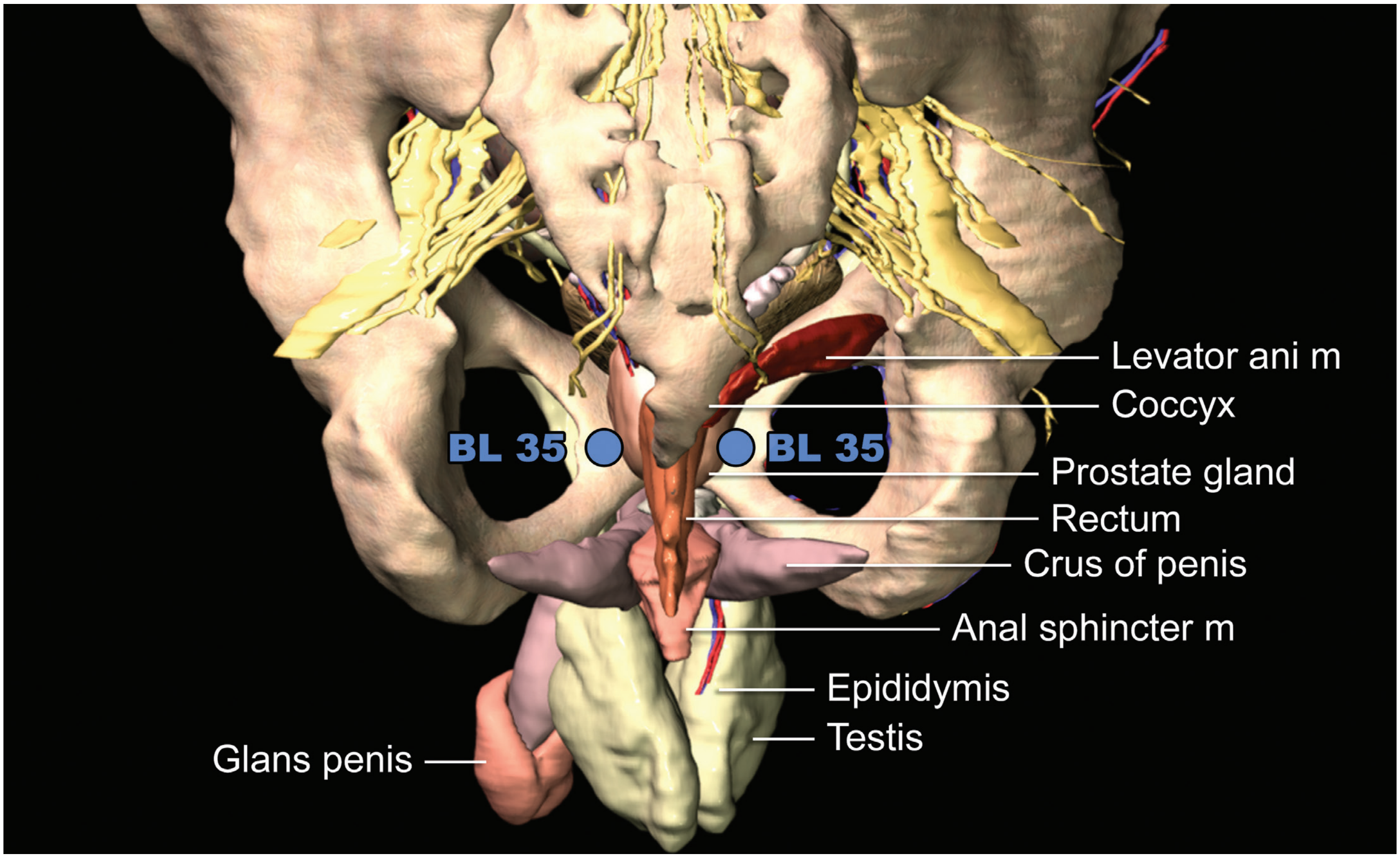


Figure 7-73B. The nerves that supply BL 35 reflex through sacral segments and sympathetic ganglia that also innervate the local viscera, shown here.

thetic convergence site and multifaceted treatment opportunity.

Clinical Relevance: Anesthetic blockade or radiofrequency ablation of the ganglion impar has been used to treat chronic neuropathic pelvic or perineal pain due to nonmalignancy-associated etiologies. Problems treated include coccydynia;[6] sacral postherpetic neuralgia; spinal cord malformations; failed back surgery; visceral disease in the distal rectum, anus, distal urethra, vulva, or distal third of the vagina; and perineal hyperhidrosis. Perineal pain from cancer metastasized to the perineum (from the cervix, prostate, testicles, colon, or rectum), postsurgical thrombosis of perineal veins, vaginal prolapse or protrusion, and testicular ablation may also respond to ganglion impar blocks. A less invasive approach with acupuncture and related techniques offers an alternative to nerve blocks and radiofrequency ablation.

Vessels

- **Inferior gluteal artery:** Supplies the pelvic diaphragm (which includes the coccygeus and levator ani muscles), the piriformis, quadratus femoris, proximal hamstring, and gluteus maximus muscles as well as the sciatic nerve.
- **Inferior gluteal vein:** Drains blood from the gluteal region.

Clinical Relevance: Impaired circulation to BL 35 perpetuates myofascial dysfunction. Medical acupuncture and related techniques improve blood flow and venous drainage, benefiting tissue health.

Indications and Potential Point Combinations

- **Sacral, coccygeal, and lumbar pain:** BL 35, BL 31, BL 32, BL 25, local tender points.
- **Rectal, prostate, and anal problems:** BL 35, BL 34, GV 1.
- **Voiding dysfunction:**[7] BL 35, BL 32, BL 39, GV 2, SP 6.

Evidence-Based Applications

- A case series showed that acupuncture of BL 23 and BL 35 benefited men suffering from **chronic prostatitis.**[1]
- Acupuncture at BL 23 and BL 35 outperformed acupuncture at CV 3, CV 4, SP 6, and SP 9 in treating **chronic prostatitis**, possibly because of the influence of BL 35 on the pelvic nerve plexus.[2]

References

1. Ge S, Meng F, and Xu B. Acupuncture treatment in 102 cases of chronic prostatitis. *Journal of Traditional Chinese Medicine.* 1988;8(2):99-100.
2. Ge S and Meng F. Acupuncture in the treatment of chronic prostatitis: a report of 350 cases. *International Journal of Clinical Acupuncture.* 1991;2(1):19-23.
3. Sandri A, Regis D, Toso M, et al. Surgical removal of a partial ossified sacrotuberous ligament for refractory pudendal nerve entrapment syndrome. *J Orthop Sci.* 2013;18(4):671-674.
4. Woodley SJ, Kennedy E, and Mercer SR. Anatomy in practice: the sacrotuberous ligament. *New Zealand Journal of Physiotherapy.* 2005;33(3):91-94.
5. Sipko T, Grygler D, Barczyk K, et al. The occurrence of strain symptoms in the lumbosacral region and pelvis during pregnancy and after childbirth. *J Manipulative Physiol Ther.* 2010;33(5):370-377.
6. Foye PM and Patel SI. Paracoccygeal corkscrew approach to ganglion impar injections for tailbone pain. *Pain Practice.* 2009;9(4):317-321.

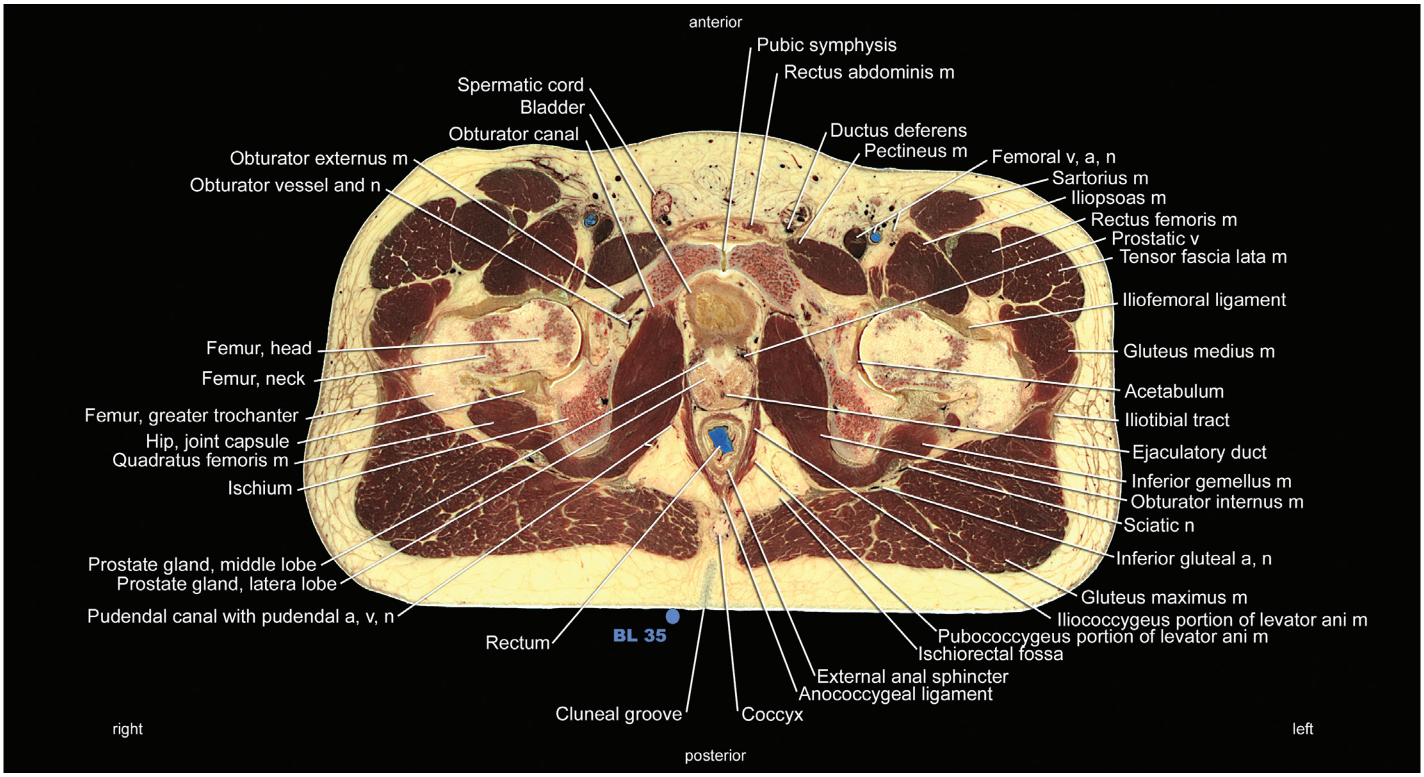

anterior
Pubic symphysis
Rectus abdominis m
Spermatic cord
Bladder
Obturator canal
Ductus deferens
Pectineus m
Femoral v, a, n
Sartorius m
Iliopsoas m
Rectus femoris m
Prostatic v
Tensor fascia lata m
Obturator externus m
Obturator vessel and n
Iliofemoral ligament
Femur, head
Femur, neck
Gluteus medius m
Acetabulum
Femur, greater trochanter
Iliotibial tract
Hip, joint capsule
Quadratus femoris m
Ejaculatory duct
Inferior gemellus m
Ischium
Obturator internus m
Sciatic n
Prostate gland, middle lobe
Prostate gland, latera lobe
Inferior gluteal a, n
Gluteus maximus m
Pudendal canal with pudendal a, v, n
Iliococcygeus portion of levator ani m
Pubococcygeus portion of levator ani m
Rectum
BL 35
Ischiorectal fossa
External anal sphincter
Anococcygeal ligament
Cluneal groove
Coccyx
right
left
posterior

Figure 7-74. From superficial to deep, the nerves impacted by BL 35 include the middle cluneal, inferior gluteal, pelvic nerve, and branches of the pudendal nerve.[8] These nerves influence reproductive organ function, control over micturition and defecation, and pelvic pain. By treating local trigger points, acupuncture and related techniques address levator ani syndrome, coccygodynia, and proctalgia fugax.[9]

7. Yang T, Liu Z, and Liu Y. Electroacupuncture at ciliao and huiyang for treating neuropathic incontinence of defecation and urination in 30 cases. *J Tradit Chin Med.* 2003;23(1):53-54.
8. Chen Y. The anatomical physiology and clinical application of the points Huiyang and Zhonglushu. *Journal of Traditional Chinese Medicine.* 2002;22(3):180-182.
9. Travell JG and Simons DG. Volume 2. Myofascial Pain and Dysfunction. The Trigger Point Manual. The Lower Extremities. Baltimore: Williams & Wilkins, 1983. Pp. 119-120.

BL 36

Cheng Fu "Hold and Support"

On the gluteal region, just below the buttock, on a line directly cranial to BL 40. In the center of the transverse gluteal fold, in a depression between the biceps femoris and the semitendinosus muscles.

Muscles

- **Gluteus maximus muscle, inferior margin:** Extends thigh and assists in lateral rotation.
- **Biceps femoris muscle (long head, tendon or musculotendinous junction):** Flexes the leg and rotates it laterally when the knee is flexed. Extends the thigh when initiating ambulation.
- **Semitendinosus muscle:** Extends the thigh. Flexes the leg and rotates it medially when knee flexes. When both the thigh and leg flex, the semitendinosus, with the semimembranosus, extend the trunk.

Clinical Relevance: Myofascial dysfunction in the gluteus maximus at BL 36 refers pain to the horizontal gluteal fold, the caudal sacrum and coccygeal region, and the hip, as well as diffusely across the entire ipsilateral buttock.

Trigger points in the semimembranosus and semitendinosus muscles refer pain strongly to the proximal thigh and BL 36. Thus, palpation of the pelvic region, including the thigh assist in revealing the fuller picture regarding sources of trigger points pathology.

Nerves

- **Inferior cluneal nerve (S2-S3):** Supplies skin of buttock or gluteal region. Arises from the posterior femoral cutaneous nerve, which sends a perineal branch to the perineum.[3]
- **Posterior femoral cutaneous nerve (S1-S3):** Sends cutaneous branches to the buttock and the posterior and uppermost medial thigh surfaces.
- **Sciatic nerve (L4-S3):** Supplies no structures in the gluteal region, but does supply all of the leg and foot muscles, as well as the skin of the posterior thigh, most of the leg, and the skin of the foot. It comprises the tibial and common fibular (or common peroneal) nerves.

Clinical Relevance: Each of the nerves supplying BL 36 can suffer entrapment or impingement from structures compressing or otherwise irritating the nerve. For example, Figure 7-75 describes, visually, how certain muscles, especially the piriformis, may compress the sciatic and posterior femoral cutaneous nerves as they exit the pelvis. Entrapment of a perineal branch of the inferior cluneal nerve can cause neuropathic pain in the perineum, in addition to pudendal neuropathy. In that the inferior cluneal nerve branches off of the posterior femoral cutaneous nerve, neuromodulation of the latter at GB 30 and BL 36 may aid in resolving the pain, as well as funding the course of myofascial dysfunction compressing the nerve.

Neuromodulation of the posterior femoral cutaneous nerve may assist in treating micturition disorders such as overactive bladder and urinary incontinence by dint of its ability to inhibit the micturition reflex through somatic afferent activation.[4]

Vessels

- **Inferior gluteal artery:** Supplies the pelvic diaphragm (which includes the coccygeus and levator ani muscles), the piriformis, quadratus femoris, proximal hamstring, and gluteus maximus muscles as well as the sciatic nerve.
- **Inferior gluteal vein:** Drains blood from the gluteal region.

Clinical Relevance: Impaired circulation to BL 36 perpetuates myofascial dysfunction. Medical acupuncture and related techniques improve blood flow and venous drainage, benefiting tissue health.

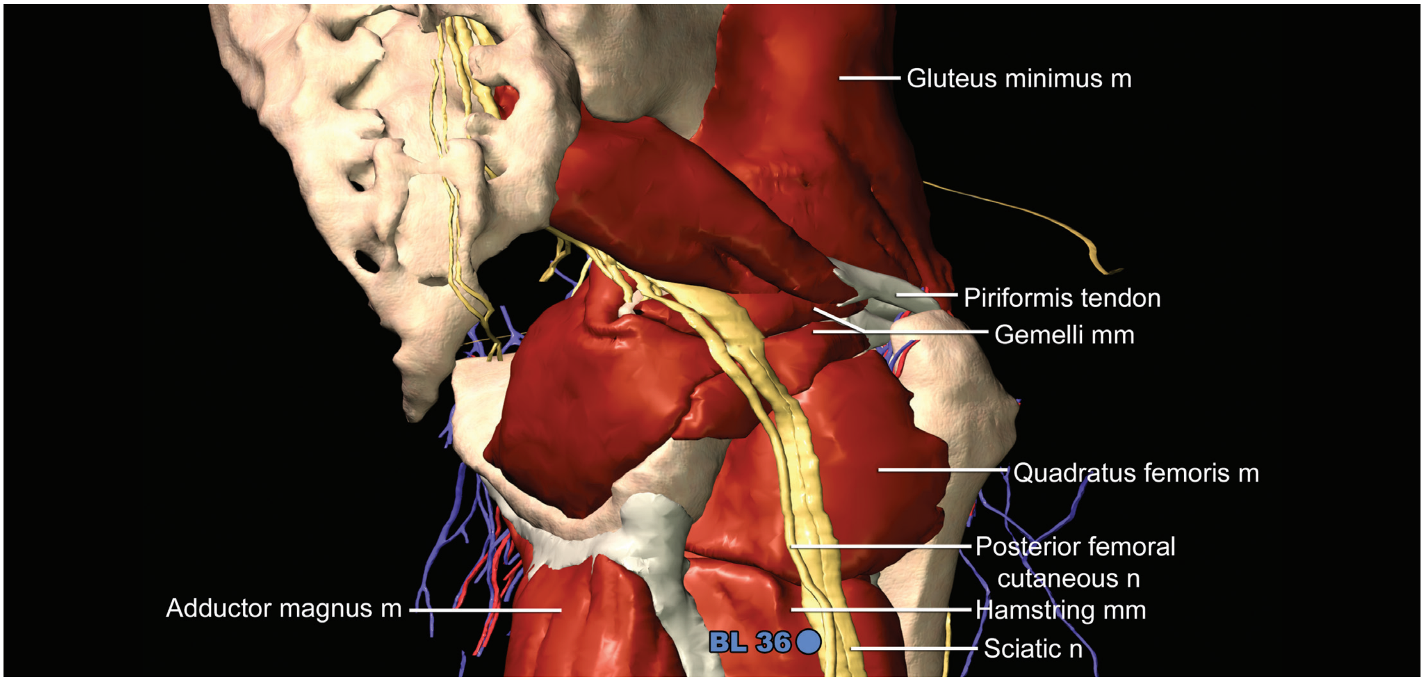


Figure 7-75. As shown here, tension held in various muscles near BL 36 may aggravate the sciatic nerve and precipitate "sciatica", exemplified by its characteristic pain radiating from the back or hip to the lower leg or foot. Although distal needling at BL 36, BL 37, BL 40, and GB 34 can help, one Chinese study indicated that the most robust and rapid benefits result from proximal needling at GB 30.[6]

Indications and Potential Point Combinations

- **Lumbar pain radiating into hips or thighs:** BL 36, BL 37, BL 40, BL 23, BL 25, other tender myofascial trigger points.
- **Hamstring strain:** BL 36, BL 37, BL 40, deactivate trigger points responsible for myofascial compression.[5]

Evidence-Based Applications

- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[1]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[2]

References

1. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology*. 2003;42:1508-1517.
2. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed.* 2000;28(1):25-33.
3. Darnis B, Robert R, Labat JJ, et al. Perineal pain and inferior cluneal nerves: anatomy and surgery. *Surg Radiol Anat.* 2008;30:177-183.
4. Tai C, Shen B, Mally AD, et al. Inhibition of micturition reflex by activation of somatic afferents in posterior femoral cutaneous nerve. *J Physiol.* 590(Pt 19):4945-55.
5. Xu XS, Lin WP, Chen JY, et al. Efficacy observation on rear thigh muscles strain of athletes treated with surrounding needling of electroacupuncture and hot compress of Chinese medicine. *Zhongguo Zhen Jiu*. 2012;32(6):511-514.
6. Zhao Y and Wang GL. Randomized controlled study on proximal needling for sciatica. *Zhongguo Zhen Jiu*. 2011;31(5):425-428.

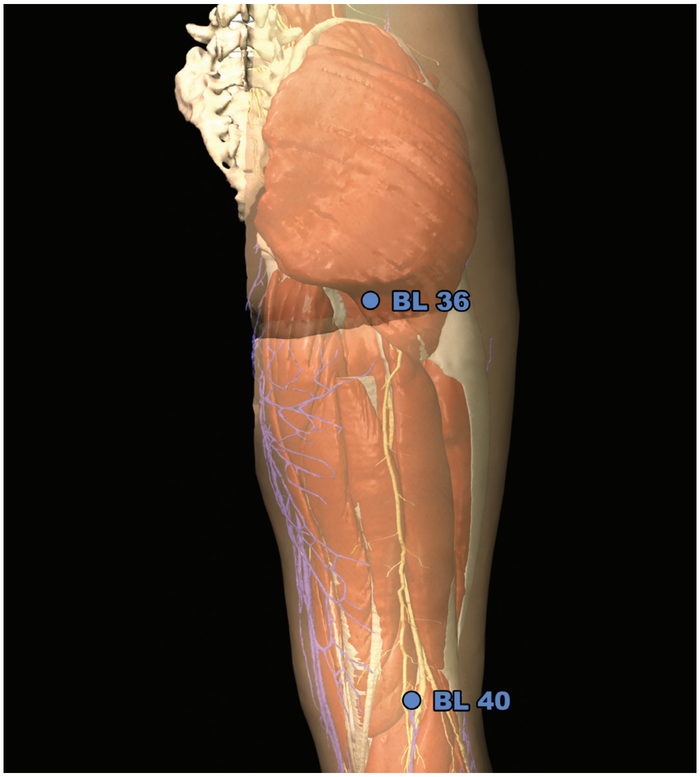


Figure 7-76. Known as "Hold and Support", BL 36 exists near structures that help hold the body upright and standing; i.e., the sciatic nerve, the hamstring muscles, the gluteus maximus, and the pelvis itself. Finding BL 36 should not pose too much difficulty, as it lies in the middle of the gluteal crease in line with BL 40 at the center of the popliteal fossa.

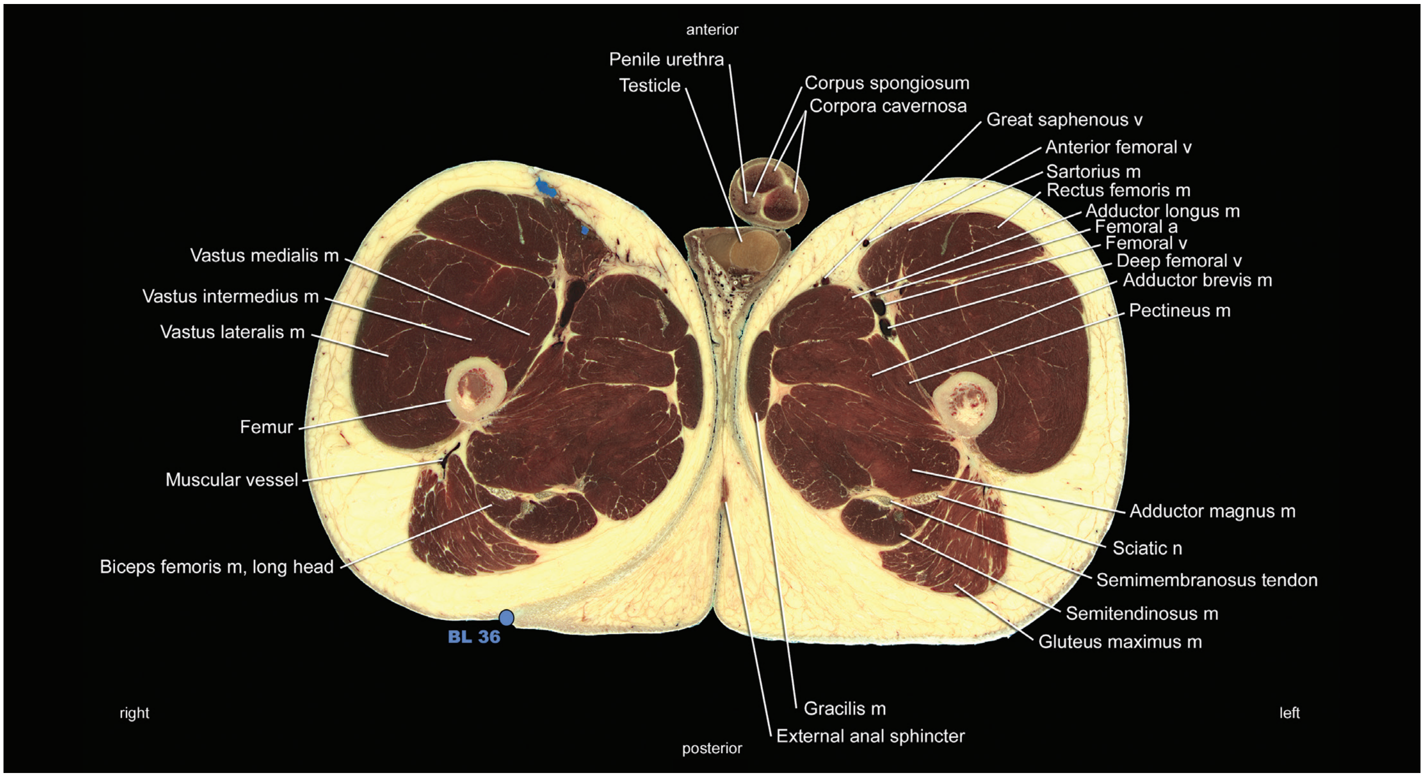

anterior
Penile urethra
Testicle
Corpus spongiosum
Corpora cavernosa
Great saphenous v
Anterior femoral v
Sartorius m
Rectus femoris m
Adductor longus m
Femoral a
Femoral v
Deep femoral v
Adductor brevis m
Pectineus m
Vastus medialis m
Vastus intermedius m
Vastus lateralis m
Femur
Muscular vessel
Biceps femoris m, long head
BL 36
Adductor magnus m
Sciatic n
Semimembranosus tendon
Semitendinosus m
Gluteus maximus m
right
left
Gracilis m
External anal sphincter
posterior

Figure 7-77. The distance between the sciatic nerve and BL 36 will depend on the muscularity and adiposity of a patient., but one should remember its presence beneath BL 36 to avoid damaging the nerve with incautious insertion.

BL 37

Yin Men "Gate of Abundance" or "Center of Abundance"

On the posterior thigh, in a depression between the biceps femoris and semitendinosus muscles, 6 cun distal to BL 36 or 8 cun proximal to BL 40, on the line connecting BL 36 to BL 40.

Muscles

- **Biceps femoris muscle:** Flexes the leg and rotates it laterally when the knee is flexed. Extends the thigh when initiating ambulation.
- **Semitendinosus and semimembranosus muscles (medial hamstrings):** Hip extensors and knee flexors when the thigh and leg are freely moveable (i.e., not "fixed" in one location). The medial hamstrings assist with medial hip rotation.

Clinical Relevance: While local hamstring trigger points refer pain to the caudal thigh that extends from the transverse gluteal crease to the popliteal region, pain at BL 37 may be referred from the gluteus minimus as well. Trigger points in the posterior portion of the gluteus minimus send pain toward the coccyx (BL 35) and the back of the thigh and leg (from BL 36 to BL 56).

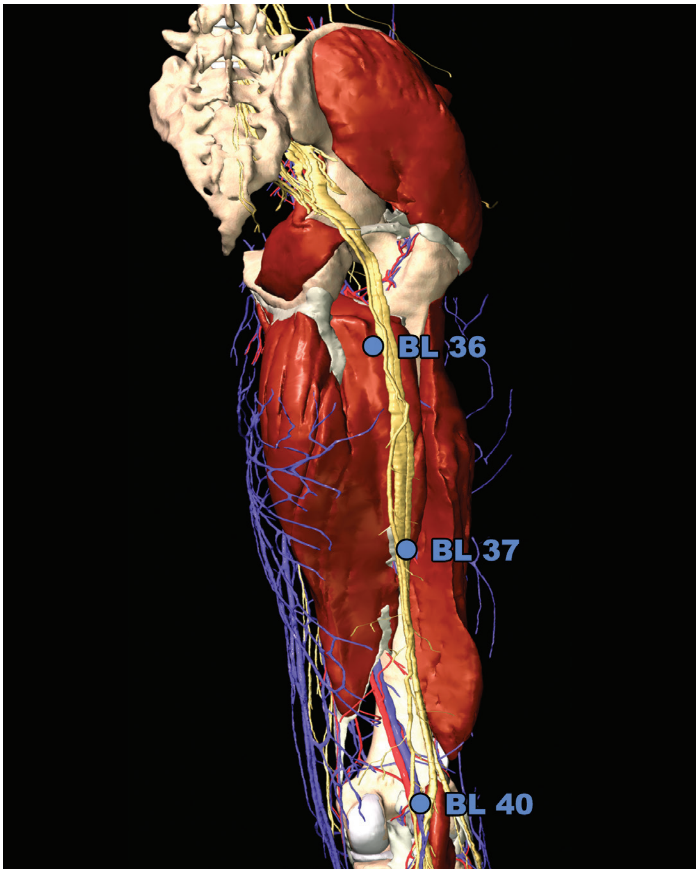


Figure 7-78. This "Gate of Abundance", BL 37, lands where the hamstring muscles separate into lateral and medial bundles. This point has been used since ancient times in China and Tibet for sciatic neuropathy.[4] Its alternate name, "Center of Abundance" connotes the central placement of BL 37 on the caudal thigh, amid the massive muscle (or other fleshy tissue) found there.

Nerves

- **Posterior femoral cutaneous nerve (S1-S3):** Sends cutaneous branches to the buttock and the posterior and uppermost medial thigh surfaces.
- **Sciatic nerve (L4-S3):** Innervates the hamstring muscles, all of the leg and foot muscles, as well as the skin of the posterior thigh, most of the leg, and the skin of the foot. It comprises the tibial and common fibular (or common peroneal) nerves.

Clinical Relevance: Neuromodulation of the posterior femoral cutaneous nerve may assist in treating micturition disorders such as overactive bladder and urinary incontinence by dint of its ability to inhibit the micturition reflex through somatic afferent activation.[2]

Neuromodulation of the sciatic nerve is helpful for a variety of conditions caused by sciatic nerve damage, including piriformis syndrome, total hip arthroplasty, injury of the vasa nervorum to the sciatic, and trauma. One should consider neuromodulation of the spinal nerve roots contributing to the sciatic (L4-S3), the axon itself (GB 30 to BL 37), and its branches (common fibular and tibial), on down to the digital nerves of the foot.

Vessels

- **Profunda femoris artery:** This is the principal arterial supply to the adductor, extensor, and flexor muscles of the thigh.

The profunda femoris artery also gives rise to the lateral and medial circumflex femoral arteries, the perforating arteries and numerous muscular branches.

- **Profunda femoris vein:** Drains the regions supplied by the muscular and perforating branches of the profunda femoris artery and thereby establishes communications with the popliteal vein or superficial femoral vein below and the inferior gluteal vein. It may also drain the medial and lateral circumflex femoral veins.

Clinical Relevance: Electroacupuncture stimulation of BL 35 and other sites that affect the pudendal nerve may significantly increase blood flow to the sciatic nerve without increasing heart rate or systemic blood pressure.[3] Thus, treating patients for sciatic neuropathy may warrant including somatic afferent stimulation to the pudendal nerve in order to neuromodulate the vasa nervorum of the sciatic nerve.

Indications and Potential Point Combinations

- **Lumbar pain radiating to hips and thighs, thigh pain or swelling, inability to ambulate or bear weight, other problems relating to the sciatic nerve, including pain, weakness, numbness:** BL 37, BL 36, BL 25, BL 23, GV 4, ST 36, tender myofascial trigger points, BL line points related to somatic dysfunction and/or spinal cord injury. Consider Bafeng points at web spaces between the toes for paresis or paralysis.

Evidence-Based Applications

- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain**

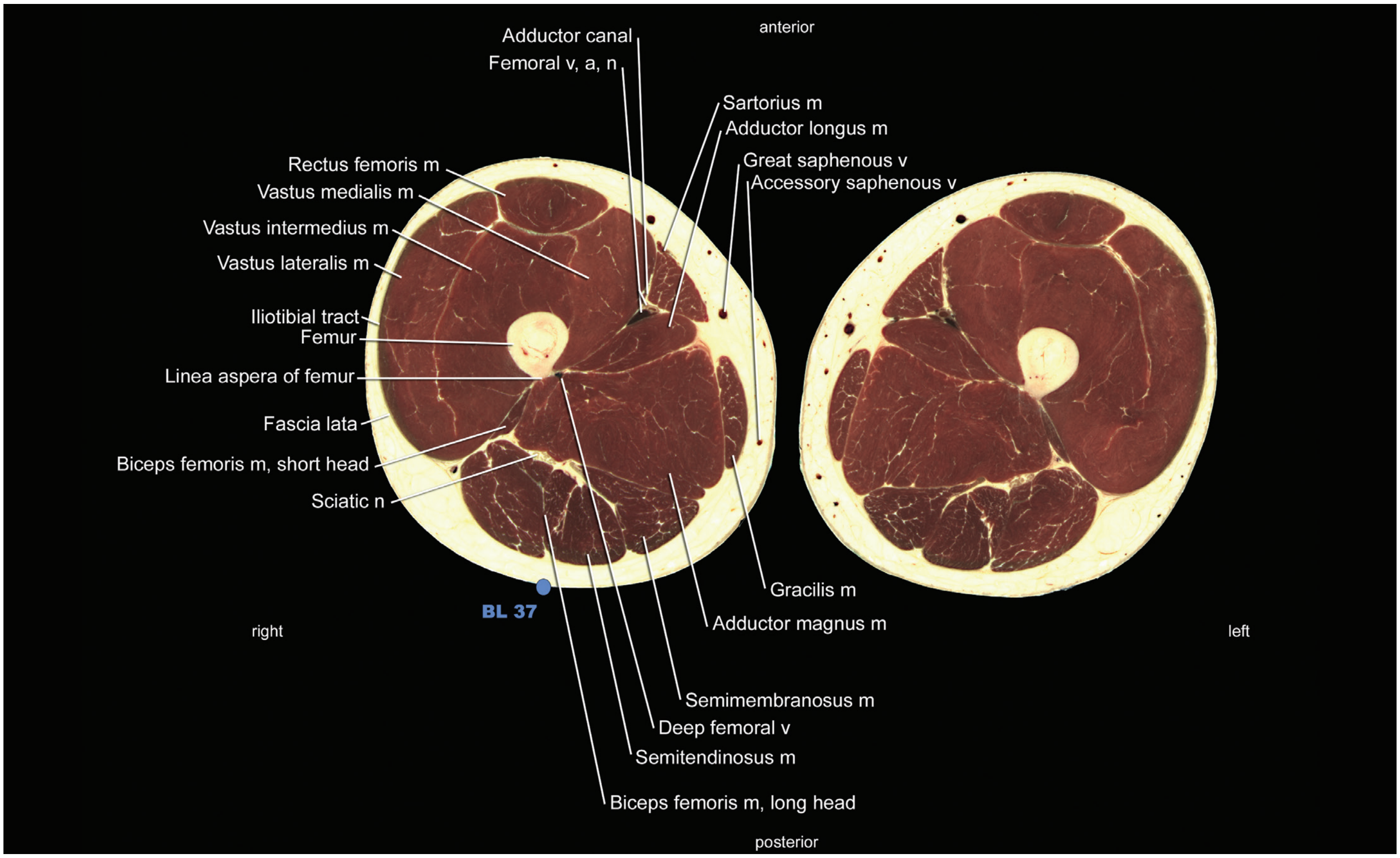

anterior
Adductor canal
Femoral v, a, n
Sartorius m
Adductor longus m
Great saphenous v
Accessory saphenous v
Rectus femoris m
Vastus medialis m
Vastus intermedius m
Vastus lateralis m
Iliotibial tract
Femur
Linea aspera of femur
Fascia lata
Biceps femoris m, short head
Sciatic n
Gracilis m
Adductor magnus m
BL 37
right
left
Semimembranosus m
Deep femoral v
Semitendinosus m
Biceps femoris m, long head
posterior

Figure 7-79. Myofascial restriction in the biceps femoris and semitendinosus muscles can compress the sciatic nerve, worsened further by tension in the adductor magnus muscle.

provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[1]

References

1. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.
2. Tai C, Shen B, Mally AD, et al. Inhibition of micturition reflex by activation of somatic afferents in posterior femoral cutaneous nerve. *J Physiol.* 590(Pt 19):4945-55.
3. Inoue M, Hojo T, Nakajima M, et al. The effect of electrical stimulation of the pudendal nerve on sciatic nerve blood flow in animals. *Acupunct Med.* 2008;26(3):145-148.
4. Zhao Q, Wu M-Z, and Zhao J-P. Heated moxibustion and bloodletting in Tibetan medical literature of Dunhuang Heritage. *Chin J Integr Med.* 2012;18(3):230-232.

BL 38

Fu Xi “Superficial Cleft”

Proximal to the popliteal region, 1 cun proximal to BL 39, on the medial side of the tendon of the biceps femoris muscle. Find with the knee slightly flexed.

Muscles

- **Biceps femoris muscle:** Flexes the leg and rotates it laterally when the knee is flexed. Extends the thigh when initiating ambulation.
- **Plantaris muscle:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.

Clinical Relevance: While local hamstring trigger points refer pain to the caudal thigh that extends from the transverse gluteal crease to the popliteal region, pain at BL 37 may be referred from the gluteus minimus as well. Trigger points in the posterior portion of the gluteus minimus send pain toward the coccyx (BL 35) and the back of the thigh and leg (from BL 36 to BL 56). Trigger point pathology in the biceps femoris at BL 37 can refer pain to the popliteal region, encompassing BL 38, BL 39, and BL 40.

Treatment of BL 38 may also impact the attachment trigger point of the plantaris muscle near to where it attached onto the lateral supracondylar line of the femur. The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to “tennis leg”, a calf injury identified by a “snapping” in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[1] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

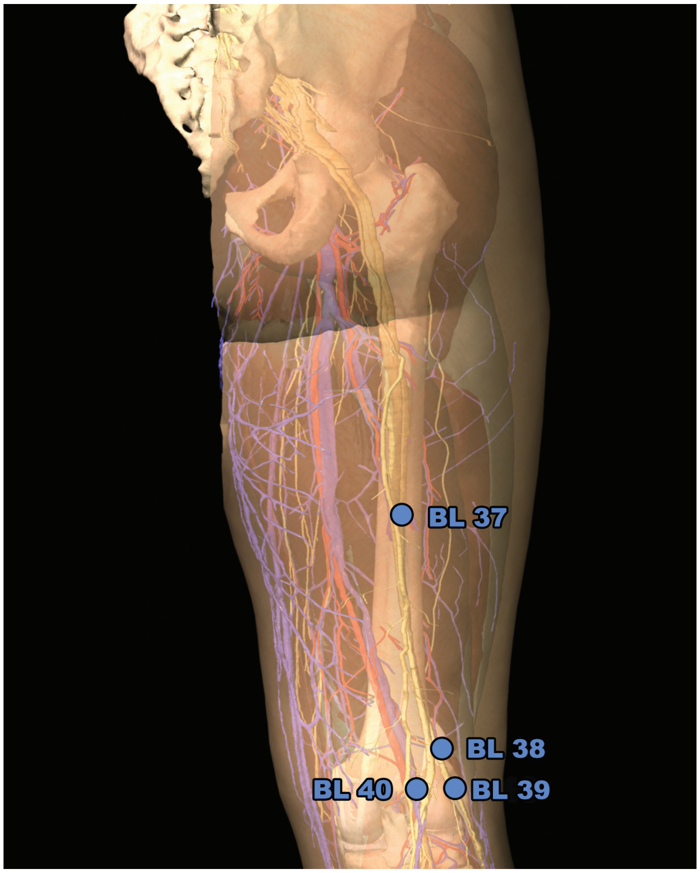


Figure 7-80. BL 38 falls in a depression formed by the biceps femoris muscle as it narrows into a tendon. Its name “Superficial Cleft” refers to this palpable valley as well as to the division of the sciatic nerve into the common fibular and tibial nerves.

Nerves

- **Posterior femoral cutaneous nerve (S1-S3):** Sends cutaneous branches to the buttock and the posterior and uppermost medial thigh surfaces.
- **Sciatic nerve (L4-S3):** Supplies no structures in the gluteal region, but does supply all of the leg and foot muscles, as well as the skin of the posterior thigh, most of the leg, and the skin of the foot. It comprises the tibial and common fibular (or common peroneal) nerves.
- **Tibial nerve (S1-S2):** Supplies the plantaris muscle with fibers arising from spinal segments S1 and S2.

Clinical Relevance: Neuromodulation of the posterior femoral cutaneous nerve may assist in treating micturition disorders such as overactive bladder and urinary incontinence by dint of its ability to inhibit the micturition reflex through somatic afferent activation.[2]

Neuromodulation of the sciatic nerve is helpful for a variety of conditions caused by sciatic nerve damage, including piriformis syndrome, total hip arthroplasty, injury of the vasa nervorum to the sciatic, and trauma. One should consider neuromodulation of the spinal nerve roots contributing to the sciatic (L4-S3), the axon itself (GB 30 to BL 37), and its branches (common fibular and tibial), on down to the digital nerves of the foot.

Vessels

- **Profunda femoris artery:** This is the principal arterial supply to the adductor, extensor, and flexor muscles of the thigh. The profunda femoris artery also gives rise to the lateral and medial circumflex femoral arteries, the perforating arteries and numerous muscular branches.
- **Profunda femoris vein:** Drains the regions supplied by the muscular and perforating branches of the profunda femoris artery and thereby establishes communications with the popliteal vein or superficial femoral vein below and the inferior gluteal vein. It may also drain the medial and lateral circumflex femoral veins.

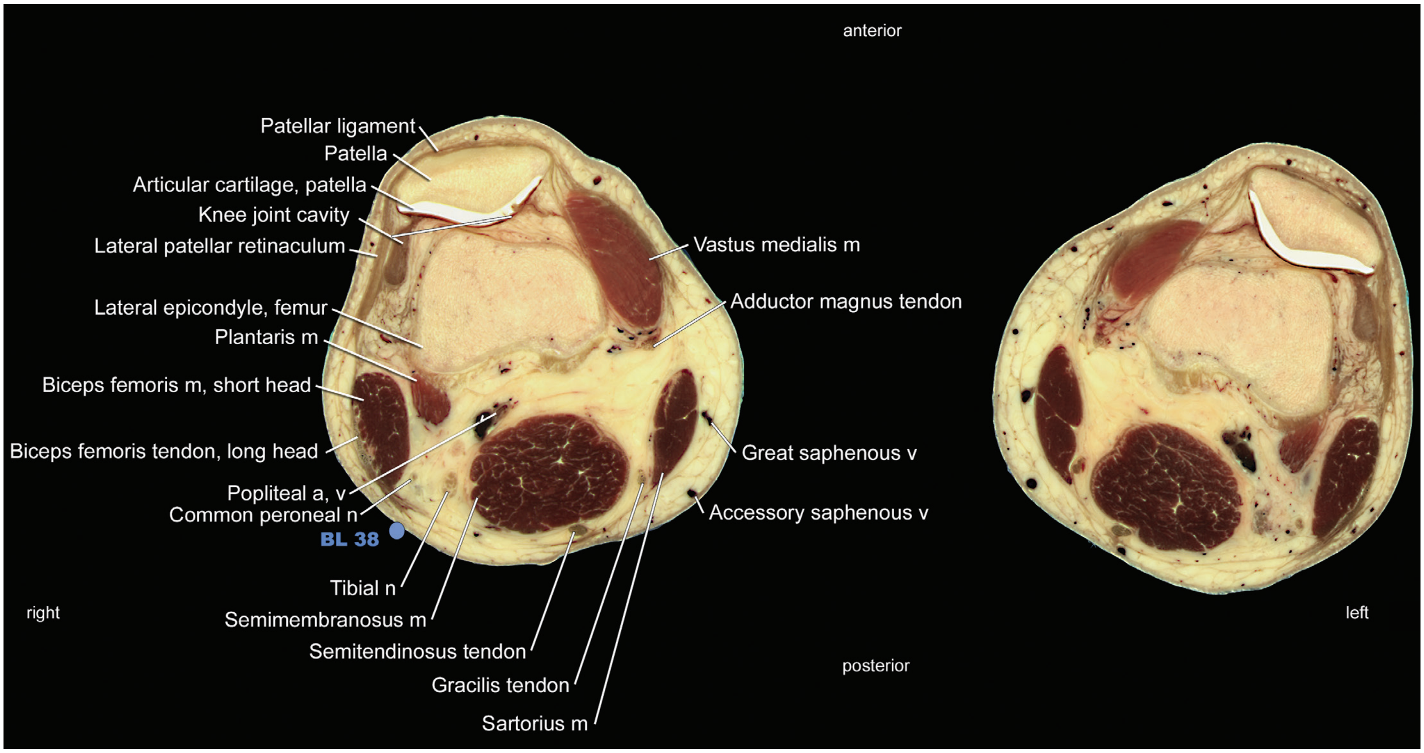

anterior
Patellar ligament
Patella
Articular cartilage, patella
Knee joint cavity
Lateral patellar retinaculum
Lateral epicondyle, femur
Plantaris m
Biceps femoris m, short head
Biceps femoris tendon, long head
Popliteal a, v
Common peroneal n
BL 38
Tibial n
Semimembranosus m
Semitendinosus tendon
Gracilis tendon
Sartorius m
Vastus medialis m
Adductor magnus tendon
Great saphenous v
Accessory saphenous v
right
left
posterior

Figure 7-81. In contrast to the heavy musculature housed at BL 37, "Central Abundance", this cross section at the level of BL 38 is dominated by structures that move and constitute the knee.

Clinical Relevance: Electroacupuncture stimulation of BL 35 and other sites that affect the pudendal nerve may significantly increase blood flow to the sciatic nerve without increasing heart rate or systemic blood pressure.[3] Thus, treating patients for sciatic neuropathy may warrant including somatic afferent stimulation to the pudendal nerve in order to neuromodulate the vasa nervorum of the sciatic nerve.

Indications and Potential Point Combinations

- **Lumbar pain radiating to hips and thighs, thigh pain or swelling, inability to ambulate or bear weight, other problems relating to the sciatic nerve, including pain, weakness, numbness:** BL 37, BL 36, BL 25, BL 23, GV 4, ST 36, tender myofascial trigger points, BL line points related to somatic dysfunction and/or spinal cord injury. Consider Bafeng points at web spaces between the toes for paresis or paralysis.

Sciatic nerve injury: GB 30, BL 36, BL 37, BL 38, ST 36.

References

1. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology.* 2002;224:112-119.

2. Tai C, Shen B, Mally AD, et al. Inhibition of micturition reflex by activation of somatic afferents in posterior femoral cutaneous nerve. *J Physiol.* 590(Pt 19):4945-55.

3. Inoue M, Hojo T, Nakajima M, et al. The effect of electrical stimulation of the pudendal nerve on sciatic nerve blood flow in animals. *Acupunct Med.* 2008;26(3):145-148.

BL 39

Wei Yang "Outside of the Crook" or "Bend Yang"

On the back of the knee, at the lateral limit of the popliteal crease, in a depression just medial to the tendon of the biceps femoris muscle.

Muscles

- **Biceps femoris muscle:** Flexes the leg and rotates it laterally when the knee is flexed. Extends the thigh when initiating ambulation.
- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended. Raises the heel during ambulation. Flexes the leg at the knee joint.
- **Plantaris muscle:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.

Clinical Relevance: While local hamstring trigger points refer pain to the caudal thigh that extends from the transverse gluteal crease to the popliteal region, pain at BL 37 may be referred from the gluteus minimus as well. Trigger points in the posterior portion of the gluteus minimus send pain toward the coccyx (BL 35) and the back of the thigh and leg (from BL 36 to BL 56). Trigger point pathology in the biceps femoris at BL 37 can refer pain to the popliteal region, encompassing BL 38, BL 39, and BL 40. Palpatory findings of intense pain at the distal biceps femoris should heighten suspicion of a myofascial trigger point.[2]

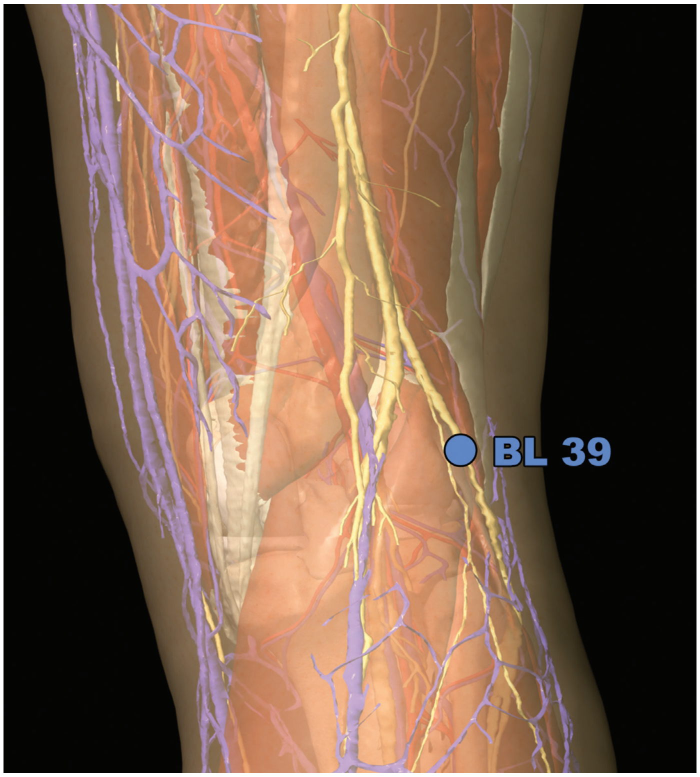


Figure 7-82. This caudomedial view of the right knee examines the location of BL 39 at the lateral extent of the popliteal fossa. Both of the point's descriptive titles, "Outside of the Crook" and "Bend Yang" indicate the placement of BL 39 at this lateral landmark. Consistent with the way in which the BL channel followed the sciatic nerve, now that the sciatic nerve separated (at BL 38), the lateral line joins at BL 39 with the common fibular while BL 40 takes the medial line with the tibial nerve.

The trigger point in the proximal, lateral head of the gastronemius muscle refers causes the sensation of pain in the lateral, distal popliteal fossa and proximal calf.

Treatment of BL 39 may also impact the attachment trigger point of the plantaris muscle near to where it attached onto the lateral supracondylar line of the femur. The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to "tennis leg", a calf injury identified by a "snapping" in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[3] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

Nerves

- **Posterior femoral cutaneous nerve (S1-S3):** Sends cutaneous branches to the buttock and the posterior and uppermost medial thigh surfaces.
- **Common fibular (peroneal) nerve (L4-S2) at origin of lateral sural cutaneous nerve:** The common fibular nerve branch (i.e., the lateral sural cutaneous nerve) supplies the skin on the lateral portion of the posterior aspect of the leg. The articular branch innervates the knee joint. The common fibular nerve divides into the superficial and deep fibular nerves. The superficial fibular nerve innervates the fibularis longus and brevis muscles, as well as the skin on the distal third of the anterior surface of the leg, and the dorsum of the foot. The deep fibular nerve innervates the anterior muscles of the leg and the dorsum of the foot, as well as the skin of the first interdigital cleft. The deep fibular nerve also innervates the joints it crosses with its articular branches.
- **Tibial nerve (S1-S2):** Supplies the plantaris muscle with fibers arising from spinal segments S1 and S2.

Clinical Relevance: After the common fibular nerve leaves the sciatic at BL 38, it courses laterad toward BL 39 in an exposed fibro-osseous tunnel toward the fibular neck and head to enter a fibular tunnel between the two heads of the peroneus longus muscle.[4] This location represents only the beginning of several sites of nerve entrapment that the common fibular nerve may experience on its way to the foot. As such, BL 39 represents a proximal point to include in such conditions, as one attends also to other sources of compression such as myofascial restriction

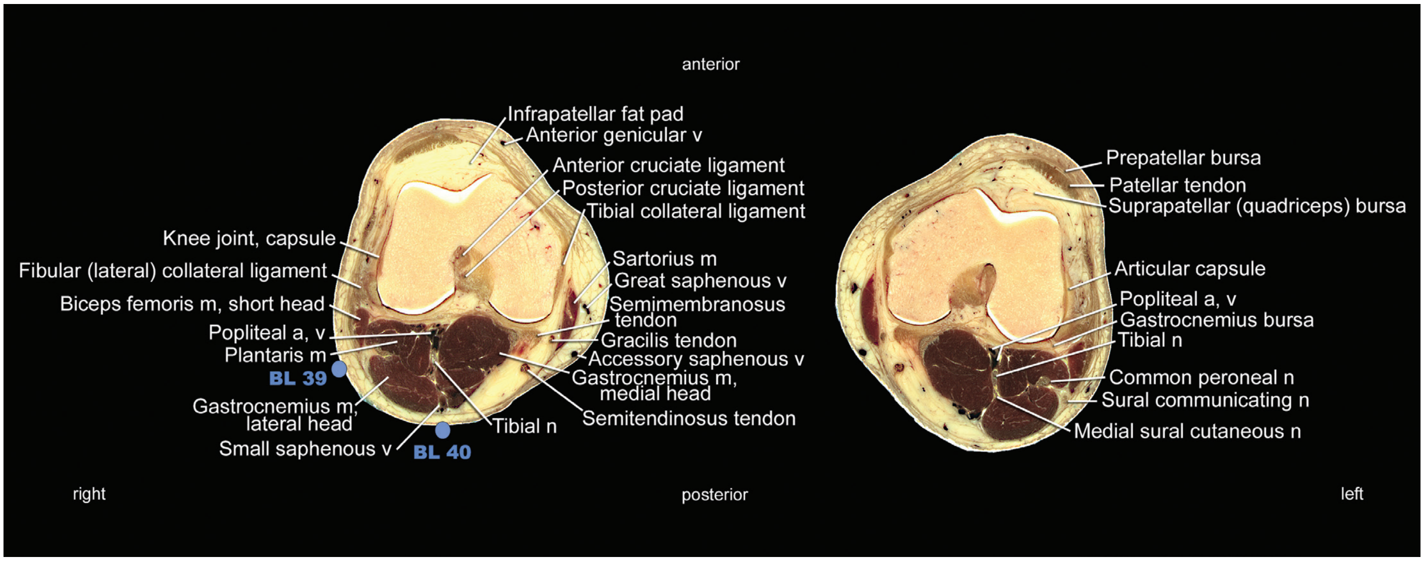

anterior
Infrapatellar fat pad
Anterior genicular v
Anterior cruciate ligament
Posterior cruciate ligament
Tibial collateral ligament
Knee joint, capsule
Fibular (lateral) collateral ligament
Biceps femoris m, short head
Sartorius m
Great saphenous v
Semimembranosus tendon
Popliteal a, v
Gracilis tendon
Plantaris m
Accessory saphenous v
BL 39
Gastrocnemius m, medial head
Gastrocnemius m, lateral head
Semitendinosus tendon
Tibial n
Small saphenous v
BL 40
Prepatellar bursa
Patellar tendon
Suprapatellar (quadriceps) bursa
Articular capsule
Popliteal a, v
Gastrocnemius bursa
Tibial n
Common peroneal n
Sural communicating n
Medial sural cutaneous n
right
posterior
left

Figure 7-83. Both BL 39 ("Outside of the Crook") and BL 40 ("Middle of the Crook") fall along the popliteal crease, or "crook". Note the variety of structures within reach of BL 39, including the plantaris muscle that gives stability to the knee by means of proprioceptive support.

and fascial tension, to be discovered by means of an astute myofascial palpation evaluation.

Although most of the neurologic influence associated with BL 39 involves the common fibular nerve, a branch of the tibial nerve supplies the plantaris muscle, making this a poly-impact site.

Somatovisceral reflexes stimulated by activating afferent endings at BL 39 involve organs supplied by lumbopelvic nerves. This explains the integration of BL 39 into treatments for voiding dysfunction (including urinary and fecal incontinence) and pelvic pain.

Vessels

- **Lateral superior genicular artery and vein:** One of five genicular branches of the popliteal artery and vein that contribute to the formation of the genicular anastomosis, which is a network of vessels around the knee.

Clinical Relevance: Surgical approaches to the knee that take a high lateral approach may damage ligaments, the popliteal tendon, the popliteofibular ligament, the arcuate popliteal ligament, and the lateral collateral ligament, all of which act as principal stabilizers of the caudolateral corner of the knee.[5] Surgery may also damage blood vessels that supply and drain the knee and, as such, impair tissue repair and predispose patients to pain in that region. In addition, the lateral ligament of the knee, an inconstant, small fibrous structure along the lateral end of the femur, may compress the artery but not usually the vein, arguing for treatment of this site with acupuncture, massage, and/or laser therapy.

Indications and Potential Point Combinations

- **Muscle tension in the pelvic limb (posterior thigh or calf):** BL 39, BL 55, BL 56, BL 57, tender myofascial trigger points.
- **Low back pain:** BL 39, along with myofascial trigger points or areas of tension, BL 60, KI 3.
- **Intestinal cramping, distension:** BL 39, ST 36, SP 6.
- **Voiding dysfunction, micturition disorders, fecal incontinence:** BL 39, BL 32, BL 33, BL 34, SP 6, KI 3.
- **Paresis or paralysis of the pelvic limb:** BL 39, identify source and spinal segmental level of dysfunction, including impaired neural transmission lines and select points accordingly.

Evidence-Based Applications

- Acupuncture at SP 6, BL 28, BL 39, and CV 4 provided significant improvement in women diagnosed as having **overactive bladder with urge incontinence**.[1]

References

1. Emmons SL and Otto L. Acupuncture for overactive bladder – a randomized controlled trial. *Obstetrics & Gynecology*. 2005;106:138-143.
2. Aftimos S. Myofascial pain in children. *New Zealand Medical Journal*. 1989;102(874):440-441.
3. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology*. 2002;224:112-119.
4. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med*. 2002;32(6):371-391.
5. Miguel M, Ortiz JC, Calzada J, et al. An inconstant ligament in the popliteal region associated to the superior genicular arteries: surgical importance. *Surg Radiol Anat*. 2006;28:457-461.

BL 40

Wei Zhong "Middle of the Crook"

On the popliteal fossa, at the midpoint of the popliteal crease, midway between the tendons of the biceps femoris and semitendinosus muscles.

Popliteal Fossa

- Where the medial and lateral hamstring group and the medial and lateral heads of the gastronemius muscle divide, they create the diamond-shaped depression at the back of the knee called the popliteal fossa.

Clinical Relevance: Baker cyst is a chronic disorder that can cause compression of the tibial nerve and popliteal vein. Acupuncture and related techniques may help mobilize structures in and around the popliteal fossa, freeing the fascia that further constricts the tibial nerve and popliteal vein.

Popliteal Lymph Nodes

- Six or seven small lymph nodes live embedded in the popliteal fat. One commonly lies beneath the fascial layer near the termination of the small saphenous vein. This lymph node drains the area where the vein receives its tributaries. Another lymph node occupies the site between the popliteal artery and the caudal knee joint. It receives lymphatic tributaries from the joint as well as lymphatic vessels that accompany the genicular arteries. The remaining nodes sit beside the popliteal vessels and receive efferent lymphatic vessels therefrom.

Clinical Relevance: In instances of local edema, treating BL 40 may improve venous and lymphatic drainage of the joint, lessening the pain that frequently develops as a result of tissue tension and restricted biomechanics. However, if one finds an enlarged lymph node anywhere, it is best to identify the source of the swelling and rule out neoplasia or other causes before treating with laser, acupuncture, or manual therapy.

Muscles

- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended. Raises the heel during ambulation. Flexes the leg at the knee joint.
- **Plantaris muscle:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.

Clinical Relevance: While local hamstring trigger points refer pain to the caudal thigh that extends from the transverse gluteal crease to the popliteal region, pain at BL 37 may be referred from the gluteus minimus as well. Trigger points in the posterior portion of the gluteus minimus send pain toward the coccyx

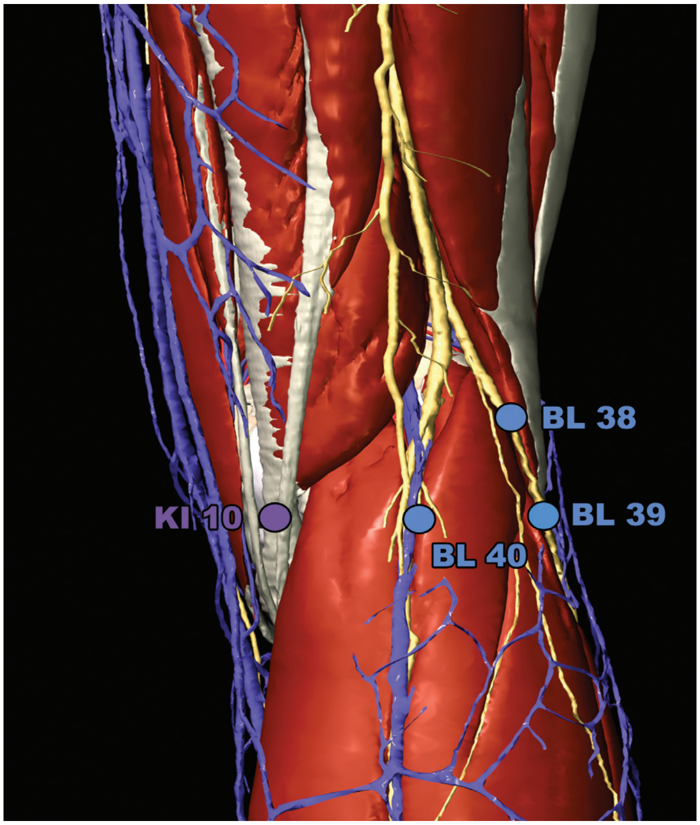


Figure 7-84A. BL 40, along with BL 23, BL 54, BL 60, GB 34, and relevant huatuojiaji points (i.e., sites 0.5 cun from the midline of the spine) are some of the most commonly preferred acupuncture points to treat chronic low back pain, along with additional local and distal points.[17]

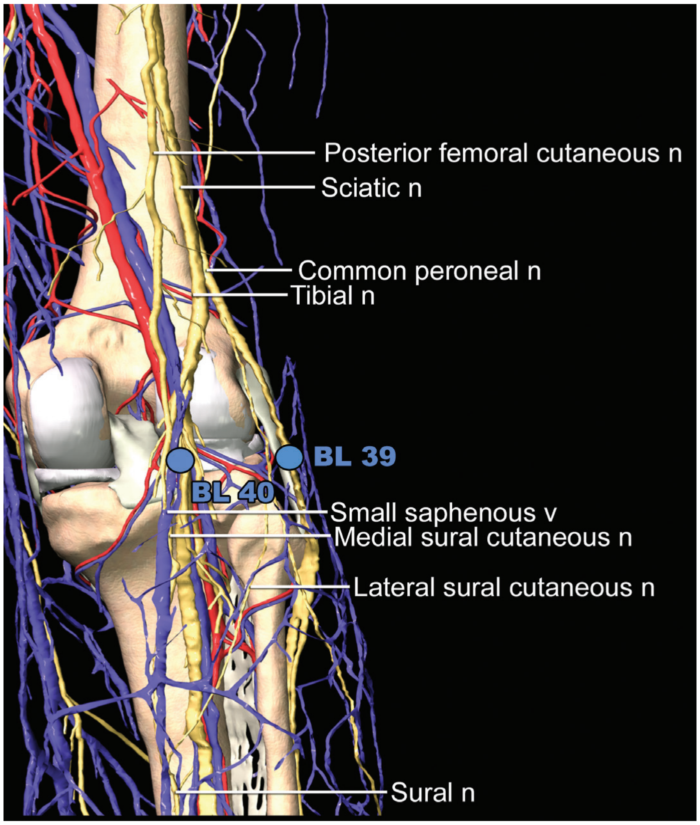


Figure 7-84B. BL 40, "Middle of the Crook", sits at the center of the popliteal fossa, a busy neurovascular highway. This view depicts the neurovascular differences between BL 39 and BL 40; i.e.,, BL 39 relates to the common fibular (formerly called "peroneal") nerve while BL 40 pertains to the tibial nerve.

(BL 35) and the back of the thigh and leg (from BL 36 to BL 56). Trigger point pathology in the biceps femoris at BL 37 can refer pain to the popliteal region, encompassing BL 38, BL 39, and BL 40. Palpatory findings of intense pain at the distal biceps femoris should heighten suspicion of a myofascial trigger point.[10]

The trigger point in the proximal, lateral head of the gastrocnemius muscle refers causes the sensation of pain in the lateral, distal popliteal fossa and proximal calf.

Treatment of BL 40 may also impact the attachment trigger point of the plantaris muscle near to where it attached onto the lateral supracondylar line of the femur. The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to “tennis leg”, a calf injury identified by a “snapping” in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[11] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

Nerves

- **Posterior femoral cutaneous nerve (S1-S3):** Sends cutaneous branches to the buttock and the posterior and uppermost medial thigh surfaces.
- **Medial sural cutaneous nerve:** Innervates the skin on the posterior and lateral leg and lateral side of the foot; forms the sural nerve if it joins the lateral sural cutaneous nerve. Accompanies the small saphenous vein.
- **Tibial nerve (L4, L5, S1-S3):** Supplies all the muscles in the posterior compartment of the leg.

Clinical Relevance: Not all tibial nerve branches carry fibers from all spinal cord segments that supply the tibial nerve. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). This explains why points such as SP 6 and KI 3 appear more routinely in needling formulae for voiding dysfunction than, for example, BL 40 or BL 55.

Symptomatic Baker cysts produce signs and symptoms that implicate compression of the popliteal vein and tibial nerve.[12] Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[13] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[14]

Vessels

- **Popliteal artery:** Supplies the articular capsule and ligaments of the knee joint with its five genicular branches. These branches participate in the formation of the genicular anastomosis around the knee. Muscular branches of the popliteal artery supply the hamstring muscles, the gastrocnemius and soleus muscles, and the plantaris muscle.
- **Popliteal vein:** Lies in the same fibrous sheath as the popliteal artery and runs between the posterior artery and the tibial nerve.
- **Small saphenous vein:** Begins as a continuation of the lateral marginal vein, and ascends along the posterior aspect of the lateral malleolus. It courses along the lateral border of the calcaneal tendon and penetrates deep fascia over the midline of the fibula. The small saphenous vein then ascends between the two heads of the gastrocnemius muscle and pierces the deep popliteal fascia and to empty into the popliteal vein.

Clinical Relevance: Compression of the contents of the popliteal fossa by conditions such as a Baker cyst less commonly compromises function of the popliteal artery due to its higher pressure, stiffer walls, and location deep in the fossa.

Popliteal venous aneurysms can occur that lead to thrombosis and pulmonary emboli, even in the anticoagulated patients.[15] Popliteal artery aneurysms and ganglia can also compress the tibial nerve.

Compartment syndromes may develop after phlebitis episodes that affect veins in the popliteal fossa, producing collateral vein thrombosis.

A spontaneous compartment syndrome may result from a varicosed popliteal vein.

Treatment for neurovascular compression by means of acupuncture and related techniques should be performed carefully but may improve circulation and nerve health by reducing myofascial tension.

Indications and Potential Point Combinations

- **Back, sacral, hip, or pelvic limb pain, sciatic-related pain or weakness:** Identify dysfunctional joint, soft tissue, nerve, or spinal segmental contributions and treat accordingly. BL 40, BL 23, BL 25, BL 60, as indicated by the dysfunction.
- **Micturition disorders, fecal or urinary incontinence**: BL 40, BL 23, BL 28, BL 32, BL 39, BL 40, SP 6.
- **Nocturnal enuresis:** BL 40, HT 7, CV 3, BL 28.[16]

Evidence-Based Applications

- Bloodletting of “the engorged vein” near BL 40, either alone or with SI 3 needling improved the symptoms related to **acute lumbar strain.**[1,2] **(Note: Needling “engorged veins” in the**

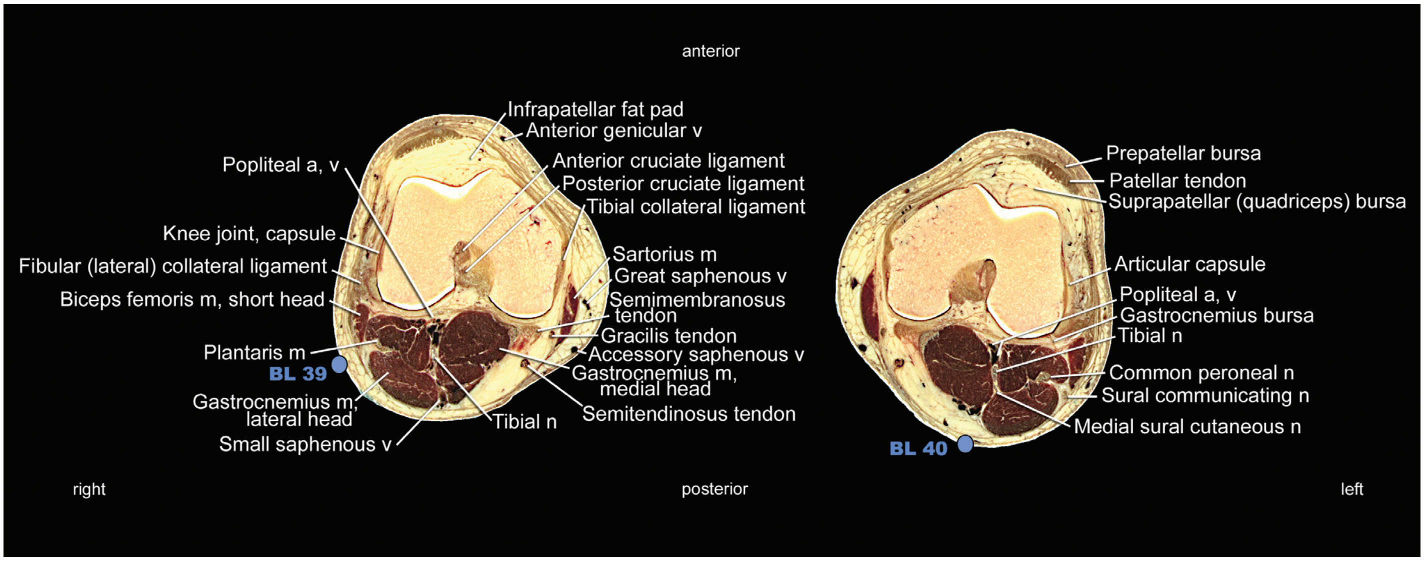

anterior
Infrapatellar fat pad
Anterior genicular v
Popliteal a, v
Anterior cruciate ligament
Posterior cruciate ligament
Tibial collateral ligament
Knee joint, capsule
Fibular (lateral) collateral ligament
Sartorius m
Great saphenous v
Biceps femoris m, short head
Semimembranosus tendon
Gracilis tendon
Plantaris m
Accessory saphenous v
BL 39
Gastrocnemius m, medial head
Gastrocnemius m, lateral head
Tibial n
Semitendinosus tendon
Small saphenous v
Prepatellar bursa
Patellar tendon
Suprapatellar (quadriceps) bursa
Articular capsule
Popliteal a, v
Gastrocnemius bursa
Tibial n
Common peroneal n
Sural communicating n
Medial sural cutaneous n
BL 40
right
posterior
left

Figure 7-85. This figure compares locations and relevant anatomy of BL 39 and BL 40 (on the left and right sides of the image, respectively).

popliteal fossa may be ill-advised.)

- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L 4 and L 5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[3]

- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) **improved the orthopedic management of chronic low back pain.**[4]

- EA at BL 23, BL 25, BL 40, and SP 6, combined with back exercises provided more relief of **chronic low back pain** and improvement in functional capacity compared to exercise alone; the benefits were maintained at a 3-month follow-up.[5]

- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[6]

- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[7]

- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain**, even at a 3 month follow-up.[8]

- Electroacupuncture at BL 40 and BL 57 relieved **local ankle spasticity** in a child with mild spastic hemiplegic cerebral palsy.[9]

References

1. Chen C-J, Tsai W-C, Yen J-H, Tsai J-J, Ou T-T, Lin C-C, and Liui H-W. Bloodletting acupuncture of the engorged vein around BL-40 (Wei-Chung) for acute lumbar sprain. *American Journal of Chinese Medicine.* 2001;29(3-4):387-391.

2. Zhang Y, Zhang L, LiuH, and Lei Z. Bloodletting at Weizhong point (UB 40) for treatment of acute lumbar sprain. *Journal of Traditional Chinese Medicine.* 1993;13(3):192-193.

3. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.

4. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.

5. Yeung CKN, Leung MCP, and Chow DHK. The use of electro-acupuncture in conjunction with exercise for the treatment of chronic low-back pain. *Journal of Alternative and Complementary Medicine.* 2003;9(4):479-490.

6. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.

7. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed.* 2000;28(1):25-33.

8. Molsberger AF, Mau J, Pawelec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.

9. Svedberg L, Nordahl G, and Lundeberg T. Electroa-acupuncture in a child with mild spastic hemiplegic cerebral palsy. *Developmental Medicine & Child Neurology.* 2003;45:503-504.

10. Aftimos S. Myofascial pain in children. *New Zealand Medical Journal.* 1989;102(874):440-441.

11. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology.* 2002;224:112-119.

12. Sanchez JE, Conkling N, and Labropoulos N. Compression syndromes of the popliteal neurovascular bundle due to Baker cyst. *J Vasc Surg.* 2011;54(6):1821-1829.

13. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.

14. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery.* 2012;56(1):181-188.

15. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.

16. Yuping W, Runfang L, and Hua K. Acupuncture treatment of children nocturnal enuresis – a report of 56 cases. *J Tradit Chin Med.* 2006;26(2):106-107,

17. Molsberger AF, Zhou J, Arndt D, et al. Chinese acupuncture for chronic low back pain: an international expert survey. *J Altern Complement Med.* 2008;14(9):1089-1095.

BL 41

Fu Fen "Attached Branch"

On the cranial thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T2, level with BL12. An alternate and neuroanatomically more precise location places BL 41 at the lateral border of the iliocostalis muscle in the 2nd intercostal space. See Figure 7-86A for comparison of both point placements.

CAUTION: This is one of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) where deep needling can cause pneumothorax. This risk is higher with the outer BL line points than the parallel inner line.[1]

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Serratus posterior superior muscle:** Elevates the upper four ribs, thereby raising the sternum and increasing the anteroposterior diameter of the thorax.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: A myofascial trigger point in the serratus posterior superior muscle, just medial to the angle of the scapula, causes pain in the cranial scapula, caudal deltoid, olecranon tip, and wrist, overlapping with the TH, PC, and HT channels. Rhomboid trigger points refer to the medial border of the scapula. Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C5, C8, T2 and T3 spinal nerves:** Dorsal rami innervate skin, bones, joints, muscles of the back. Ventral rami form intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **T2-T5 spinal nerves, ventral rami (2nd to 5th intercostal nerves):** Innervate serratus posterior superior muscle.
- **Dorsal scapular nerve (C4, C5):** innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: BL 41 begins a series of points making up the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also

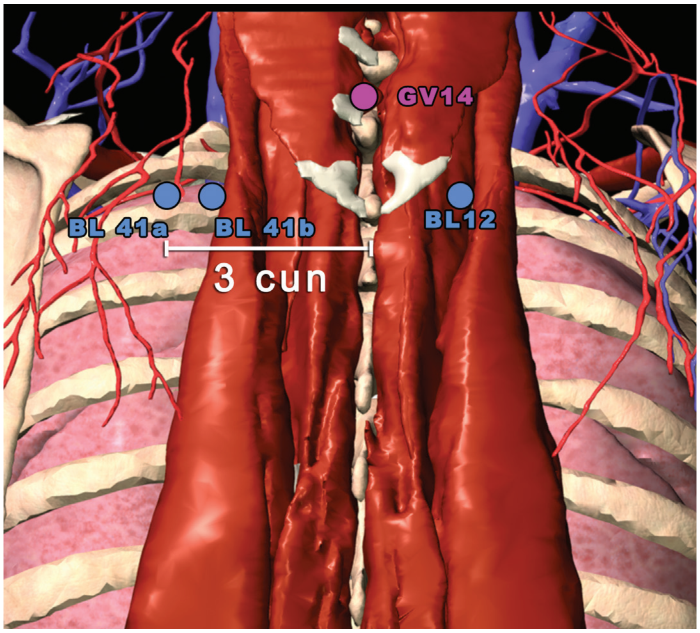


Figure 7-86A. Two ways exist to locate BL points of the outer channel. In this image, BL 41a identifies the location determined by cun count. BL 41b puts the point at the lateral iliocostalis border. As shown by the erector spinae muscle group reproduced in this figure, the latter point location method will place outer BL line points at variable distances from the midline. Finding points in this manner affords a more accurate neuroanatomic location than strict implementation of cun measurements.

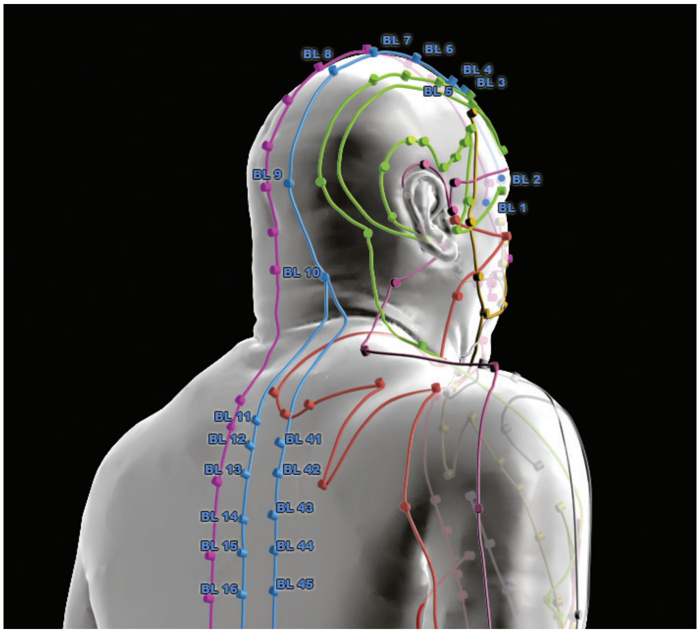


Figure 7-86B. This "glassman" image illustrates why BL 41 earns the name "attached branch", representing the first point on the outer BL line.

represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[2]

The outer Bladder line points echo the effects of inner BL points on visceral function through reflexes in the spinal cord.[3] Although BL 41 is not paired with an organ traditionally, but its indications resonate with those of BL 12 in terms of treating the upper airways and immune system.

Figure 7-87 outlines the structures within reach of a needle entering BL 41 and BL 12. Neurologically, BL 41 relates more closely to the ventral ramus of the spinal nerve than does its dermatomal partner, BL 12.

Vessels

- **2nd posterior intercostal artery:** Arises from the supreme intercostal artery, a branch of the costocervical artery of the subclavian artery. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **2nd posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. The 1st through the 3rd intercostal veins either empty into the brachiocephalic vein or superior vena cava. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: The intercostal artery becomes exposed within the intercostal space in the territory described by the BL channels.[4] Contrary to most artists' renditions of the posterior intercostal vessels, the posterior intercostal neurovascular bundles exhibit variable tortuosity.[5] Inadvertent puncture of these vessels can cause hematoma or hemothorax, which are serious consequences of percutaneous needling. Usually, acupuncture needling will not reach the depth of the intercostal vessels because coursing through the chest wall could induce pneumothorax.

Indications and Potential Point Combinations

- **Tension or pain in the upper back, neck, shoulder:** Check first for trigger points; consider BL 41 for tenderness to palpation in this shoulder region. Muscles accessible at this level include the trapezius, rhomboideus major, and the posterior lip of the serratus anterior muscle as it attaches to the medial border of the scapula.
- **Numbness in the thoracic limb:** BL 41 to reduce regional neural compression and to provide input to spinal segments governing thoracic limb function. Add distal points to facilitate nerve communication along compromised pathways. Add spinal segmental points to address the affected area cranial and caudal to the dysfunction.
- **Early viral illness:** BL 41, BL 12, BL 13, ST 36, LI 4.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
3. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
4. Helm EJ, RAhman NM, Talakoub O, et al. Course and variation of the intercostal artery by computed tomography. *Chest.* 2013;143(3):634-639.
5. Dewhurst C, O'Neill S, O'Regan K, et al. Demonstration of the course of the posterior intercostal artery on CT angiography: relevance to interventional radiology procedures in the chest. *Diagn Interv Radiol.* 2012;18:221-224.

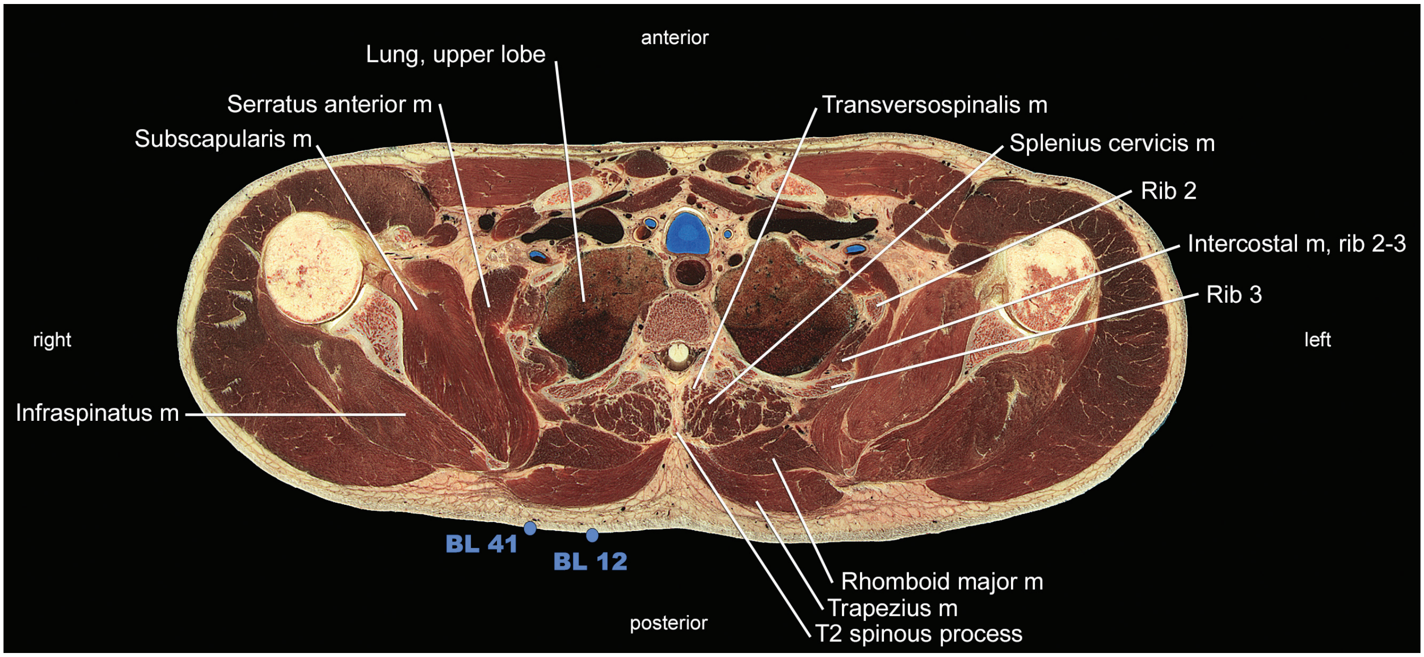


Figure 7-87. While a large distance exists between the skin surface at BL 41 and the upper lobe of the lung in this specimen, far less tissue would protect the lungs in a thin, geriatric patient.

BL 42

Po Hu "Door of the Corporeal Soul"

On the cranial thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T3, level with BL 13. An alternate and neuroanatomically more precise location places BL 42 at the lateral border of the iliocostalis muscle in the 3rd intercostal space.

CAUTION: This is one of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) where deep needling can cause pneumothorax. This risk is higher with the outer BL line points than the parallel inner line.[1]

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Serratus posterior superior muscle:** Elevates the upper four ribs, thereby raising the sternum and increasing the anteroposterior diameter of the thorax.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: A myofascial trigger point in the serratus posterior superior muscle, just medial to the angle of the scapula, causes pain in the cranial scapula, caudal deltoid, olecranon tip, and wrist, overlapping with the TH, PC, and HT channels. Rhomboid trigger points refer to the medial border of the scapula. Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C5, C8, T1-T3 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **T2-T5 spinal nerves, ventral rami (2nd to 5th intercostal**

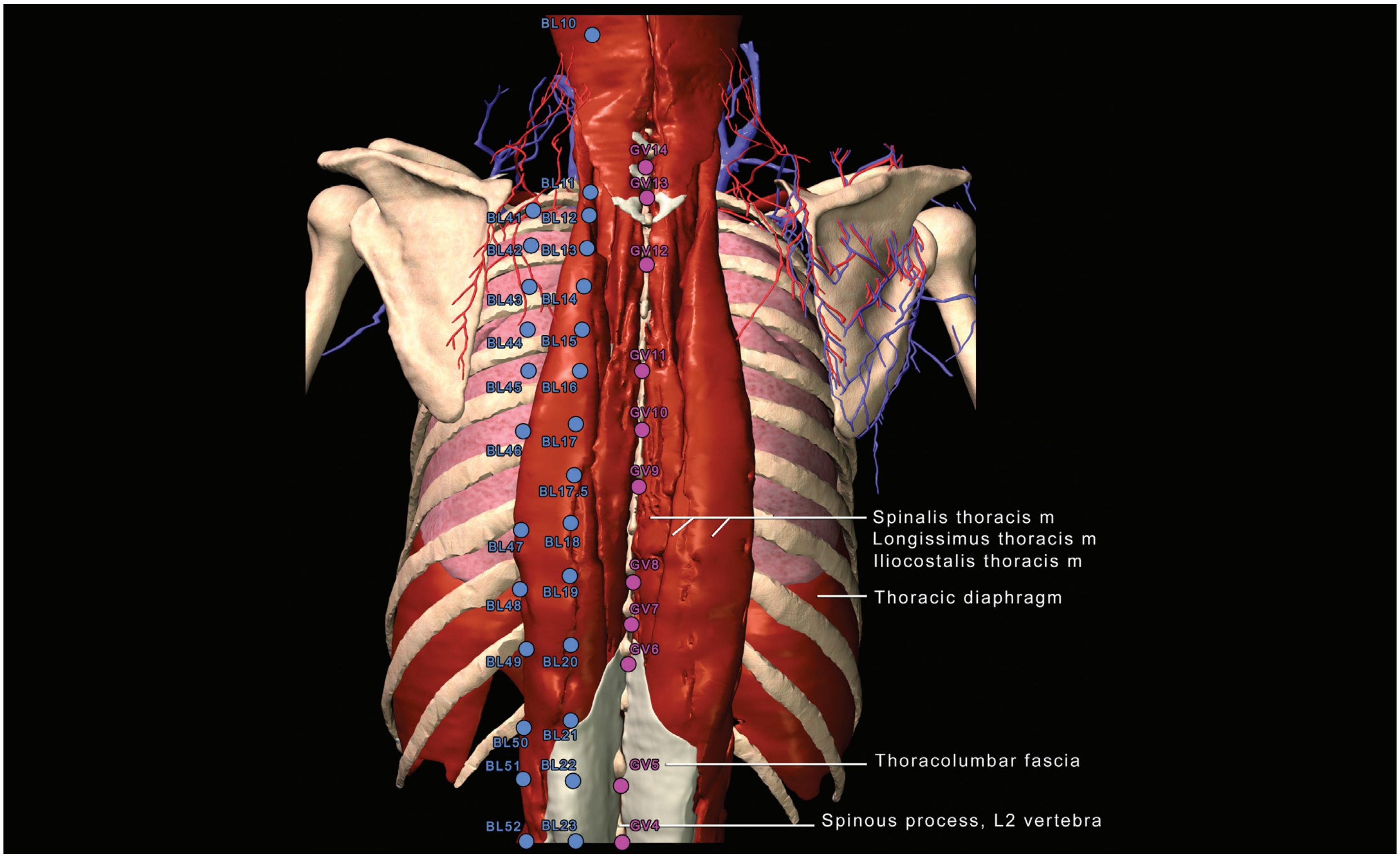


Figure 7-88. In Chinese medicine, the term "Corporeal Soul" in the descriptive name for BL 42, "Door of the Corporeal Soul" refers to that part of one's being which initiates and drives physiologic processes. Because the lungs inhale air (Qi), the oxygen taken in does indeed support bodily life; without it, one will perish. The lungs in this image extend well caudal to BL 13 and BL 42 but their sympathetic fibers arise from the cranial thoracic spinal segments shared by these two points. Points in this image along both the inner and outer BL channel segments have been placed according to cun (body inch) count rather than topographical features such as the medial and lateral border of the iliocostalis muscle. If one contours the BL channels to these muscle borders, both trajectories become curvilinear rather than straight lines. Finding points based on actual anatomy rather than strict measurements translates into more reliable neuroanatomic localization and consistent neuromodulatory outcomes.

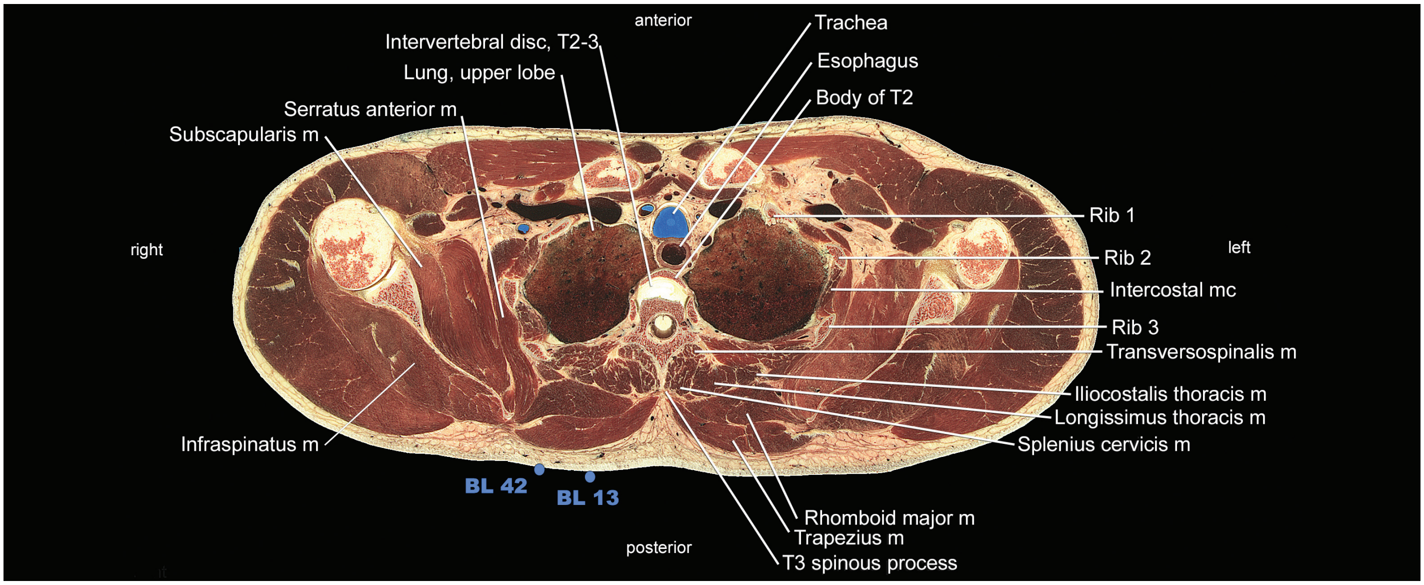


Figure 7-89. Several layers of robust muscles deep to BL 42 protect the lung in this cross section. However, thin, cachectic, geriatric or other patients with atrophic or underdeveloped musculature would exhibit more risk for pneumothorax with deep needling at this "Door of the Corporeal Soul".

nerves): Innervate serratus posterior superior muscle.

- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: BL 42 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[3]

The outer Bladder line echoes the effects of its parallel partner by indirectly influencing visceral function through reflexes that occur in the spinal cord.[4]

Figure 7-89 compares the anatomy beneath BL 42 and BL 13. Neurologically, BL 42 relates more closely to the ventral ramus of the spinal nerve than does its dermatomal partner, BL 13, the lung "Back Shu" point.

Vessels

- **3rd posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin.

Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.

- **3rd posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. The 1st through the 3rd intercostal veins either empty into the brachiocephalic vein or superior vena cava. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: The intercostal artery becomes exposed within the intercostal space in the territory described by the BL channels.[5] Contrary to most artists' renditions of the posterior intercostal vessels, the posterior intercostal neurovascular bundles exhibit variable tortuosity. Inadvertent puncture of these vessels can cause hematoma or hemothorax, which are serious consequences of percutaneous needling. Usually, acupuncture needling will not reach the depth of the intercostal vessels because coursing through the chest wall could induce pneumothorax.

Indications and Potential Point Combinations

- **Respiratory problems:** BL 42, BL 13, BL 23, ST 36, LU 7.
- **Stiffness in the neck or upper back:** BL 42, other tender myofascial trigger points in the upper thorax and neck.

Evidence-Based Applications

- Symptoms of **chronic emotional disorders** improved following injection of ultra-low-dose triamcinolone into tender points along the outer Bladder line, from BL 42-BL 46.[2]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Finston P. Preliminary study: treatment of chronic emotional disorders by ultra-low-dose steroid injection of outer Bladder points 42-46. *Medical Acupuncture.* 16(1). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_1/case1.html. Obtained on 01-10-06.
3. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
4. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
5. Helm EJ, RAhman NM, Talakoub O, et al. Course and variation of the intercostal artery by computed tomography. *Chest.* 2013;143(3):634-639.
6. Dewhurst C, O'Neill S, O'Regan K, et al. Demonstration of the course of the posterior intercostal artery on CT angiography: relevance to interventional radiology procedures in the chest. *Diagn Interv Radiol.* 2012;18:221-224.

BL 43

Gao Huang Shu "Vital Region Shu"

On the cranial thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T4, level with BL 14. An alternate and neuroanatomically more precise location places BL 43 at the lateral border of the iliocostalis muscle in the 4th intercostal space. See Figures 7-90A and 7-90B in order to compare the locations derived by strict adherence to the usual definition versus finding the point on the basis of neuroanatomically relevant landmarks.

One of several acupuncture points (including LU 2; ST 11-ST 18; KI22-KI27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Trapezius muscle:** The middle fibers of the trapezius muscle retract the scapula (i.e., pull it in a caudal direction).
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Serratus posterior superior muscle:** Elevates the upper four ribs, thereby raising the sternum and increasing the anteroposterior diameter of the thorax.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: A myofascial trigger point in the serratus posterior superior muscle, just medial to the angle of the scapula, causes pain in the cranial scapula, caudal deltoid, olecranon tip, and wrist, overlapping with the TH, PC, and HT channels. Rhomboid trigger points refer to the medial border of the scapula. Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **C8-T4 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.
- **T2-T5 spinal nerves, ventral rami (2nd to 5th intercostal nerves):** Innervate serratus posterior superior muscle.

Clinical Relevance: BL 43 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back

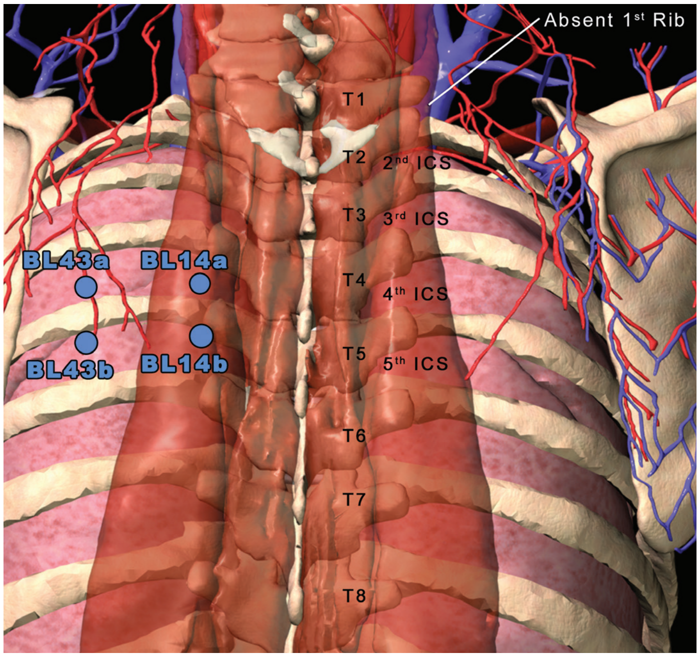


Figure 7-90A. In this image, BL 14 (a and b) falls 1.5 cun from the midline, and BL 43 (a and b), 3 cun. The appropriate level where BL 14a and BL 43a should land is in the 4th intercostal space associated with the 4th intercostal vein, artery, and nerve. On the other hand, following the classical definition puts BL 14b and BL 43b in the 5th intercostal space, level with the caudal border of the T4 spinous process.

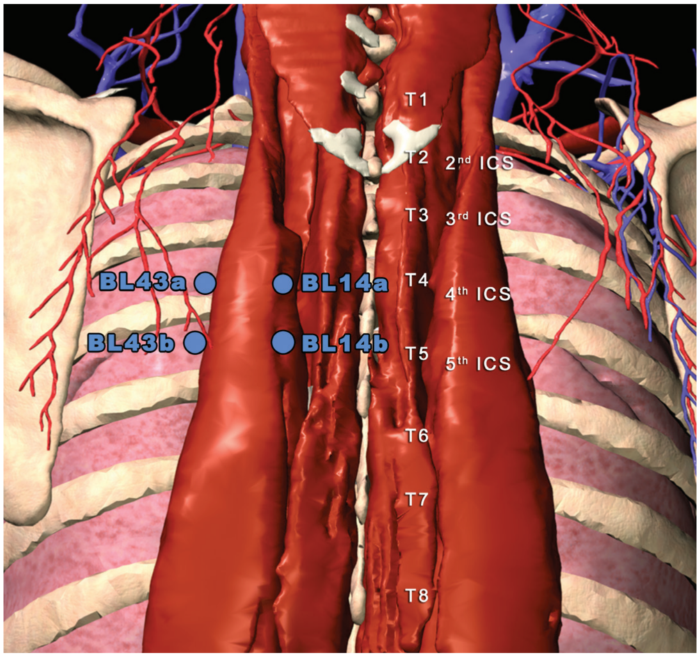


Figure 7-90B. This point placement identifies the longitudinal locations for BL 14 and BL 43 according to muscle borders rather than cun measurements.

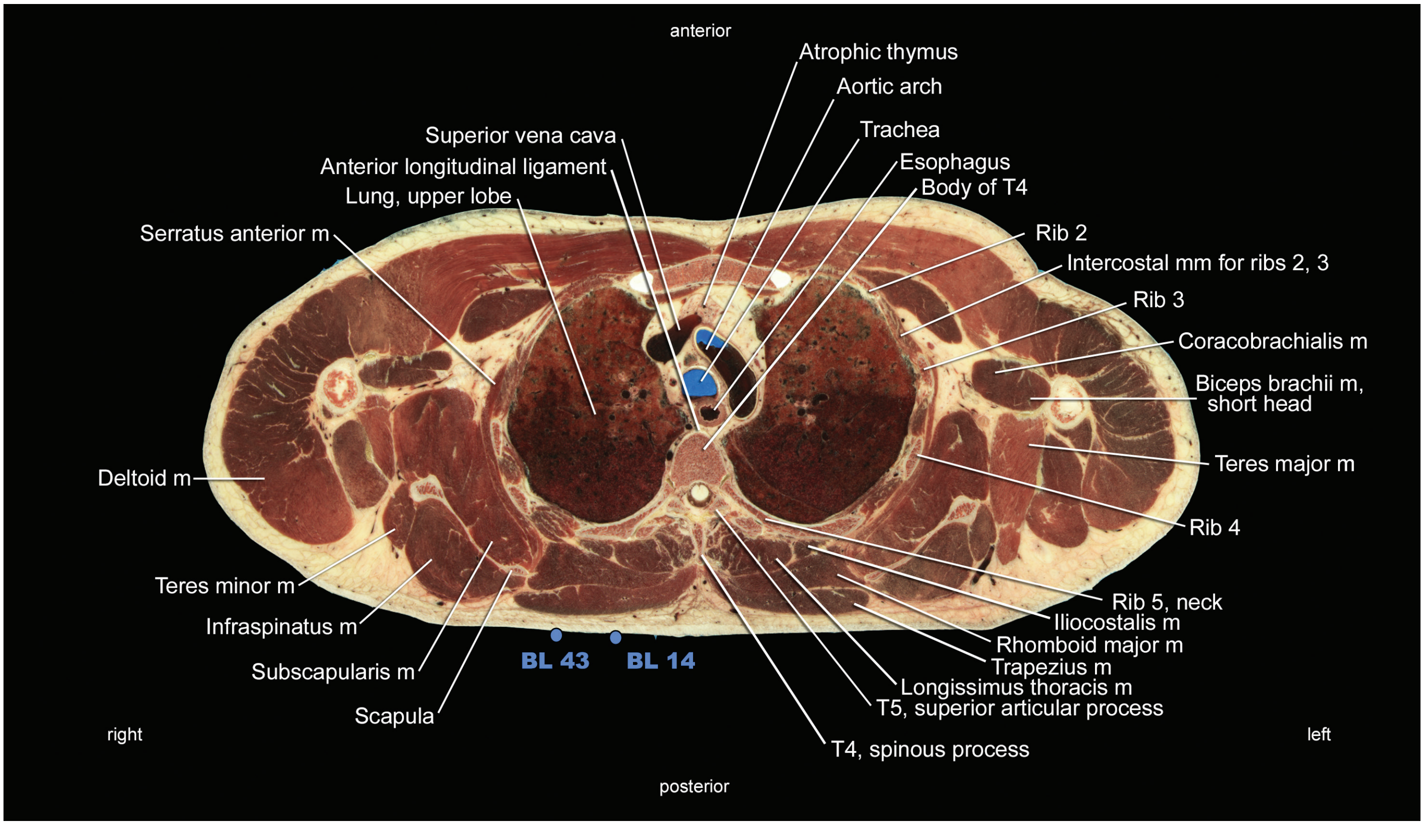

anterior
Atrophic thymus
Aortic arch
Trachea
Superior vena cava
Anterior longitudinal ligament
Esophagus
Body of T4
Lung, upper lobe
Serratus anterior m
Rib 2
Intercostal mm for ribs 2, 3
Rib 3
Coracobrachialis m
Biceps brachii m, short head
Teres major m
Deltoid m
Rib 4
Rib 5, neck
Teres minor m
Iliocostalis m
Infraspinatus m
Rhomboid major m
BL 43
BL 14
Trapezius m
Subscapularis m
Longissimus thoracis m
T5, superior articular process
Scapula
right
left
T4, spinous process
posterior

Figure 7-91. BL 43, or "Vital Region Shu", is the outer BL line counterpart in relation to BL 14 (Pericardium Back Shu). Its Chinese name of "gao huang' means "fat membrane", likely referring to pericardial fat or to the pericardium itself. This cross section reveals how deep needling at BL 43 could reach the lung whereas acupuncture at BL 14 might first encounter bone.

pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[3]

The outer Bladder line echoes the effects of its parallel partner by indirectly influencing visceral function through reflexes that occur in the spinal cord.[4]

Vessels

- **4th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **4th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: The intercostal artery becomes exposed within the intercostal space in the territory described by the BL channels.[5] Contrary to most artists' renditions of the posterior intercostal vessels, the posterior intercostal neurovascular bundles exhibit variable tortuosity. Inadvertent puncture of these vessels can cause hematoma or hemothorax, which are serious consequences of percutaneous needling. Usually, acupuncture needling will not reach the depth of the intercostal vessels because coursing through the chest wall could induce pneumothorax.

Indications and Potential Point Combinations

- **Cough, asthma:** BL 43, BL 13, BL 42, BL 23, LU 5, LI 4.
- **Back pain or stiffness:** BL 43 and local trigger points.

Evidence-Based Applications

- Symptoms of **chronic emotional disorders** improved following injection of ultra-low-dose triamcinolone into tender points along the outer Bladder line, from BL 42-BL 46.[2]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Finston P. Preliminary study: treatment of chronic emotional disorders by ultra-low-dose steroid injection of outer Bladder points 42-46. *Medical Acupuncture.* 16(1). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_1/case1.html. Obtained on 01-10-06.
3. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
4. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
5. Helm EJ, RAhman NM, Talakoub O, et al. Course and variation of the intercostal artery by computed tomography. *Chest.* 2013;143(3):634-639.
6. Dewhurst C, O'Neill S, O'Regan K, et al. Demonstration of the course of the posterior intercostal artery on CT angiography: relevance to interventional radiology procedures in the chest. *Diagn Interv Radiol.* 2012;18:221-224.

BL 44

Shen Tang "Hall of the Spirit"

On the upper thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T5, level with BL 15. An alternate and neuroanatomically more precise location places BL 44 at the lateral border of the iliocostalis muscle in the 5th intercostal space.

One of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Trapezius muscle:** The musculotendinous part provides added resistance to needle insertion. Inferior fibers depress the scapula and lower the shoulder.
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the erector spinae bend the vertebral column in a lateral direction; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Rhomboid trigger points refer to the medial border of the scapula. Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 44 that extends around the trunk to the chest could cause diagnostic confusion and cause some to interpret myofascial referred pain as cardiac in origin.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T2-T5 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: BL 44 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal

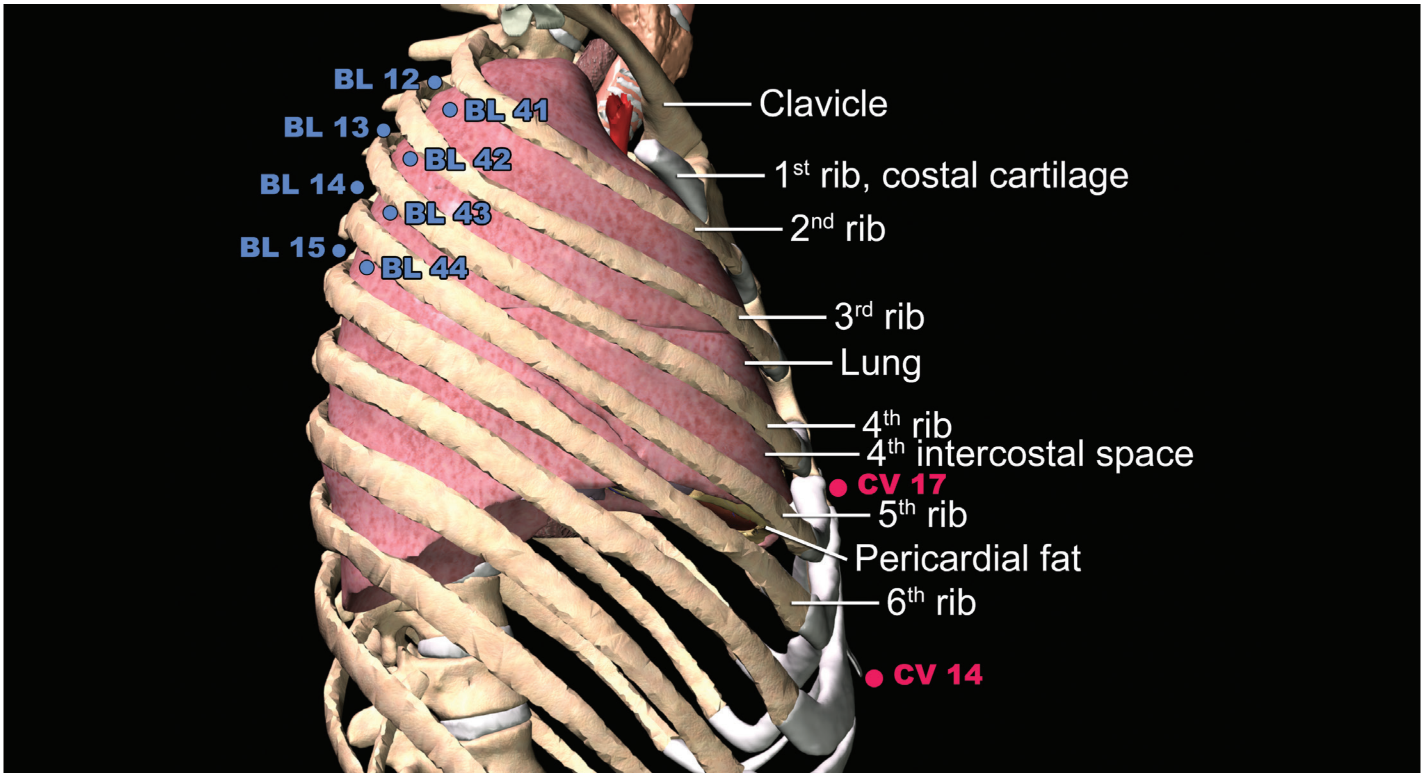


Figure 7-92. BL 44 resides in the 5th intercostal space with its inner BL line partner, BL 15, the Back Shu points of the heart. In Chinese medicine, the heart houses the spirit, which explains why they called BL 44 "Hall of the Spirit". This section of the trunk corresponds closely with the heart and pericardium from a neuroanatomic perspective. The T1-T5 spinal cord segments mediate sympathetic somatovisceral and viscerosomatic reflexes between the cardiac system and the upper back. The 5th intercostal nerves courses along the 5th intercostal space from back to front, arriving at the midline near the Front Mu point for the heart, CV 14. The Chinese medicine association of the heart with the mind lends insight into why BL 44 might appear in a treatment formula for stroke patients suffering from Broca's aphasia.[7] Some associate the clinical benefits derived from stimulating points along the outer BL line with the "emotional" aspects ascribed to the paired inner BL line point. For BL 44, then, the effects of needling would pertain to the more spiritual aspects of cardiac function.

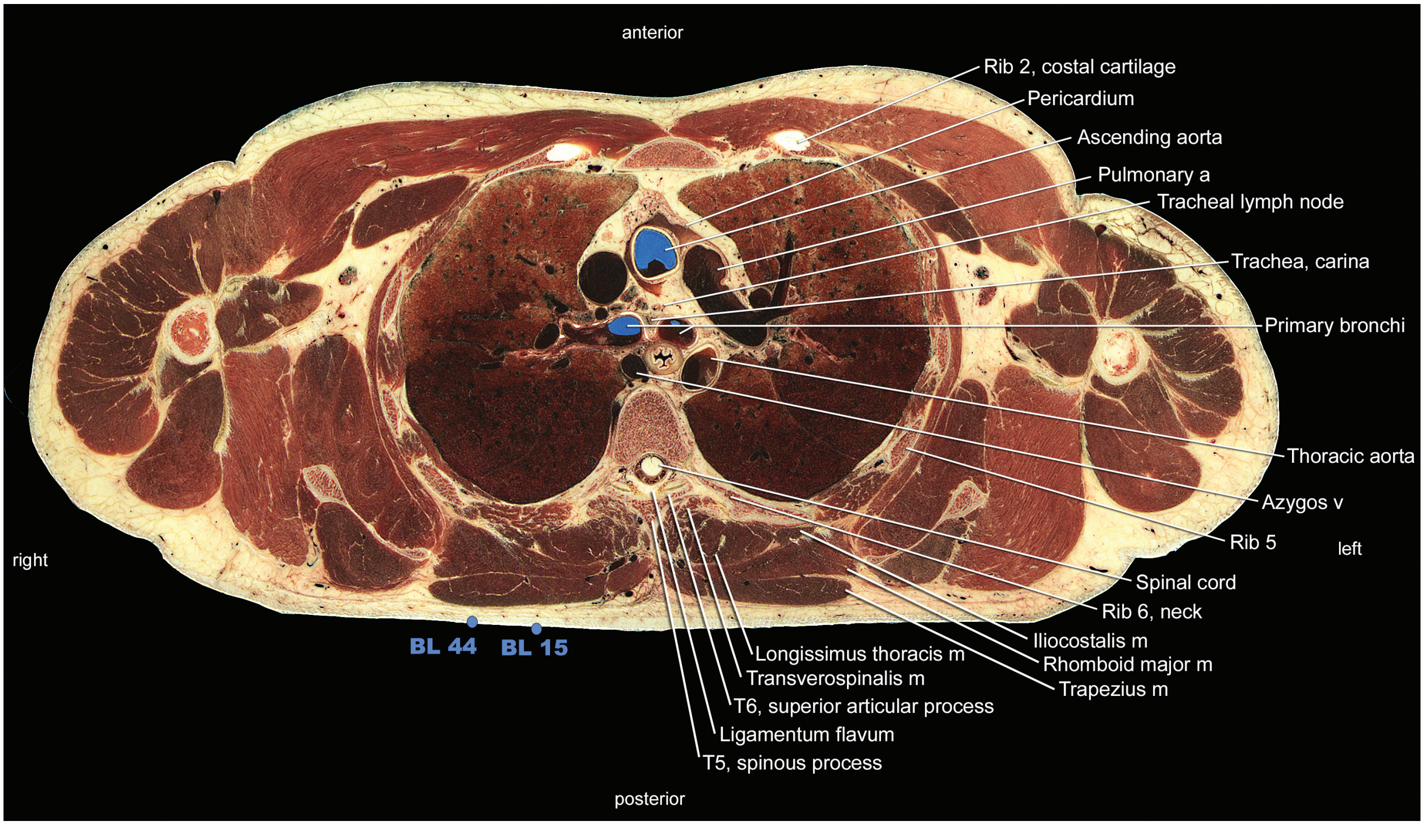


Figure 7-93. The thick, heavy musculature beneath BL 44 and BL 15 makes these sites prime targets for trigger point deactivation.

nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[3]

The outer Bladder line echoes the effects of its parallel partner by indirectly influencing visceral function through reflexes that occur in the spinal cord.[4] In the case of BL 44 and BL 15, the internal organ with which they correspond is the heart.

Vessels

- **5th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **5th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: The intercostal artery becomes exposed within the intercostal space in the territory described by the BL channels.[5] Contrary to most artists' renditions of the posterior intercostal vessels, the posterior intercostal neurovascular bundles exhibit variable tortuosity.[6] Inadvertent puncture of these vessels can cause hematoma or hemothorax, which are serious consequences of percutaneous needling. Usually, acupuncture needling will not reach the depth of the intercostal vessels because coursing through the chest wall could induce pneumothorax.

Indications and Potential Point Combinations

- **Emotional upset: agitation, insomnia:** BL 44, BL 15, PC 6, PC 7, HT 3, HT 7, LR 3.
- **Upper back pain:** BL 44, other trigger points in the region.

Evidence-Based Applications

- Symptoms of **chronic emotional disorders** improved following injection of ultra-low-dose triamcinolone into tender points along the outer Bladder line, from BL 42-BL 46.[2]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Finston P. Preliminary study: treatment of chronic emotional disorders by ultra-low-dose steroid injection of outer Bladder points 42-46. *Medical Acupuncture.* 16(1). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_1/case1.html. Obtained on 01-10-06.
3. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
4. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
5. Helm EJ, RAhman NM, Talakoub O, et al. Course and variation of the intercostal artery by computed tomography. *Chest.* 2013;143(3):634-639.
6. Dewhurst C, O'Neill S, O'Regan K, et al. Demonstration of the course of the posterior intercostal artery on CT angiography: relevance to interventional radiology procedures in the chest. *Diagn Interv Radiol.* 2012;18:221-224.
7. Luo WP, Tan JL, and Huang HY. Clinical observation on treatment of cerebral infarction-induced broca aphasia by Tiaoshen Fuyin acupuncture therapy combined with language training. *Zhongguo Zhen Jiu.* 2008;28(3):171-175.

BL 45

Yi Xi "Sigh", "Hiccup", or "Sob"

On the upper thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T6, level with BL 16. The line describing 3 cun from the midline is continuous with the medial border of the scapula in the thoracic region, when the shoulder is relaxed. An alternate and neuroanatomically more precise location places BL 45 at the lateral border of the iliocostalis muscle in the 6th intercostal space. One of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Trapezius muscle:** The inferior fibers depress the scapula and lower the shoulder.
- **Rhomboideus major muscle:** Retracts and rotates the scapula; assists the serratus anterior muscle in holding the scapula against the thoracic wall; holds the scapula in place the scapula while the thoracic limb is moving.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.

Clinical Relevance: Rhomboid trigger points refer to the medial border of the scapula. Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 45 that extends around the trunk to the chest could cause diagnostic confusion and cause some to interpret myofascial referred pain as cardiac in origin.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T3-T6 spinal nerves:** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **Dorsal scapular nerve (C4, C5):** Innervates the rhomboid muscles, entering at their deep surface. Arises chiefly from C5 and often receives contribution from C4. May provide fibers to the levator scapulae.

Clinical Relevance: BL 45 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[4]

The outer Bladder line echoes the effects of its parallel partner by indirectly influencing visceral function through reflexes that occur in the spinal cord.[5] In the case of BL 45, however, its inner line companion is the Back Shu point for the Governing Vessel (BL 16). BL 16 associates not with a viscus but with a vascular network that includes the azygous (also spelled "azygos") vein, shown in Figure 7-94b, ventral to the vertebral body. The azygous vein enters the superior vena cava at or below the level of BL 16/BL 45 in most cases. This horizontal plane includes the bifurcation of the pulmonary trunk.[6] The azygous vein may join the caval venous system directly or it may empty indirectly by way of the hemiazygous and accessory hemiazygous veins.

Vessels

- **6th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin.

Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.

- **6th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Neuromodulation at BL 45 may improve circulation to and from the structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and

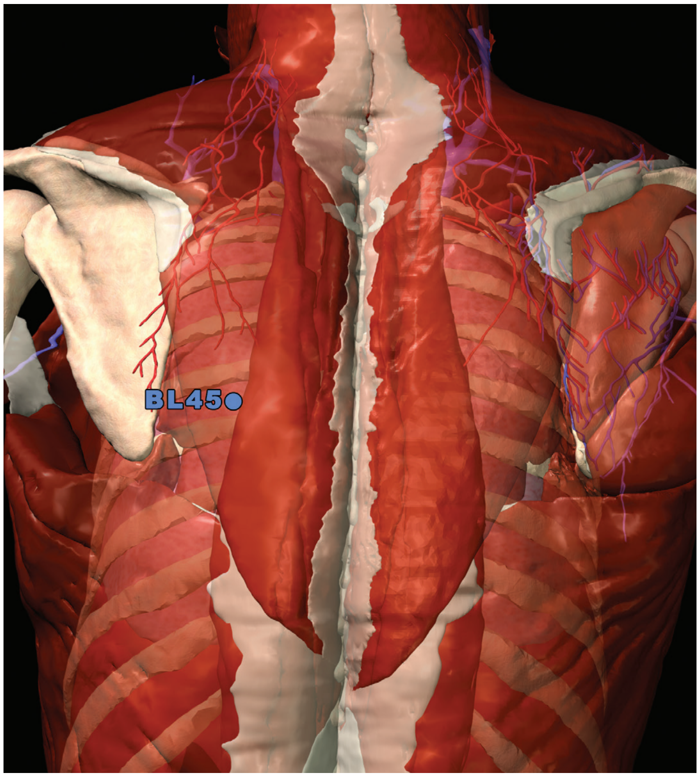


Figure 7-94A. Pressing this site on the back makes some patients cough, sigh, or utter various sounds. Try it on yourself and see what happens. It also stops hiccups (hiccoughs) in certain cases and promotes deeper respiration in others.

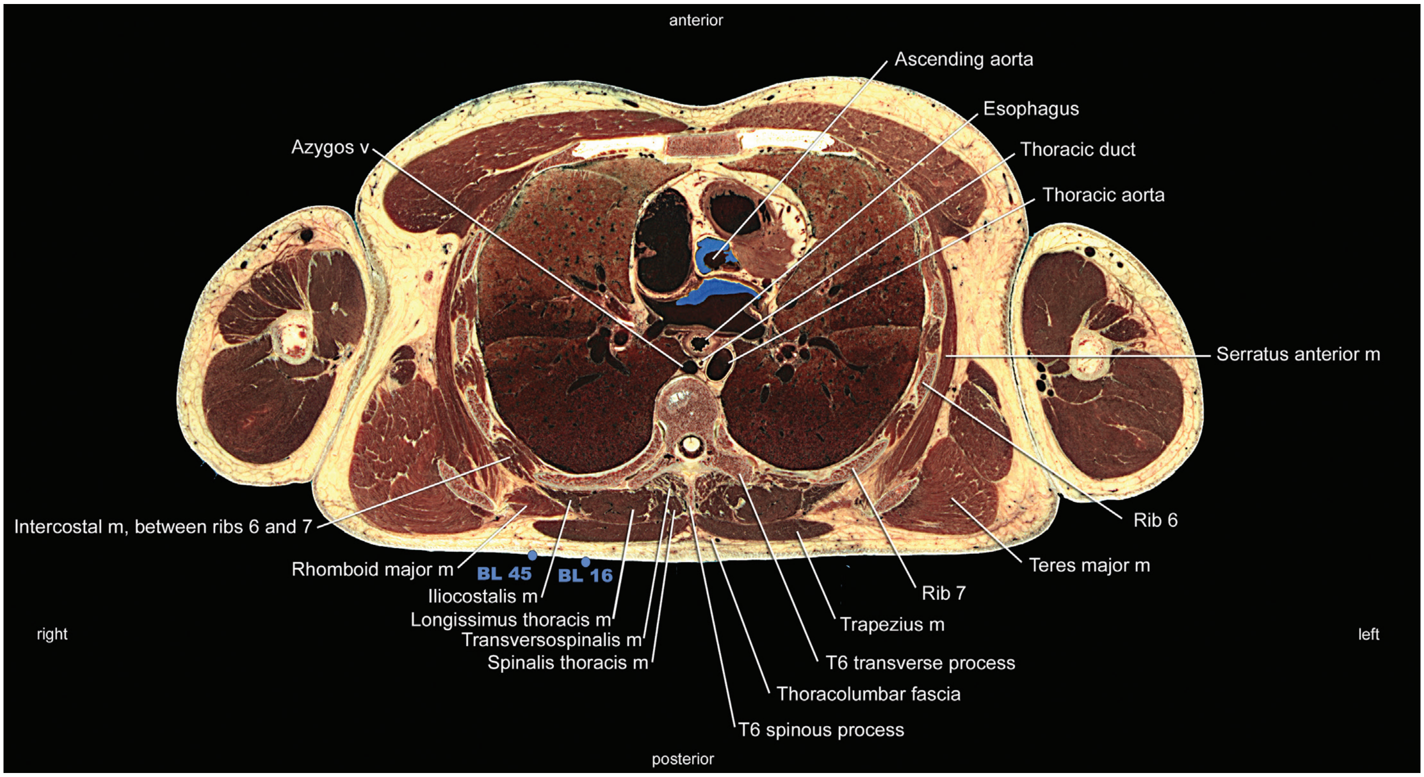

anterior
Ascending aorta
Esophagus
Azygos v
Thoracic duct
Thoracic aorta
Serratus anterior m
Intercostal m, between ribs 6 and 7
Rib 6
Rhomboid major m
BL 45
BL 16
Teres major m
Iliocostalis m
Rib 7
Longissimus thoracis m
Trapezius m
Transversospinalis m
right
left
Spinalis thoracis m
T6 transverse process
Thoracolumbar fascia
T6 spinous process
posterior

Figure 7-94B. The multiple muscle borders encountered by a needle inserted at BL 45 include the narrowing trapezius, the caudal limit of the rhomboideus major, and finally the iliocostalis muscle from the erector spinae group, which is increasing in width and strength, as shown in Figure 7-94A.

massage benefit blood flow and venous return, which supports soft tissue health and restoration.

Indications and Potential Point Combinations

- **Cough, asthma, dyspnea:** Check for intercostal trigger points; take BL45 if tender. Add BL 12, BL 13, BL 23, LI 4, ST 36.
- **Shoulder or back pain, stiffness:** BL 45, other local points that exhibit tenderness to palpation. Address spinal segments pertaining to somatic dysfunction.

Evidence-Based Applications

- Acupuncture provided an effective alternative to medication for the treatment of renal colic with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[2]
- Symptoms of chronic emotional disorders improved following injection of ultra-low-dose triamcinolone into tender points along the outer Bladder line, from BL 42-BL 46.[3]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology.* 1992;147:16-18.
3. Finston P. Preliminary study: treatment of chronic emotional disorders by ultra-low-dose steroid injection of outer Bladder points 42-46. *Medical Acupuncture.* 16(1). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_1/case1.html. Obtained on 01-10-06.
4. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
5. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
6. Mirjalili SA, Hale SJM, Buckenham T, et al. A reappraisal of adult thoracic surface anatomy. *Clinical Anatomy.* 2012;25:827-834.

BL 46

Ge Guan "Diaphragm Gate"

On the upper thorax, in a groove medial to the vertebral border of the scapula, 3 cun lateral to the caudal border of the spinous process of T7, level with BL 17. The line describing 3 cun from the midline is continuous with the medial border of the scapula in the thoracic region, when the shoulder is relaxed. Approximately level with the inferior angle of the scapula. BL 46 sits alongside BL 17 in the 7th intercostal space.

One of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1] Because this point lies near the triangle of auscultation, the risk of entering the lung increases.

Muscles

- **Trapezius muscle**: The inferior fibers depress the scapula and lower the shoulder.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the iliocostalis sidebends the vertebral column; acting bilaterally, it extends the spine.

Clinical Relevance: Erector spinae trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 46 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as cardiac in origin. Trigger points in the trapezius at this level typically refer pain that ascends toward BL 11 and/or GB 21.

Nerves

- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **T3-T7 spinal nerves:** Dorsal ramus innervates skin, bones, joints, and erector spinae at this level. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: BL 46 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[4]

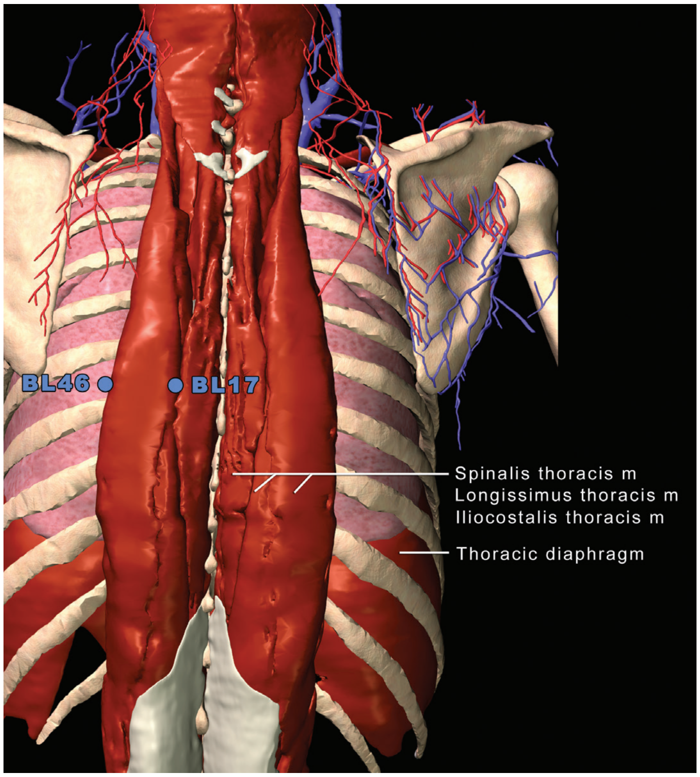


Figure 7-95. BL 46, like BL 17, should fall within the 7th intercostal space, level with the inferior angle of the scapula, on the lateral border of the iliocostalis thoracis muscle. BL 46, "Diaphragm Gate", harkens the presence of the diaphragm, which actually attaches to the back below this level. This dome-shaped musculofibrous septum divides the thoracic cavity from its abdominal counterpart. Its attachments span from the dorsum of the xiphoid process to the inner surfaces of the cartilaginous portions of the lower six ribs, onto the lumbocostal arches and vertebrae by means of its crura, or pillars.

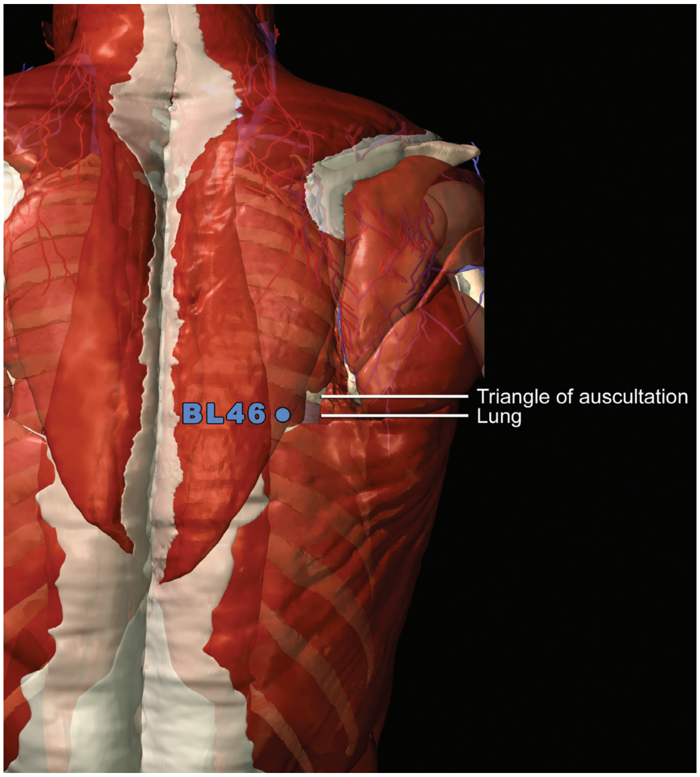


Figure 7-96. BL 46 lands close to or falls within the "triangle of auscultation". This site gains significance due to the relative ease of auscultating lung sounds on account of less soft tissue interference. At the same time, however, less muscle means higher risk of pneumothorax with needling this location.

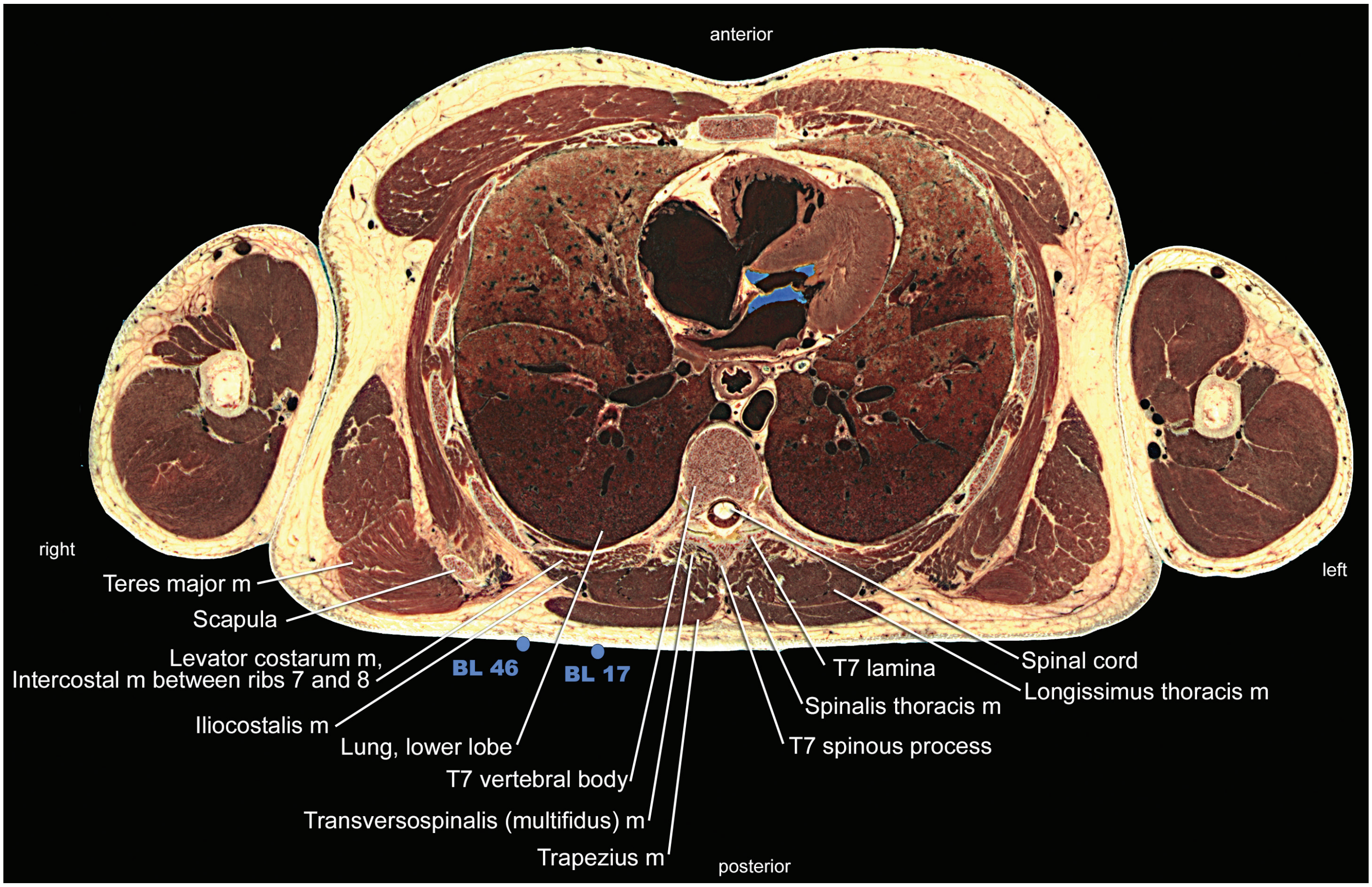


Figure 7-97. The window to the lungs, the triangle of auscultation, appears here deep to BL 46.

The outer Bladder line points echo the effects of the inner group by stimulating similar spinal nerves and cord segments.[5] In the case of BL 46, its inner line companion is the Back Shu point for the diaphragm (BL 17). Figure 7-95 compares the relative locations of the dorsal aspects of the diaphragm in relation to BL 17 and BL 46.

Vessels

- **7th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **7th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Neuromodulation at BL 46 may improve circulation to and from the structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and repair. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation.

Indications and Potential Point Combinations

- **Local pain:** Only needle if necessary due to local pain or restriction; caution required near the triangle of auscultation.

Evidence-Based Applications

- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[2]
- Symptoms of **chronic emotional disorders** improved following injection of ultra-low-dose triamcinolone into tender points along the outer Bladder line, from BL 42-BL 46.[3]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology.* 1992;147:16-18.
3. Finston P. Preliminary study: treatment of chronic emotional disorders by ultra-low-dose steroid injection of outer Bladder points 42-46. *Medical Acupuncture.* 16(1). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_1/case1.html. Obtained on 01-10-06.
4. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
5. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.

BL 47

Hun Men “Gate of the Ethereal Soul”

Below the inferior angle of the scapula, 3 cun lateral to the caudal border of the spinous process of T9, level with BL 18. BL 47 lives in the 9th intercostal space beside its partner, BL 18.

One of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the iliocostalis sidebends the vertebral column; acting bilaterally, it extends the spine.

Clinical Relevance: Trigger points in the latissimus dorsi muscle refer strongly to the region inhabited by BL 47 and BL 48. From here, the trigger-point-issued pain climbs to TH 14 and then down the thoracic limb, following the Triple Heater channel to the fingers. Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 47 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as visceral in origin. Serratus posterior inferior trigger points produce pain in the BL 47 to BL 51 region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T5-T9 spinal nerves:** Dorsal ramus innervates skin, bones, joints, and erector spinae at this level. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: BL 47 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[3]

The outer Bladder line points echo the impact of points on

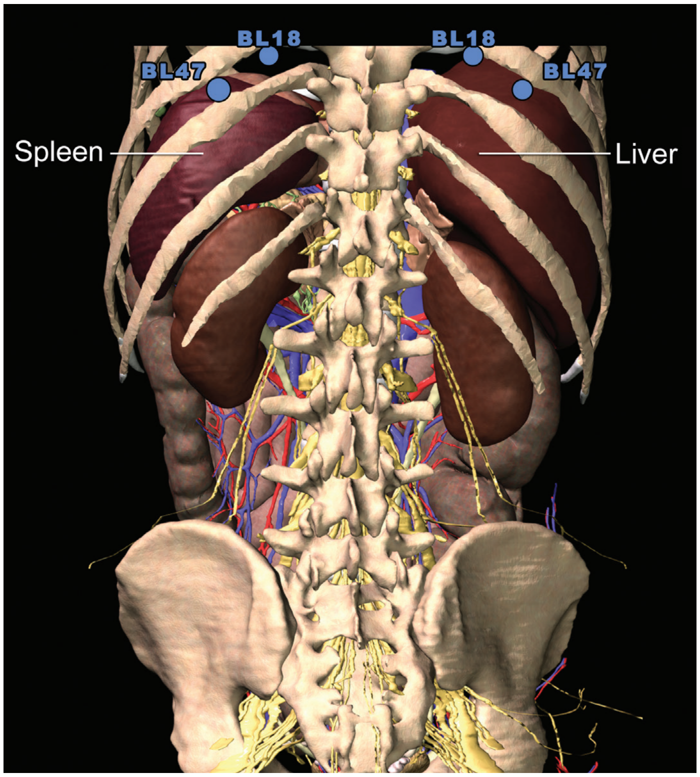


Figure 7-98A. Chinese medical philosophy holds that the liver houses the “ethereal soul” that governs imagination, intuition, and dreaming. This contrasts with BL 42, “Po Door”, where “Po” stands for the “corporeal soul” which we now understand as physiologic processes. BL 47 sits atop the liver as a “Gate to the Ethereal Soul”, similar to the way in which BL 42, “Po Door”, lands atop the lungs.

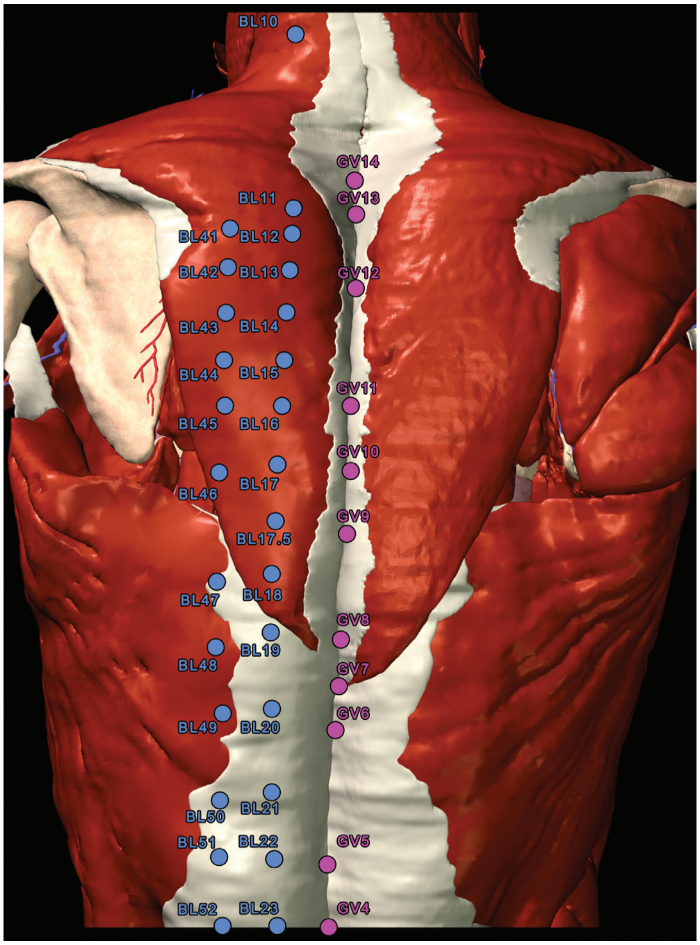


Figure 7-98B. At BL 47, the latissimus dorsi muscle replaces the trapezius as the superficial muscle layer overlying the erector spinae.

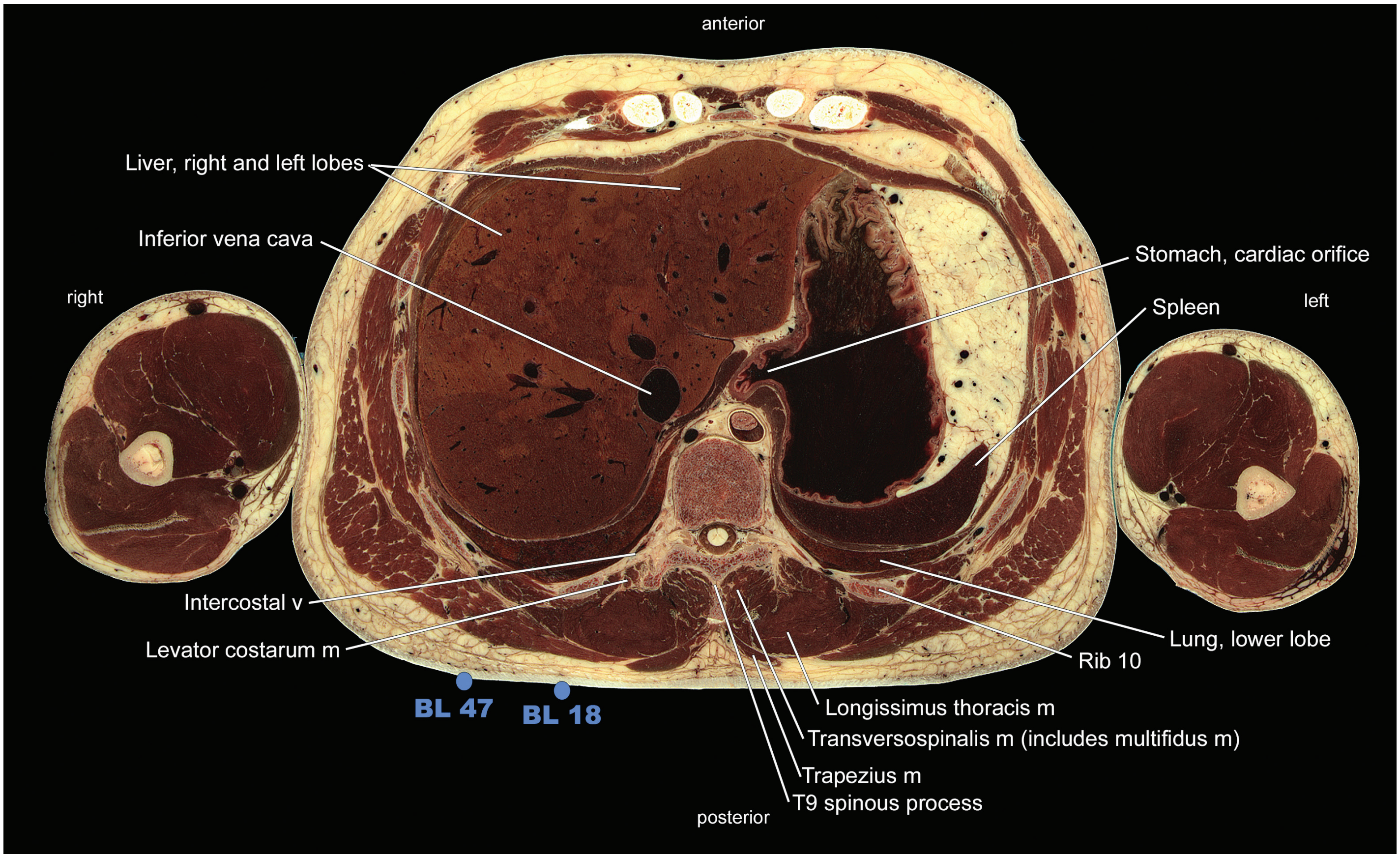


Figure 7-98C. The latissimus dorsi is the thick, most superficial muscle embracing the dorsolateral trunk. This cross section describes how, from a muscular perspective, the an acupuncture needle would first encounter the latissimus dorsi at BL 47, followed by the lateral border of the erector spinae muscle column (specifically, the iliocostalis thoracis).

the inner line by stimulating similar spinal nerves and cord segments.[4] In the case of BL 47, the inner line companion is the Back Shu point for the liver (BL 18). Figure 7-98C exposes how prominent the liver has become on this horizontal plane, illustrating the anatomical linkage between these points and the liver.

Vessels

- **9th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **9th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Neuromodulation at BL 47 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation.

Indications and Potential Point Combinations

- **Pain in the chest or lateral thorax:** BL 47, other tender locations and BL points on related spinal segmental levels. Assess for intercostal restriction and discomfort.
- **Back pain:** BL 47, other tender locations and BL points on related spinal segmental levels. If pain emanates from the spine itself, add GV points and/or Huatuojiaji points (1/2 lateral to the midline).
- **Insomnia:** BL 47, BL 18, HT 3, HT 7, PC 7.
- **Liver disorders:** BL 47, BL 18, LR 14, GB 24.

Evidence-Based Applications

- Acupuncture provided an effective alternative to medication for the treatment of **renal colic** with acupuncture points BL 21, BL 22, BL 23, BL 24, BL 25, BL 45, BL 46, and BL 47.[2]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.
2. Lee Y-H, Lee W-C, Chen M-T, Huang J-K, Chung C, and Chang LS. Acupuncture in the treatment of renal colic. *Journal of Urology*. 1992;147:16-18.
3. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine*. 2012;37(14):E817-E822.
4. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy*. 2009;8:32-35.

BL 48

Yang Gang "Yang's Key Link" or "Yang Headrope"

On the lateral border of the erector spinae muscle column in the 10th (second to last) intercostal space, which BL 19 shares.

One of several acupuncture points (including LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1] However, the risk of pneumothorax decreases from BL 48 to BL 50 because abdominal organs replace thoracic structures caudal to, or below, the diaphragm. Figure 7-99A illustrates the transition from BL 18/BL 47 to BL 19/BL 48. At the level of the upper pair, the empty thoracic cage identifies the location of the lungs, though one should remember that the relationships in this image show the organ layout in exhalation.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the iliocostalis sidebends the vertebral column; acting bilaterally, it extends the spine.

Clinical Relevance: Trigger points in the latissimus dorsi muscle refer strongly to the region inhabited by BL 47 through BL 49. From here, the trigger-point-issued pain climbs to TH 14 and then down the thoracic limb, following the Triple Heater channel to the fingers. Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 48 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as visceral in origin. Serratus posterior inferior trigger points produce pain in the BL 47 to BL 51 region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T6-T10 spinal nerves:** Dorsal ramus innervates skin, bones, joints, and erector spinae at this level. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: BL 48 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[2]

The outer Bladder line points echo the impact of points on the inner line by stimulating similar spinal nerves and cord segments.[3] In the case of BL 48, the inner line companion is the Back Shu point for the gallbladder (BL 19). Figure 7-99B exposes how prominent the liver remains at this level, though it does appear in the upcoming cross section for BL 20/BL 49. Figure 7-99A describes how the intercostal spaces angle downward laterally, which may mean that the actual cross section for BL 48 may be somewhere between Figure 7-99B and Figure 7-100B.

Vessels

- **10th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **10th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

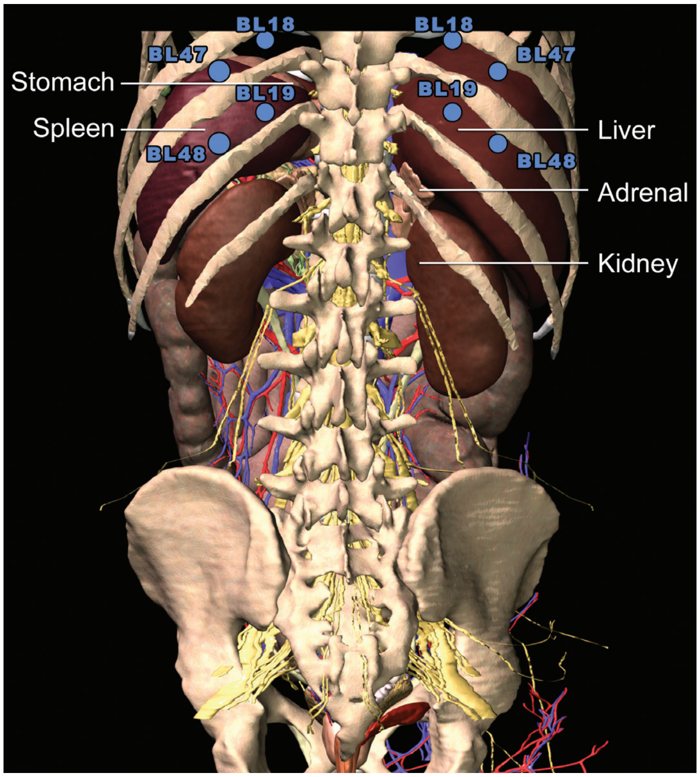


Figure 7-99A. BL 48, "Yang's Key Link", marks the level at which Back Shu points appear in cross section that relate to Yang (hollow) as opposed to Yin (solid) organs. Previously, the associated organs were all considered Yin: lung, pericardium, heart, and liver. Now, BL 48 partners with BL 19, affiliated with the gallbladder. Upcoming Yang Back Shu associations include the stomach (BL 21), the triple heater (BL 22), the large intestine (BL 25), the small intestine (BL 27), and the urinary bladder (BL 28).

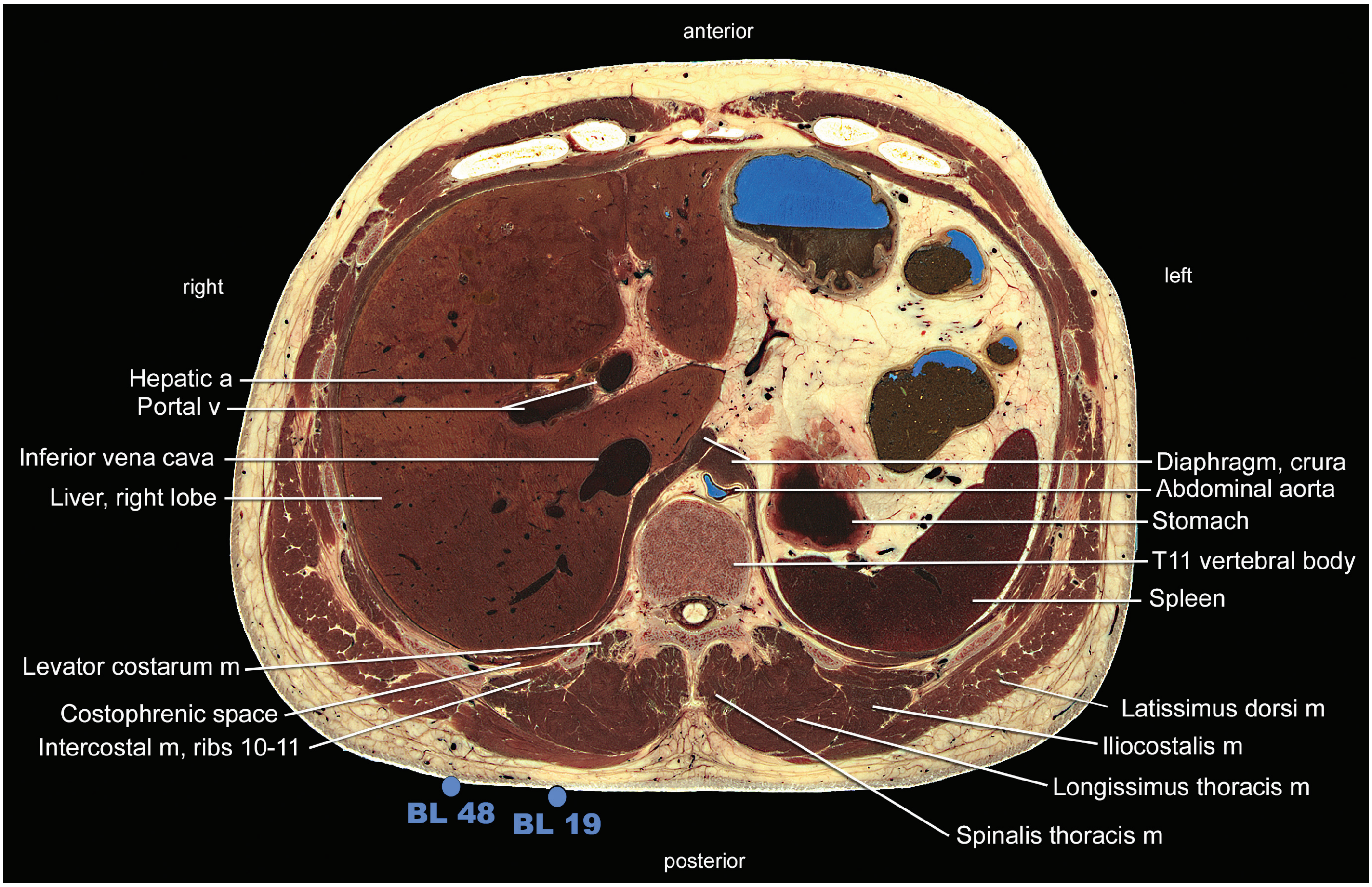

anterior
right
left
Hepatic a
Portal v
Inferior vena cava
Liver, right lobe
Diaphragm, crura
Abdominal aorta
Stomach
T11 vertebral body
Spleen
Levator costarum m
Costophrenic space
Intercostal m, ribs 10-11
Latissimus dorsi m
Iliocostalis m
Longissimus thoracis m
Spinalis thoracis m
BL 48
BL 19
posterior

Figure 7-99B. This cross section illustrates how the tissue deep to BL 48 has thinned in comparison with more cranial levels and how deep needling may affect the liver.

Clinical Relevance: Neuromodulation at BL 48 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation.

Indications and Potential Point Combinations

- **Back pain:** BL 48 if tender, along with other trigger points and BL points related to somatic dysfunction in a spinal segmental manner, accounting for the multisegmental input of nociceptive signals. BL 40, BL 60, and/or ST 36 as strong distal points.
- **Liver and/or gallbladder dysfunction:** BL 48, BL 19, BL 18, GV 24, LR 14, ST 36, LR 3.
- **Jaundice:** BL 48.[4]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
3. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
4. Wu XD and Huang LX. Discussion on the citation of acu-moxibustion treatment verses in textbook acupuncturology. *Zhen Ci Yan Jiu.* 2008;33(4):272-276.

BL 49

Yi She "Abode of Thought" or "Reflection Abode"

On the lateral border of the erector spinae muscle column in the 11th (last) intercostal space, shared by BL 20.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (iliocostalis thoracis):** Acting unilaterally, the iliocostalis sidebends the vertebral column; acting bilaterally, it extends the spine.

Clinical Relevance: Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 49 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as visceral in origin. Serratus posterior inferior trigger points produce pain in the BL 47 to BL 51 region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T6-T11 spinal nerves:** Dorsal ramus innervates skin, bones, joints, and erector spinae at this level. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: BL 49 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[1]

The outer Bladder line points echo the impact of points on the inner line by stimulating similar spinal nerves and cord segments.[2] In the case of BL 49, the inner line companion is the Back Shu point for the spleen (BL 20).

Vessels

- **11th posterior intercostal artery:** Arises from the thoracic aorta. Provides branches that supply dorsal ramus of the spinal nerve, spinal cord, vertebral column, back muscles, and skin. Anastomoses anteriorly with the anterior intercostal artery to supply the intercostal muscles, overlying skin, and parietal pleura.
- **11th posterior intercostal vein:** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygous venous system, which conveys venous blood to the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Neuromodulation at BL 49 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation.

Indications and Potential Point Combinations

- **Emotional disturbance, mental fatigue:** BL 49, HT 3, GV 20, ST 36.
- **Abdominal distension, diarrhea, intestinal discomfort:** BL 49, BL 20, BL 21, CV 12, ST 36, SP 6.
- **Back pain:** BL 49 if tender, BL 23, BL 25, GV 4, GB 30, BL 40, BL 60.
- **Vomiting:** BL 49[3], ST 39, PC 6, CV 12.

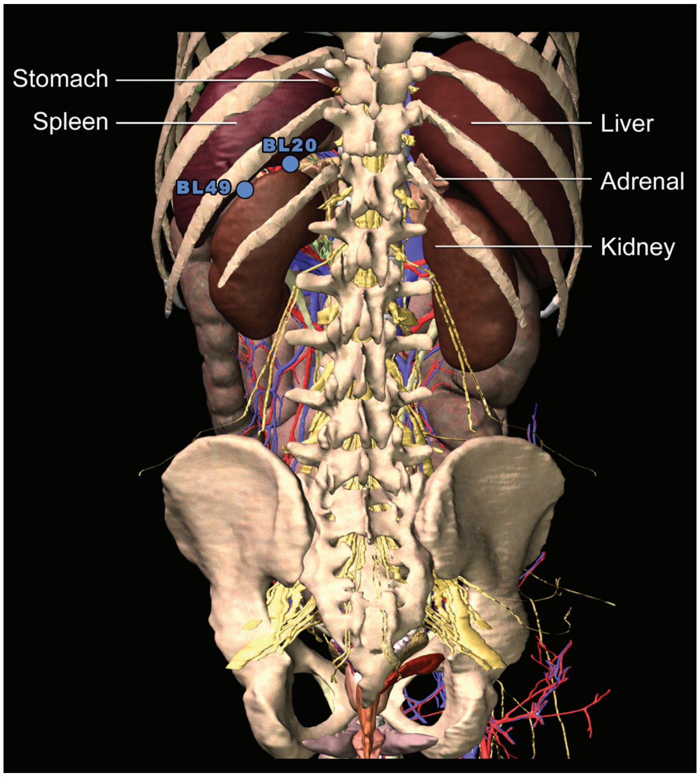


Figure 7-100A. Both BL 49 and BL 20 relate to the horizontal plane of the spleen organ, shown here. As with other outer BL line points, the function of BL 49 pertains to the mental or "psychic" functions affiliated with the organ of the partner Back Shu point. For BL 49, the emotional-mental state assigned to the spleen is "thoughtful reflection", explaining the name, "Abode of Thought" or "Reflection Abode". From a modern medical perspective, patients with splenic disorders may report fatigue and difficulty thinking clearly due to secondary anemia.

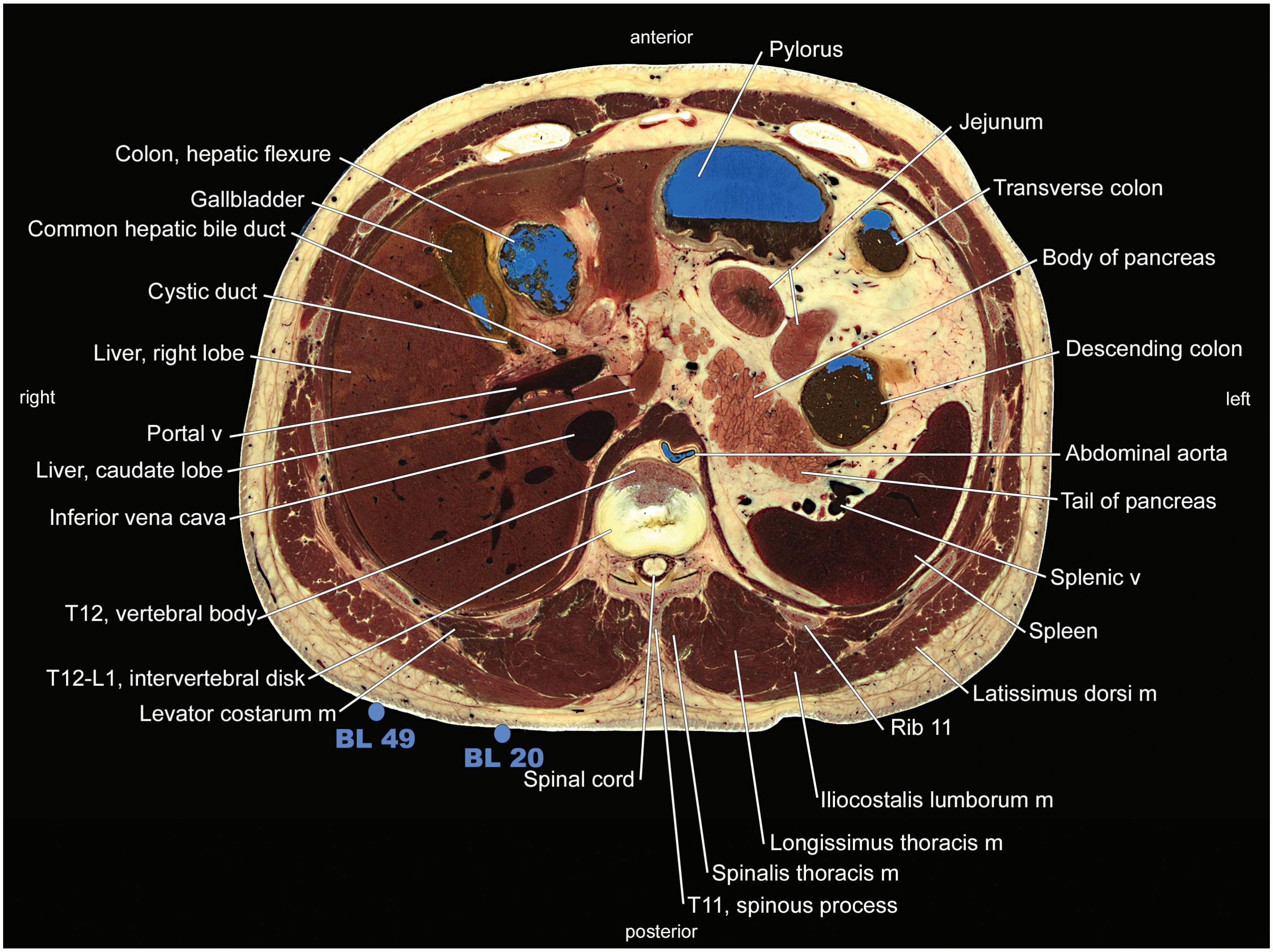

anterior
Pylorus
Jejunum
Colon, hepatic flexure
Transverse colon
Gallbladder
Common hepatic bile duct
Body of pancreas
Cystic duct
Descending colon
Liver, right lobe
right
left
Portal v
Abdominal aorta
Liver, caudate lobe
Tail of pancreas
Inferior vena cava
Splenic v
T12, vertebral body
Spleen
T12-L1, intervertebral disk
Latissimus dorsi m
Levator costarum m
Rib 11
BL 49
BL 20
Spinal cord
Iliocostalis lumborum m
Longissimus thoracis m
Spinalis thoracis m
T11, spinous process
posterior

Figure 7-100B. The cross-section shown here portrays the relationship implied in Chinese medicine that attributes activities of the pancreas to those of the spleen. For example, the metaphorical syndrome of "Spleen Deficiency Diarrhea" describes loose stools with undigested food or watery stool. In modern medicine, these signs pertain to diarrhea from *pancreatic* insufficiency.

References

1. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
2. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.
3. Wu XD and Huang LX. Discussion on the citation of acu-moxibustion treatment verses in textbook acupuncturology. *Zhen Ci Yan Jiu.* 2008;33(4):272-276.

BL 50

Wei Cang "Stomach Granary"

On the lateral border of the erector spinae muscle column behind the last rib.

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (iliocostalis):** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 50 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as visceral in origin. Serratus posterior inferior trigger points produce pain in the BL 47 to BL 51 region. Quadratus lumborum trigger points near BL 50 refer pain just lateral and caudal to the iliac crest. Pain may extend to the ventral iliac crest, and inguinal canal, and the caudolateral abdomen. Some pain from a BL 50 trigger point in the quadratus lumborum muscle refers to the ipsilateral sacroiliac region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T7-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.

Clinical Relevance: BL 50 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[1]

The outer Bladder line points echo the impact of points on the inner line by stimulating similar spinal nerves and cord segments.[2] In the case of BL 50, the inner line companion is the Back Shu point for the stomach (BL 21).

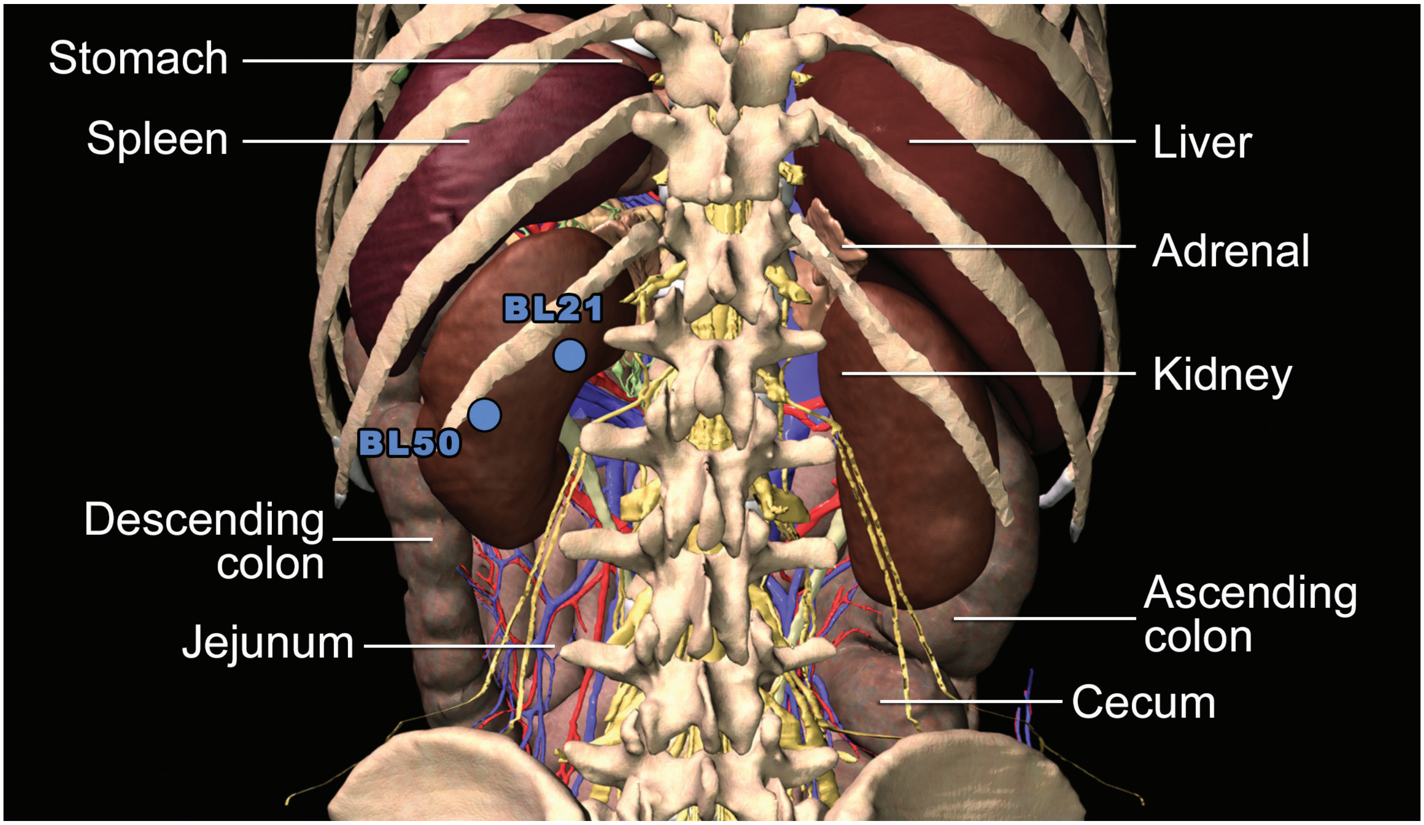


Figure 7-101A. A "granary" stores food, mostly grain, which formed the basis for the Chinese people's subsistence. As the "Stomach Granary", BL 50 acted on food taken in by the stomach. This organ-layer depiction reveals a collection of digestive organs in the vicinity of BL 50 except for the stomach, found several levels up. Neuroanatomically, however, nerves emitted from T12 supply the stomach, supporting a somatovisceral connection.

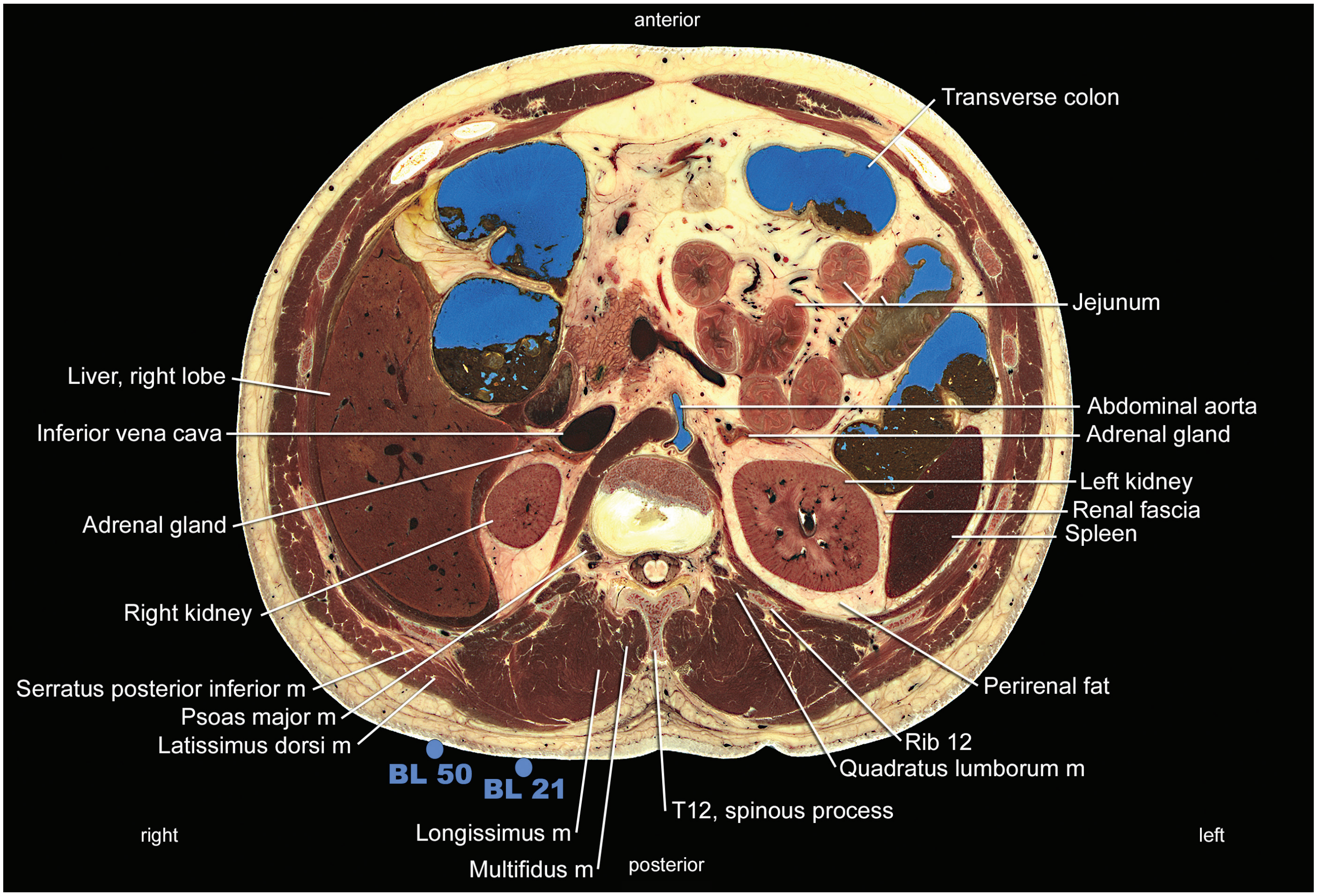

anterior
Transverse colon
Jejunum
Abdominal aorta
Adrenal gland
Left kidney
Renal fascia
Spleen
Liver, right lobe
Inferior vena cava
Adrenal gland
Right kidney
Serratus posterior inferior m
Psoas major m
Latissimus dorsi m
Perirenal fat
Rib 12
Quadratus lumborum m
BL 50
BL 21
T12, spinous process
right
Longissimus m
left
Multifidus m
posterior

Figure 7-101B. This image is one of the few cross-sections to display the serratus posterior inferior muscle, albeit appearing here only as a sliver.

Vessels

- **12th posterior intercostal artery (subcostal artery):** Arises from the thoracic aorta. Supplies the muscles of the anterolateral abdominal wall.
- **12th posterior intercostal vein (subcostal vein):** Posterior intercostal veins anastomose with anterior intercostal veins, which are tributaries of the internal thoracic veins. Most posterior intercostal veins terminate in the azygos venous system, which conveys venous blood to the superior vena cava. The azygos vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Neuromodulation at BL 50 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation.

Indications and Potential Point Combinations

- **Abdominal pain or distension, nausea, vomiting, constipation:** BL 50, BL 21, ST 36, PC 6.
- **Back pain:** BL 50, other points related to the somatic dysfunction in terms of myofascial trigger points, spinal segments supplying the painful region (BL points), GV and Huatuojiaji (1/2 cun from the midline) points for spine-based pain.

References

1. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
2. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.

BL 51

Huang Men "Vitals Gate"

Below the thoracolumbar junction, at the lateral border of the iliocostalis muscle, level with BL 22 and the caudal aspect of the L1 spinous process.

CAUTION: Avoid deep needling that may injure internal organs.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure.
- **Lumbar interfascial triangle (LIFT):** The LIFT appears in Figure 7-102B. This fat-filled space, situated along the lateral margin of the paraspinal muscles from rib 12 to the iliac crest, forms from the ventral and dorsal laminae of the transversus abdominis and internal oblique aponeurosis where they become continuous with the paraspinal rectal sheath. As such, the LIFT comprises several fascial sheaths that come together at the lateral border of the thoracolumbar fascia. The lateral raphe represents the thickened complex of dense connective tissue formed at this lateral border of the thoracolumbar fascia that contains the LIFT. It occupies the site where the myofascial layers of the abdominal wall meet and join with the paraspinal rectal sheath.[1] This ridged-union juncture of connective tissue brings together fascial contributions from the ventrolateral abdominal wall, the superficial and deep layers of back musculature, and aspects of the gluteal region. Thus, forces tugging on the LIFT from one direction can distribute across several structures, thereby limiting injury to one site. The LIFT may also accommodate lateral expansion of the erector spinae during contraction or act as a fulcrum to distribute tension.
- **Clinical Relevance:** Excess tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[2] The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[3,4]

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Serratus posterior inferior muscle:** By attaching near the angles of the inferior three or four ribs, this muscle depresses the inferior ribs, preventing them from being pulled superiorly by the action of the diaphragm.
- **Erector spinae muscles (iliocostalis, specifically):** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Referred pain from BL 51 that reaches around the trunk could cause diagnostic confusion and cause some to interpret myofascial referred pain as visceral in origin. Serratus posterior inferior trigger points produce pain in the BL 47 to BL 51 region. Quadratus lumborum trigger points near BL 51 refer pain just lateral and caudal to the iliac crest. Pain may extend to the ventral iliac crest, and inguinal canal, and the caudolateral abdomen. Some pain from a BL 51 trigger point in the quadratus lumborum muscle will refer to the ipsilateral sacroiliac region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T8-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus

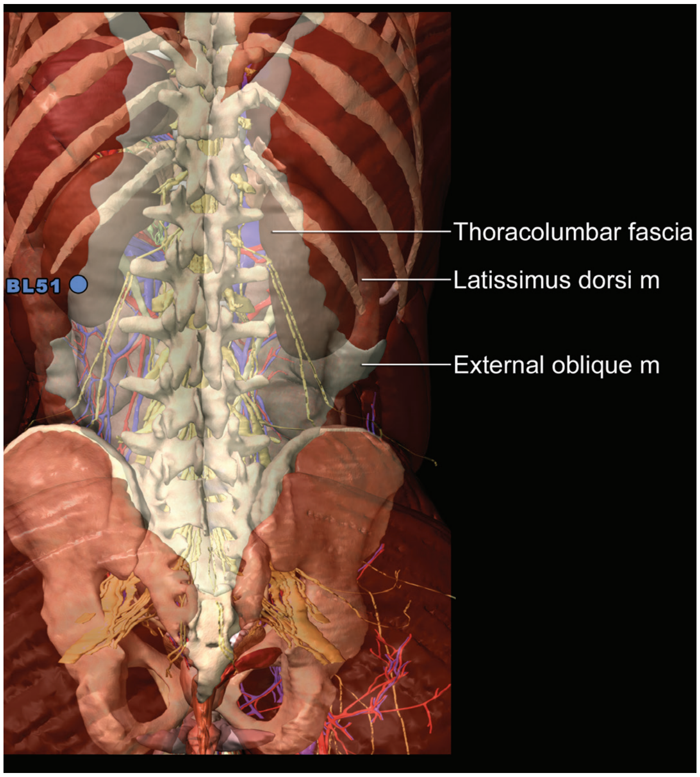


Figure 7-102A. BL 51, "Vitals Gate" describes the low back region ruled by the kidneys, which in Chinese medicine house the vital essence. The kidneys become visible here through the semi-transparent muscle layer.

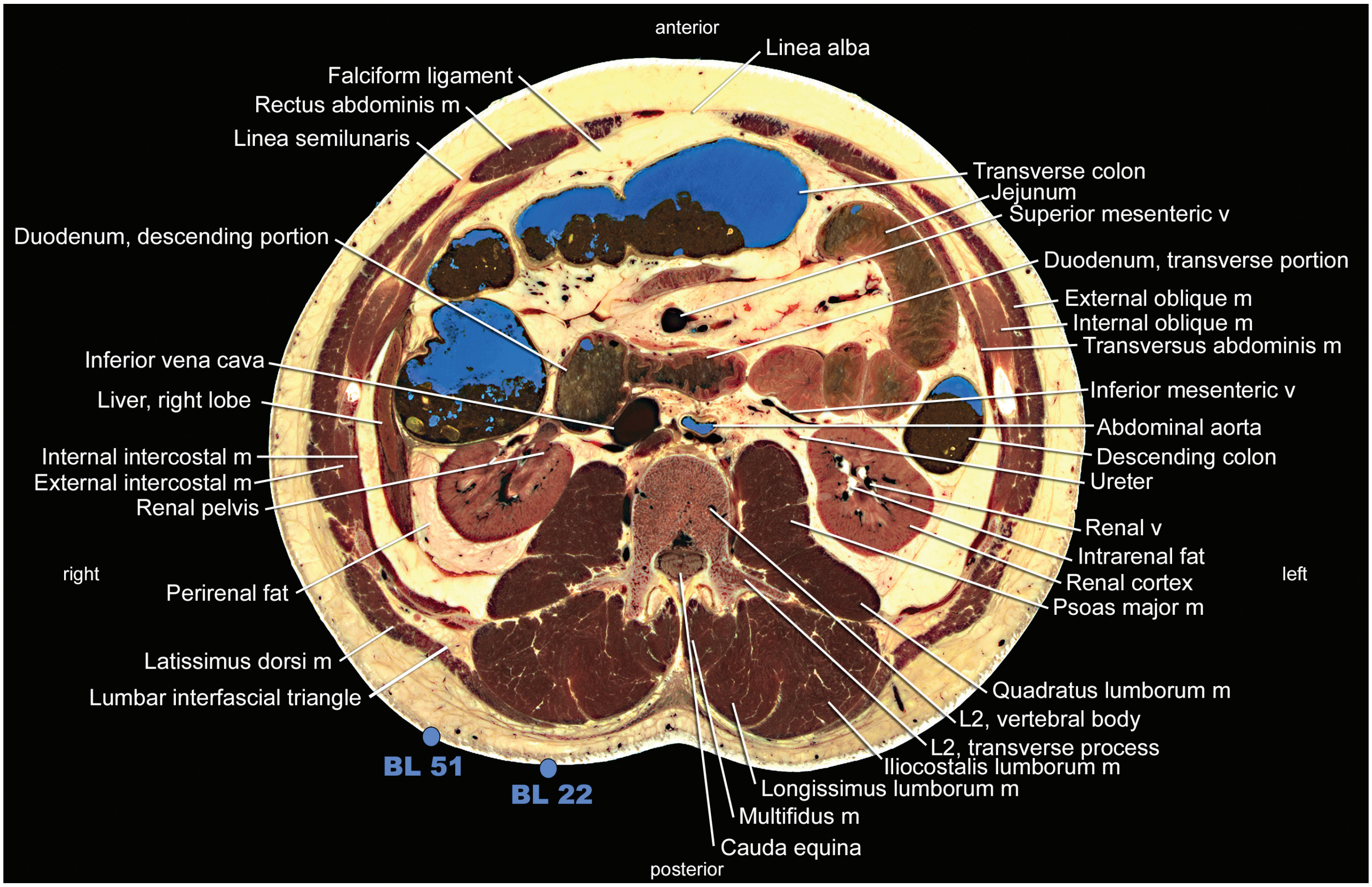

anterior
Linea alba
Falciform ligament
Rectus abdominis m
Linea semilunaris
Transverse colon
Jejunum
Superior mesenteric v
Duodenum, descending portion
Duodenum, transverse portion
External oblique m
Internal oblique m
Transversus abdominis m
Inferior vena cava
Liver, right lobe
Inferior mesenteric v
Abdominal aorta
Internal intercostal m
External intercostal m
Renal pelvis
Descending colon
Ureter
Renal v
Intrarenal fat
right
left
Perirenal fat
Renal cortex
Psoas major m
Latissimus dorsi m
Lumbar interfascial triangle
Quadratus lumborum m
L2, vertebral body
L2, transverse process
Iliocostalis lumborum m
BL 51
BL 22
Longissimus lumborum m
Multifidus m
Cauda equina
posterior

Figure 7-102B. Note the difference in structures affected by a needle entering BL 51 versus BL 22. Deep to the latissimus dorsi, the lumbar interfascial triangle (LIFT) becomes the next obvious target for BL 51. Treating this region may help dissipate tension held within the various thoracolumbar fascial layers.

provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[5]

Clinical Relevance: BL 51 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[6] Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

The outer Bladder line points echo the impact of points on the inner line by stimulating similar spinal nerves and cord segments.[7] In the case of BL 51, the inner line companion is the Back Shu point for the “triple heater” (BL 22). The endocrine organ associated with this point is the adrenal gland, supplied by T5 through T11.

Vessels

- **1st lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar psoas major muscle, psoas minor muscle, quadratus lumborum muscle, spinal cord and vertebral column, deep back muscles. The first lumbar may give rise to the inferior phrenic or middle suprarenal arteries. On occasion, one of the lumbar arteries provides the gonadal artery. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.
- **1st lumbar vein:** The lumbar veins accompany the lumbar arteries and drain blood from the posterior body wall and the lumbar vertebral venous plexuses. The first and second lumbar veins drain into the ascending lumbar vein. The ascending lumbar veins feed into the azygous venous system. The lumbar veins communicate with the epidural venous plexus within the vertebral column.

Clinical Relevance: Neuromodulation at BL 51 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation. In this case, the organs affected include the adrenal gland and kidney.

Indications and Potential Point Combinations

- **Constipation:** BL 51, BL 52, ST 36.
- **Adrenal problems:** BL 51, BL 22, GV 20.

References

1. Schuenke MD, Vleeming A, Van Hoof T, et al. A description of the lumbar interfascial triangle and its relation with the lateral raphe: anatomical constituents of load transfer through the lateral margin of the thoracolumbar fascia. *J Anat*. 2012;221:568-576.
2. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech*. 2013;26(4):E124-E129.
3. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
4. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat*. 2012;221(6):507-536.
5. Lierse W. Blood vessels and nerves of the human penis. *Urol Int*. 1982;37:145-151.
6. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine*. 2012;37(14):E817-E822.
7. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy*. 2009;8:32-35.

BL 52

Zhi Shi "Residence of the Will", "Will Chamber", Huang Men "Vitals Gate"

Below the thoracolumbar junction, at the lateral border of the iliocostalis muscle, level with BL 23 and the caudal aspect of the L2 spinous process. Another method of finding BL 52 first requires finding the caudal limit of the costal arch, then moving toward the spine in a perpendicular direction. This finds the L2/L3 interspace. BL 52 is located at the lateral border of the iliocostalis at this level.

CAUTION: Needle carefully to avoid organ puncture.

Connective Tissues

- **Thoracolumbar fascia:** Encloses the deep back muscles. Coordinates actions of the muscles of the back and maintains spinal integrity. Comprises a multi-layered, complex, connective tissue structure.
- **Lumbar interfascial triangle (LIFT):** The LIFT appears in Figure 7-103B. This fat-filled space, situated along the lateral margin of the paraspinal muscles from rib 12 to the iliac crest, forms from the ventral and dorsal laminae of the transversus abdominis and internal oblique aponeurosis where they become continuous with the paraspinal rectal sheath.[3] As such, the LIFT comprises several fascial sheaths that come together at the lateral border of the thoracolumbar fascia. The lateral raphe represents the thickened complex of dense connective tissue formed at this lateral border of the thoracolumbar fascia that contains the LIFT. It occupies the site where the myofascial layers of the abdominal wall meet and join with the paraspinal rectal sheath. This ridged-union juncture of connective tissue brings together fascial contributions from the ventrolateral abdominal wall, the superficial and deep layers of back musculature, and aspects of the gluteal region. As a result, forces tugging on the LIFT from one direction can distribute across several structures, thereby limiting injury to one site. The LIFT may also accommodate lateral expansion of the erector spinae during contraction or act as a fulcrum to distribute tension.

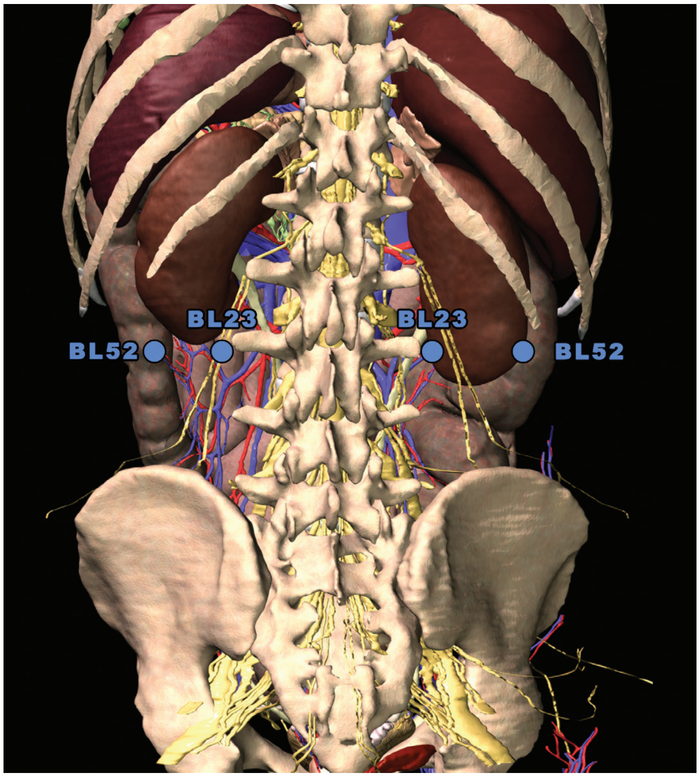


Figure 7-103A. BL 52, "Residence of the Will", speaks to locus of mental-emotional aspects attributed to the kidney that Chinese medicine describe as willpower, decision making, and standing firm for one's convictions. In modern parlance, BL 52 would help someone "have a backbone" when confronting adversaries. Anatomically, BL 52 and its partner, BL 23, enclose the kidneys. The right kidney sits lower than the left due to the presence of the liver.

Clinical Relevance: Excess tension and strain held within the thoracolumbar fascia compresses the structures embraced by it; namely, muscles, nerves, vessels, and lymphatic pathways. Disintegration of thoracolumbar fascial anatomy as can happen with adjacent vertebral segment disease, appears on magnetic resonance imaging as "sagging posterior layer thoracolumbar fascia".[4] The thoracolumbar fascia aids in stabilizing the lumbar spine by modulating forces generated by its various attachments. It may also aid in proprioception of the back through signals sent by its own free nerve endings and mechanoreceptor signals or by means of its connections with the serratus posterior inferior and other muscles conferring information about posture and position of the spine in space.[5,6]

Muscles

- **Latissimus dorsi muscle:** Extends, adducts, medially rotates humerus.
- **Erector spinae muscles (iliocostalis, specifically):** Acting unilaterally, they laterally bend the vertebral column; acting bilaterally, they extend the head and vertebral column.
- **Quadratus lumborum muscle:** Laterally flexes and extends the vertebral column. Stabilizes the 12th rib during inspiration.

Clinical Relevance: Iliocostalis trigger points in this region typically refer along the BL channel, around the trunk in a quasi-dermatomal fashion, or lead to pain on the ventral thorax or abdomen in paramedian locations. Quadratus lumborum trigger points near BL 52 refer pain just lateral and caudal to the iliac crest. Pain may extend to the ventral iliac crest, and inguinal canal, and the caudolateral abdomen. Some pain from a BL 52 trigger point in the quadratus lumborum muscle will refer to the ipsilateral sacroiliac region.

Nerves

- **Thoracodorsal nerve (C6, C7, C8):** Innervates the latissimus dorsi muscle.
- **T8-T11 spinal nerves, plus the T12 spinal nerve (subcostal nerve):** Dorsal ramus innervates skin, bones, joints, muscles of the back. Ventral ramus forms intercostal nerves; rami communicantes connect each intercostal nerve to an ipsilateral sympathetic trunk, from which fibers will travel to regional blood vessels, sweat glands, and smooth muscle.
- **L1 spinal nerve:** Dorsal ramus innervates intrinsic muscles of

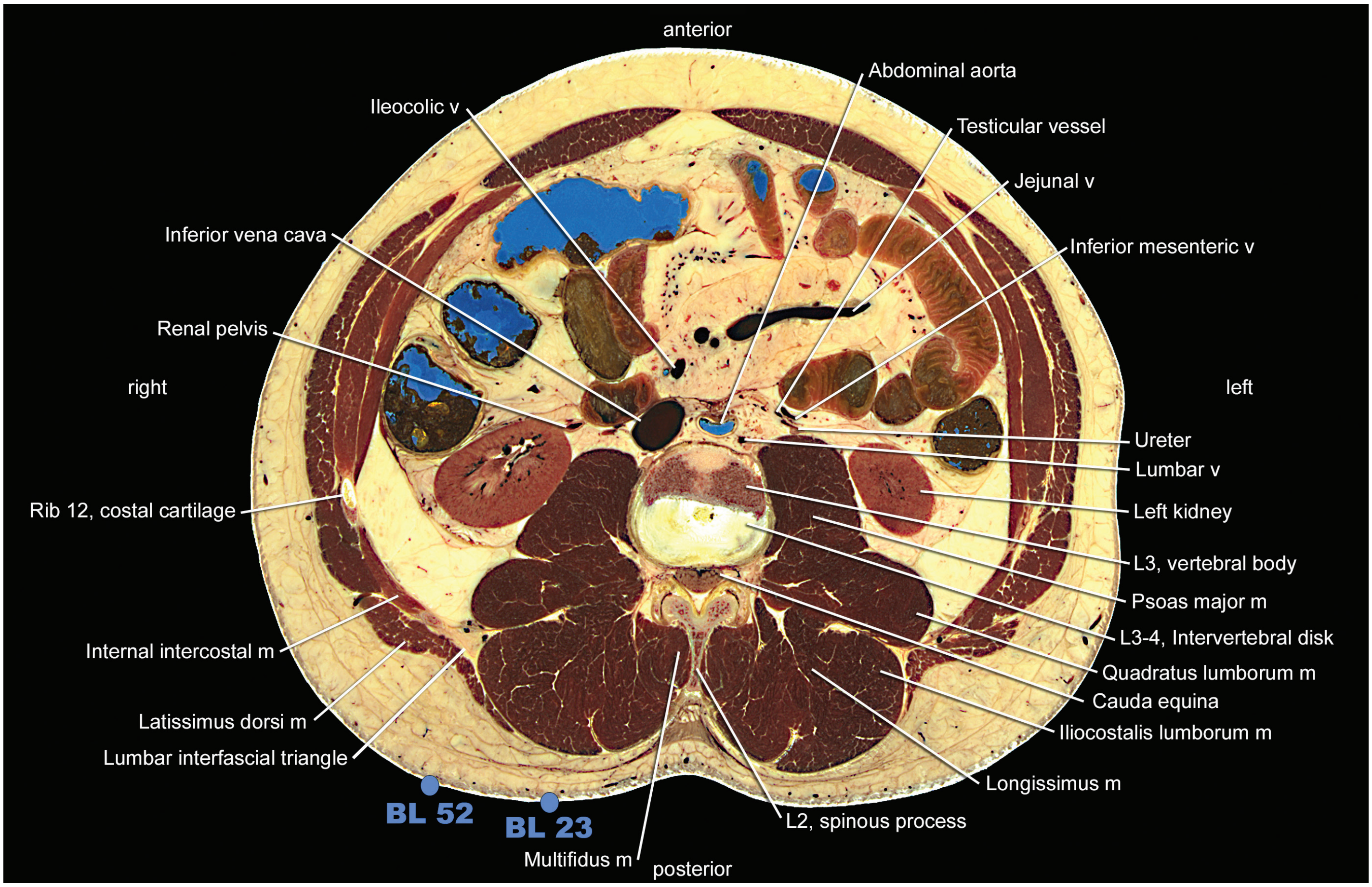

anterior
Abdominal aorta
Ileocolic v
Testicular vessel
Jejunal v
Inferior vena cava
Inferior mesenteric v
Renal pelvis
right
left
Ureter
Lumbar v
Rib 12, costal cartilage
Left kidney
L3, vertebral body
Psoas major m
L3-4, Intervertebral disk
Internal intercostal m
Quadratus lumborum m
Cauda equina
Latissimus dorsi m
Iliocostalis lumborum m
Lumbar interfascial triangle
Longissimus m
BL 52
BL 23
L2, spinous process
Multifidus m
posterior

Figure 7-103B. The latissimus dorsi muscle and lumbar interfascial triangle (LIFT) are obvious targets for BL 52.

the back and the skin adjacent to the vertebral column. Ventral ramus innervates the psoas muscle. The L1 ventral ramus provides the ilioinguinal and iliohypogastric nerves, which supply the skin of the suprapubic and inguinal regions, the superolateral quadrant of the buttock, and provides branches to the abdominal musculature. L1 is part of the lumbar plexus of nerves (composed of the ventral rami of the L1 through L4 nerves). In combination with L2, L1 gives rise to the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia. Sympathetic fibers that arise from the T12-L1 spinal cord segments course through the hypogastric plexus; ganglia of this plexus play an important role in ejaculation, as T12-L1 supplies innervation to the penis.[7]

- **L2 spinal nerve:** Dorsal ramus innervates intrinsic muscles of the back and the skin adjacent to the vertebral column. L2 (with L3 and L4) give rise to the obturator, femoral, and anterior femoral cutaneous nerves. The obturator nerve supplies the adductor muscles. The femoral nerve innervates the iliacus muscle, as well as the hip flexors and knee extensors. L2 and L1 comprise the genitofemoral nerve, which supplies the skin over the femoral triangle and the scrotum or the labia majora. The anterior femoral cutaneous nerve supplies the skin on the medial and anterior aspects of the thigh. The combination of L2 and L3 produce the lateral femoral cutaneous nerve, which supplies the skin on the anterolateral surface of the thigh. The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.

Clinical Relevance: BL 52 continues the outer BL line on the torso. The difference between the inner and outer BL channel relates to the spinal nerve branches associated with the point. That is, the outer line points associate more closely with the ventral ramus of a given spinal cord segment while the inner line points adhere to the dorsal ramus, lateral branch. These access sites for neuromodulation also represent locations where spinal nerve branches can experience entrapment and lead to back pain as nerves migrating through layers of muscle and blankets of fascia become compressed.[8] Nerves traversing this muscular region run the risk of entrapment and irritation. The risk increases as erector spinae bulk grows in size and strength. Acupuncture, massage, and laser therapy relax the myofascia and free the nerves from their oppressive compression.

The outer Bladder line points echo the impact of points on the inner line by stimulating similar spinal nerves and cord segments.[9] In the case of BL 52, the inner line companion is the Back Shu point for the kidney (BL 23). The kidney receives autonomic fibers from T10-L2; BL 23 and BL 52 live at the L2 dermatome.

Vessels

- **2nd lumbar artery:** One of four or five pairs of arteries that originate in the abdominal aorta and supply the lumbar vertebrae and the back muscles and abdominal wall. On occasion, one of the lumbar arteries provides the gonadal artery. The lumbar arteries supply part of the spinal cord, the vertebral body, and vertebral end plate. The lumbar arteries anastomose with the lower intercostal, the subcostal, the iliolumbar, the deep iliac circumflex, and the inferior epigastric arteries.

- **2nd lumbar vein:** The lumbar veins accompany the lumbar arteries and drain the posterior body wall and the lumbar vertebral venous plexuses. The first and second lumbar veins drain into the ascending lumbar vein. The ascending lumbar veins become the azygous venous system. The lumbar veins communicate with the epidural venous plexus inside the vertebral column.

Clinical Relevance: Neuromodulation at BL 52 may improve circulation to and from structures of the back, frequently afflicted with pain and tension. Acupuncture, laser therapy, and massage benefit blood flow and venous return, which supports soft tissue health and restoration. One can also consider the impact of spinal segmental neuromodulation on circulation to internal organs supplied by the same spinal segments; improving blood flow to and from the associated viscera through sympathetic neuromodulation. In this case, the organs affected include the adrenal gland and kidney.

Indications and Potential Point Combinations

- **Back pain or stiffness:** BL 52, BL 23, GV 4, other trigger points or points related to the somatic dysfunction or spinal segmental facilitation.
- **Lack of willpower and ambition:** BL 52, BL 23, GV 4, ST 36, LI 4, GV 20.
- **Kidney disorders:** BL 52, BL 23, GV 4, BL 22, KI 3.

Evidence-Based Applications

- A case series indicated that point injection at BL 23, BL 24, and BL 52 alleviated or improved **nephritic colic.**[1]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[2]

References

1. Li W, Liu W, and Jiang H. Point injection for treating nephritic colic in 101 cases. *Journalm of Traditional Chinese Medicine.* 2003;23(3):199-200.
2. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.
3. Schuenke MD, Vleeming A, Van Hoof T, et al. A description of the lumbar interfascial triangle and its relation with the lateral raphe: anatomical constituents of load transfer through the lateral margin of the thoracolumbar fascia. *J Anat.* 2012;221:568-576.
4. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-E129.
5. Loukas M, Shoja MM, Thurston T, et al. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008;30:125-129
6. Willard FH, Vleeming A, Schuenke MD, et al. The thoracolumbar fascia: anatomy, function and clinical considerations. *J Anat.* 2012;221(6):507-536.
7. Lierse W. Blood vessels and nerves of the human penis. *Urol Int.* 1982;37:145-151.
8. Ishizuka K, Sakai H, Tsuzuki N, et al. Topographic anatomy of the posterior ramus of thoracic spinal nerve and surrounding structures. *Spine.* 2012;37(14):E817-E822.
9. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.

BL 53

Bao Huang “Bladder’s Vital Centers”

On the gluteal region, 3 cun lateral to the midline, level with S2 and the 2nd sacral foramen. Along the same horizontal line as BL 28, BL 32, and the posterior superior iliac spine.[1] Along the same vertical line described by the lateral border of the erector spinae muscle column.

Muscles

- **Gluteus maximus muscle:** Extends the thigh (especially when the thigh is flexed). Assists in lateral rotation of the thigh. Steadies the thigh and helps one rise from a sitting position. Pain from trigger points in the gluteus maximus muscle worsens in cold water and with swimming, earning the muscle the name of “swimmer’s nemesis.”
- **Gluteus medius muscle:** Acts in concert with the gluteus minimus muscle to abduct the thigh. Both muscles serve to support the weight of the body on one limb; in conjunction with the tensor fasciae latae muscle, the gluteus medius and minimus support the position of the pelvis in neutral. With a flexed hip, the gluteus medius and minimus internally rotate the thigh, whereas with an extended hip, they externally rotate it.

Clinical Relevance: A trigger point at or near BL 53 in the gluteus maximus muscle refers pain to the sacroiliac joint and then to the transverse gluteal crease to the hip and proximal thigh. Referred pain from gluteus medius trigger points in the vicinity of BL 53 extends strongly to the dorsal iliac crest to the sacroiliac joint and the general gluteal region. A gluteus medius trigger point on the dorsolateral iliac crest sends pain to the dorsolateral buttock and thigh.

Nerves

- **Superior cluneal nerve (L1-L3):** Supplies the skin of the buttock region.
- **Middle cluneal nerves (S1-S3):** Supplies the skin of the buttock region.
- **Superior gluteal nerve (L4-S1; sometimes includes S2):** Supplies the gluteus medius and minimus muscles. Also innervates the tensor fasciae latae muscle.
- **Inferior gluteal n. (L5-S2):** Innervates the gluteus maximus muscle.

Clinical Relevance: Entrapment of the superior gluteal nerve causes weakness of the gluteus medius and minimus muscles, as well as the tensor fasciae latae muscle. A characteristic gait disturbance follows, known as the Trendelenburg gait. The “positive Trendelenburg sign” occurs during the swing phase of the normal, unsupported limb, in which case the pelvis drops on the side with the injured nerve.

Patients with compression of the superior gluteal nerve typically complain of spontaneous gluteal pain, tenderness to palpation of the cranial gluteal region near the greater sciatic notch, and weakness when abducting the lower limb.[2] Piriformis muscle tension and hypertrophy run the risk of compressing the superior gluteal nerve as it traverses the suprapiriformis canal, leading to superior gluteal neuropathy. While surgical transection of the piriformis muscle has been reported to alleviate symptoms and signs of superior gluteal nerve entrapment, neuromodulation

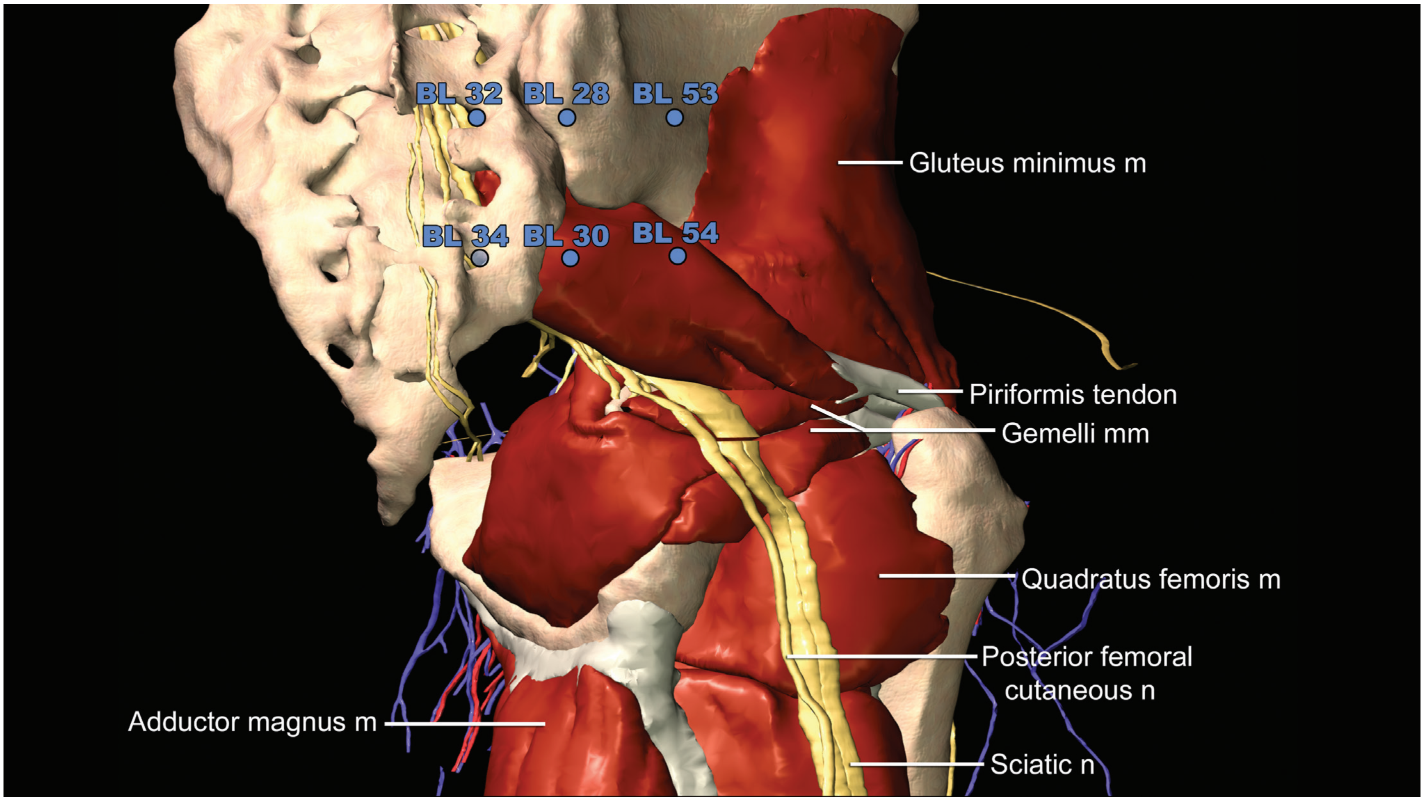


Figure 7-104. BL 53, “Bladder’s Vital Centers” falls along the same horizontal line as two other points that connect with nerve segments affecting bladder function; i.e., BL 28 and BL 32. The neuroanatomic basis for the influence over pelvic organs pertains to the somatovisceral and viscerosomatic reflexes taking place in the spinal segments that supply BL 53, i.e., L1-S2. (Refer to nerve section above or spinal cord segmental origins.)

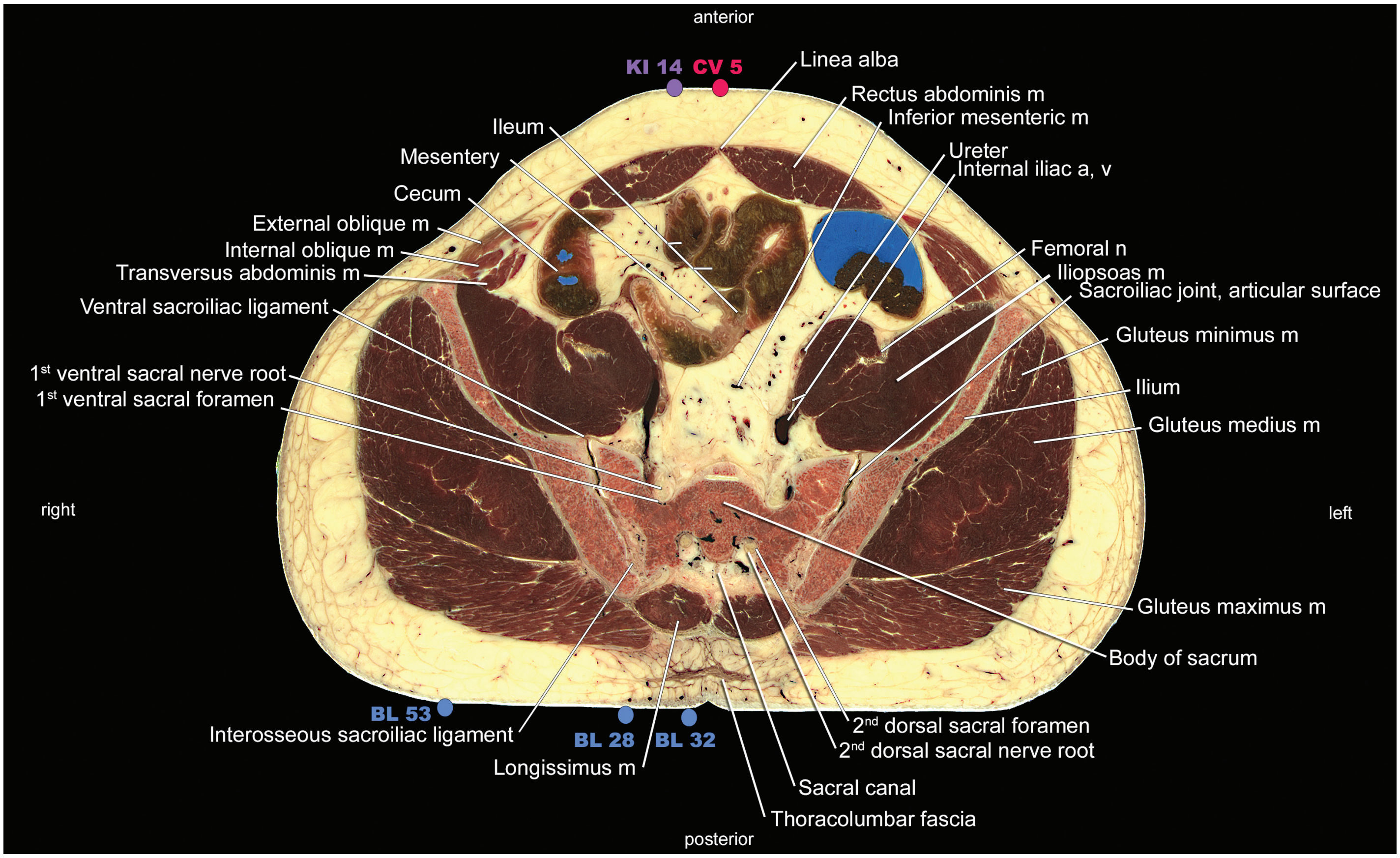

anterior
KI 14
CV 5
Linea alba
Rectus abdominis m
Inferior mesenteric m
Ileum
Ureter
Internal iliac a, v
Mesentery
Cecum
External oblique m
Internal oblique m
Transversus abdominis m
Femoral n
Iliopsoas m
Sacroiliac joint, articular surface
Ventral sacroiliac ligament
Gluteus minimus m
1st ventral sacral nerve root
1st ventral sacral foramen
Ilium
Gluteus medius m
right
left
Gluteus maximus m
Body of sacrum
BL 53
Interosseous sacroiliac ligament
BL 28
BL 32
Longissimus m
2nd dorsal sacral foramen
2nd dorsal sacral nerve root
Sacral canal
Thoracolumbar fascia
posterior

Figure 7-105. Beneath the large gluteus maximus muscle lurks the gluteus medius, called the "lumbago muscle". This cross section indicates the depth that an acupuncture needs to reach in order to deactivate trigger points in the gluteus medius muscle by way of BL 53.

with acupuncture and related techniques would be a preferred, non-invasive initial approach that allows patients to maintain functionality of muscles affecting hip motion and stabilization by leaving their attachments intact.

Middle cluneal nerve entrapment may cause low back pain, whether due to tension in the erector spinae group compressing the nerves or from gluteus maximus overload. Palpate for trigger points in the gluteus maximus, gluteus medius, and piriformis; deactivate accordingly.

Vessels

- **Superior gluteal artery:** Supplies the gluteus maximus, gluteus medius, and gluteus minimus muscles. Also supplies the tensor fasciae latae m.
- **Superior gluteal vein:** Accompanies the superior gluteal artery. Communicates with femoral vein tributaries to provide an alternate route for blood return from the pelvic limb (leg).

Clinical Relevance: The superior gluteal vessels course with the superior gluteal nerve; the venous network can surround the trunk of the superior gluteal nerve as it exits the pelvis by passing through the greater sciatic notch near BL 54. However, superior gluteal nerve entrapment is more commonly caused by internal iliac artery aneurysm.[3] Another source of vascular compromise involves an aponeurotic arch arising from the sacral attachment of the gluteus and piriformis muscles that may encircle the superficial branches of the superior gluteal artery.

Pelvic and acetabular fractures may injure the superior gluteal artery and its branches.[4] Blunt trauma to the gluteal region while the person sits in an active saddle position is at heightened risk of hemodynamic compromise and injury of the superior gluteal artery. Treatment with acupuncture, soft tissue manual therapy, and laser therapy support circulation, provide analgesia, and promote tissue recovery. As such, they are worthy of consideration early in these cases.

Indications and Potential Point Combinations

- **Painful or restricted hip motion, low back pain, local buttock pain, pain radiating to hip or to thighs and feet:** BL 53, consider piriformis dysfunction and trigger points, gluteus maximus trigger points, BL 54, GB 29, GB 30.
- **Abdominal distension, constipation:** BL 53, check for rectus abdominis trigger points in the KI 12, KI 13, ST 28, ST 29 that radiate in a band-like fashion to the back.
- **Voiding dysfunction:** BL 53, BL 28, BL 32, BL 39, CV 2, CV 3, KI 3, SP 6.

References

1. McGaugh JM, Brismee JM, Dedrick GS, et al. Comparing the anatomical consistency of the posterior superior iliac spine to the iliac crest as reference landmarks for the lumbopelvic spine: a retrospective radiological study. *Clinical Anatomy.* 2007;20:819-825.
2. Diop M, Parratte B, Tatu L, et al. Anatomical bases of superior gluteal nerve entrapment syndrome in the suprapiriformis foramen. *Surg Radiol Anat.* 2002;24:155-159.
3. Diop M, Parratte B, Tatu L, et al. Anatomical bases of superior gluteal nerve entrapment syndrome in the suprapiriformis foramen. *Surg Radiol Anat.* 2002;24:155-159.
4. Lee M, Haene RA, Fonseka S, et al. Superior gluteal artery rupture assoiated with an isolated fracture of the sacrum. Injury, *Int J Care Injured.* 2011;42:719-721.

BL 54

Zhi Bian "Sequential Limit"

On the gluteal region, 3 cun lateral to the sacrococcygeal hiatus at the midline, or the 4th sacral foramen.

Directly caudal to BL 53, level with BL 30 and BL 34, as shown in Figure 7-104. BL 54 lands at the intersection of a vertical line described by the lateral border of the erector spinae muscle group and the horizontal line at the S4 foramen and the .

Muscles

- **Gluteus maximus muscle:** Extends the thigh (especially when the thigh is flexed). Assists in lateral rotation of the thigh. Steadies the thigh and helps one rise from a sitting position.
- **Gluteus medius muscle:** Acts in concert with the gluteus minimus muscle to abduct the thigh. Both muscles serve to support the weight of the body on one limb; in conjunction with the tensor fasciae latae muscle, the gluteus medius and minimus support the position of the pelvis in neutral standing. With a flexed hip, the gluteus medius and minimus internally rotate the thigh, whereas with an extended hip, they externally rotate it.
- **Piriformis muscle (superior margin):** Laterally rotates the extended thigh. Abducts the flexed thigh. Steadies the femoral head in the acetabulum. This so-called "double devil" can induce severe pain when shortened not only through its pain projections from myofascial trigger points but also by means of its capacity to entrap the sciatic nerve.

Clinical Relevance: Dry needling of piriformis trigger points can proffer significant relief of myofascial dysfunction in the gluteal region characterized by gluteal pain, sciatic neuropathy, and difficulty walking. Piriformis "syndrome" may mimic lumbosacral intervertebral disk disease signs. Prior to embarking on a surgical correction, it is wise to palpate for a myofascial source of nerve compression through which neuromodulation can alleviate pain and dysfunction without surgery. Piriformis trigger points at BL 54 cause pain strongly in the lateral buttock near the hip, leading to diagnostic confusion between myofascial dysfunction, hip pain/arthritis, and sciatica due to concomitant nerve compression. In 10% of humans, the fibular nerve portion of the sciatic nerve courses through the piriformis muscle, making entrapment even more likely.

Gluteus maximus trigger points near BL 54 may refer pain from the sacroiliac joint to the transverse gluteal crease.

Referred pain from gluteus medius trigger points in the vicinity of BL 54 extends strongly to the dorsal iliac crest to the sacroiliac joint and the general gluteal region. A gluteus medius trigger point on the dorsolateral iliac crest sends pain to the dorsolateral buttock and thigh.

Nerves

- **L1-L2 spinal cord segments:** The L1 and L2 spinal cord segments provide the sympathetic innervation for the remaining lumbar and sacral sympathetic ganglia.
- **Superior cluneal nerve (L1-L3):** Supplies the skin of the buttock region.
- **Middle cluneal nerves (S1-S3):** Supplies the skin of the buttock region.
- **Superior gluteal nerve (L4-S1):** Supplies the gluteus medius and minimus muscles. Also innervates the tensor fasciae latae muscle.
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.
- **Sciatic nerve (L4-S3):** Supplies no structures in the gluteal region, but does supply all of the leg and foot muscles, as well as the skin of the posterior thigh, most of the leg, and the skin of the foot. It comprises the tibial and common fibular (or common peroneal) nerves.

Clinical Relevance: Careful, in-depth myofascial palpation of the lumbar region, hip joint and surrounding structures, the sacrum, gluteal regions, and thigh help elucidate the source(s) of referred pain, joint discomfort, and enigmatic sensory changes. The number of nerves coursing through this site as well as the strength and size of the muscle tissue at and around BL 54 predisposes patients to disorders arising from nerve entrapment. Dry needling, soft tissue manual therapy, laser therapy, etc. constitute valuable avenues through which to free the nerves and relax the tissues.

Vessels

- **Inferior gluteal artery:** Supplies the gluteus maximus, obturator internus, and quadratus femoris muscles and the superior portions of the hamstring muscles.
- **Inferior gluteal vein:** Accompanies the inferior gluteal artery. Communicates with femoral vein tributaries to provide an alternate route for blood return from the leg.

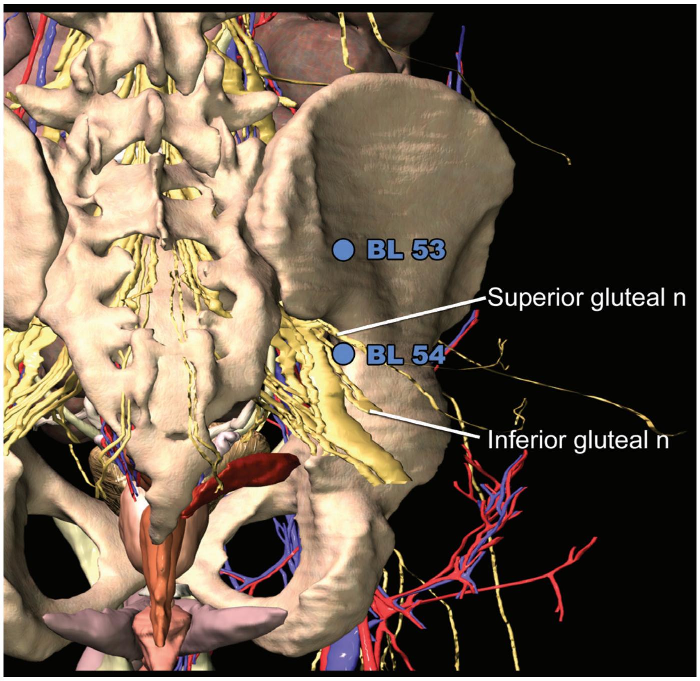


Figure 7-106. As the "Sequential Limit", BL 54 marks the caudal extent of the outer Bladder line. This neurovascular layer details the course of the superior and inferior gluteal nerves, both of which may suffer compression due to myofascial restriction or hypertrophy in the piriformis muscle, shown in Figure 7-104.

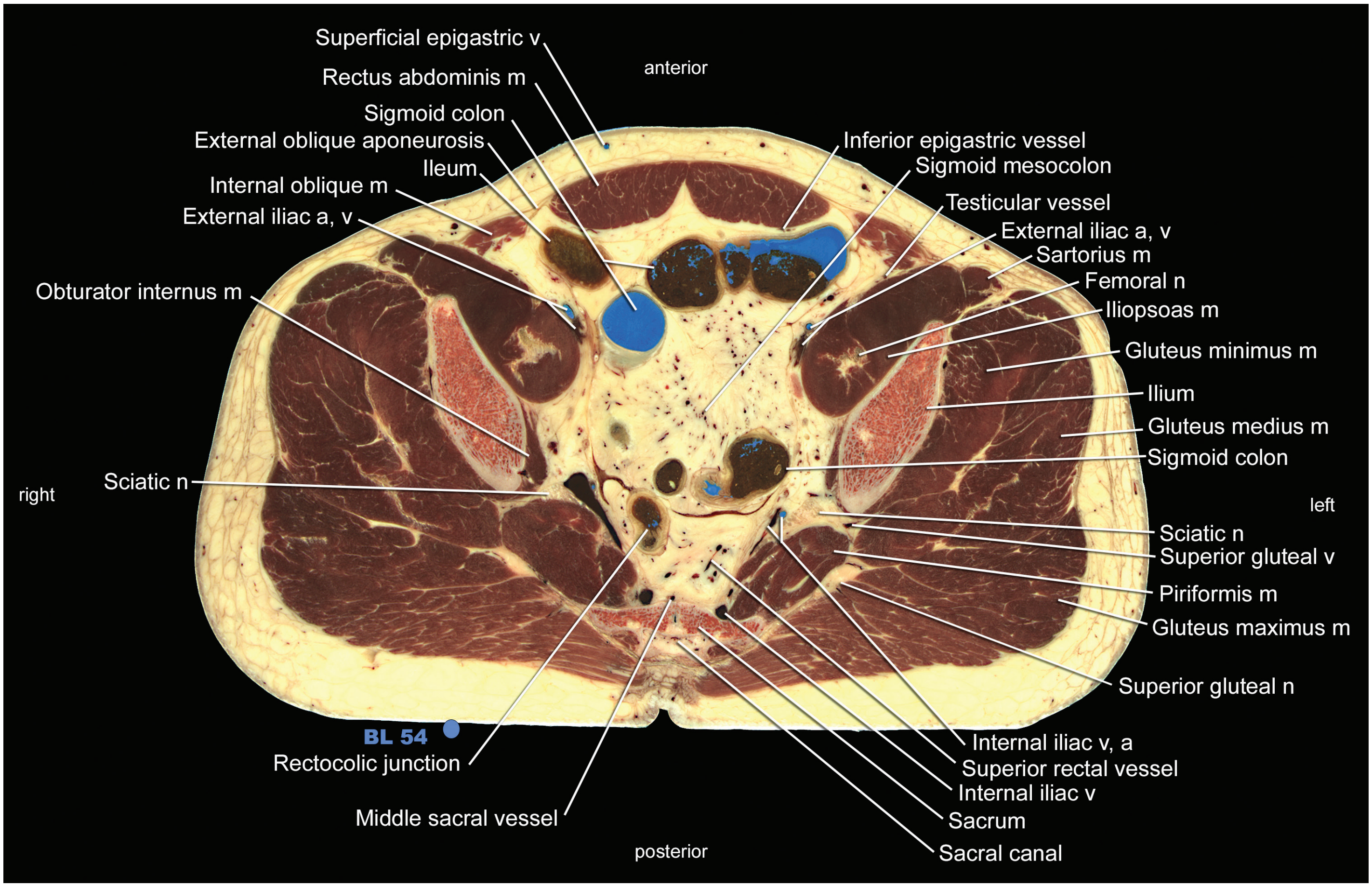

Superficial epigastric v
anterior
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
External iliac a, v
Inferior epigastric vessel
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Obturator internus m
Gluteus minimus m
Ilium
Gluteus medius m
Sigmoid colon
right
Sciatic n
left
Sciatic n
Superior gluteal v
Piriformis m
Gluteus maximus m
Superior gluteal n
BL 54
Rectocolic junction
Internal iliac v, a
Superior rectal vessel
Internal iliac v
Middle sacral vessel
Sacrum
posterior
Sacral canal

Figure 7-107. This cross section illustrates the vulnerability of the superior gluteal and sciatic nerves to entrapment by the piriformis and gluteus maximus muscles. It also exposes the depth at which one needs to treat in order to deactivate trigger point pathology in the piriformis and gluteus medius.

Clinical Relevance: Vascular enlargement (e.g., varicosities, aneurysms, etc.) may induce progressively worsening signs of sciatic nerve entrapment. Pain caused by vascular compression of the sciatic nerve sometimes lessens during ambulation when the varicosities temporarily shrink in size.

Indications and Potential Point Combinations

- **Local buttock pain and hip stiffness, especially in extension:** BL 54, BL 53, BL 27, BL 30, tender trigger points in the region, GB 30, BL 40, KI 10. Also consider GB 31, ST 36, GB 34, GB 39, and BL 60.
- **Coccygeal or sciatic pain:** BL 54, BL 35, GV 2, GV 1.
- **Hemorrhoids:** BL 54, BL 35, GV 1.
- **Cystitis:** BL 54, BL 28, BL 32, CV 3.

Evidence-Based Applications

- Clinical application **(i.e., back pain, leg pain, constipation, or hemorrhoids)** dictates optimal needling direction.[1]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction.**[2]
- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[3]
- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[4]
- Acupuncture to BL 23, BL 25, BL 40, BL 60, and GB 34, plus tender points near BL 31, BL 32, and BL 54 offered significant relief of pain from **chronic low back pain,** even at a 3 month follow-up.[5]

References

1. Zhang Y. The needling technique and clinical application of point Zhibian. *Journal of Traditional Chinese Medicine.* 2004;24(3):182-184.
2. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.
3. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine.* 2005;25(3):177-181.
4. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.
5. Molsberger AF, Mau J, Pawelec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.
6. Choudur HN, Joshi R, and Munk PL. Inferior gluteal vein varicosities: a rare cause of sciatica. *J Clin Rheumatol.* 2009;15(8):387-388.
7. Zou Z. Fifty-two cases of the piriformis syndrome treated by centro-square needling. *J Tradit Chin Med.* 2009;29(1):11-12.

BL 55

He Yang "Confluence of Yang"

On the proximal calf between the medial and lateral heads of the gastrocnemius muscle, 2 cun distal to the popliteal crease (at BL 40), on the line connecting BL 40 and BL 57.

Muscles

- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended, raises the heel during ambulation, and flexes the leg at the knee joint.
- **Soleus muscle:** Plantarflexes the ankle independently of the knee's position, and steadies the leg on the foot.
- **Plantaris muscle:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.
- **Popliteus muscle:** Weakly flexes the knee and "unlocks" it by rotating the femur in a lateral direction atop the tibial plateau. Adheres to the joint capsule of the knee. Considered the "cornerstone stabilizer" of the posterolateral aspect of the knee in conjunction with its tendon, fascicles, and meniscocapsular attachment sites.[1] For the normal, intact lateral meniscus, the popliteus muscle acts as a retractor.[2]

Clinical Relevance: The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to "tennis leg", a calf injury identified by a "snapping" in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[3] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

A soleus trigger point at BL 55 radiates pain distad to BL 57 and proximad to BL 40.

A tibialis posterior trigger point at BL 55 sends pain to the calf at BL 57, then to the calcaneal tendon, the heel, and the bottom of the foot.

Trigger points in the popliteus muscle at or near BL 55 produce pain in the popliteal fossa and caudodistal femur over the medial epicondyle. Neuromodulation applied to structures around the knee such as the popliteus muscle has the potential to improve proprioception and general stability in conjunction with neuromuscular retraining. The popliteus muscle monitors and

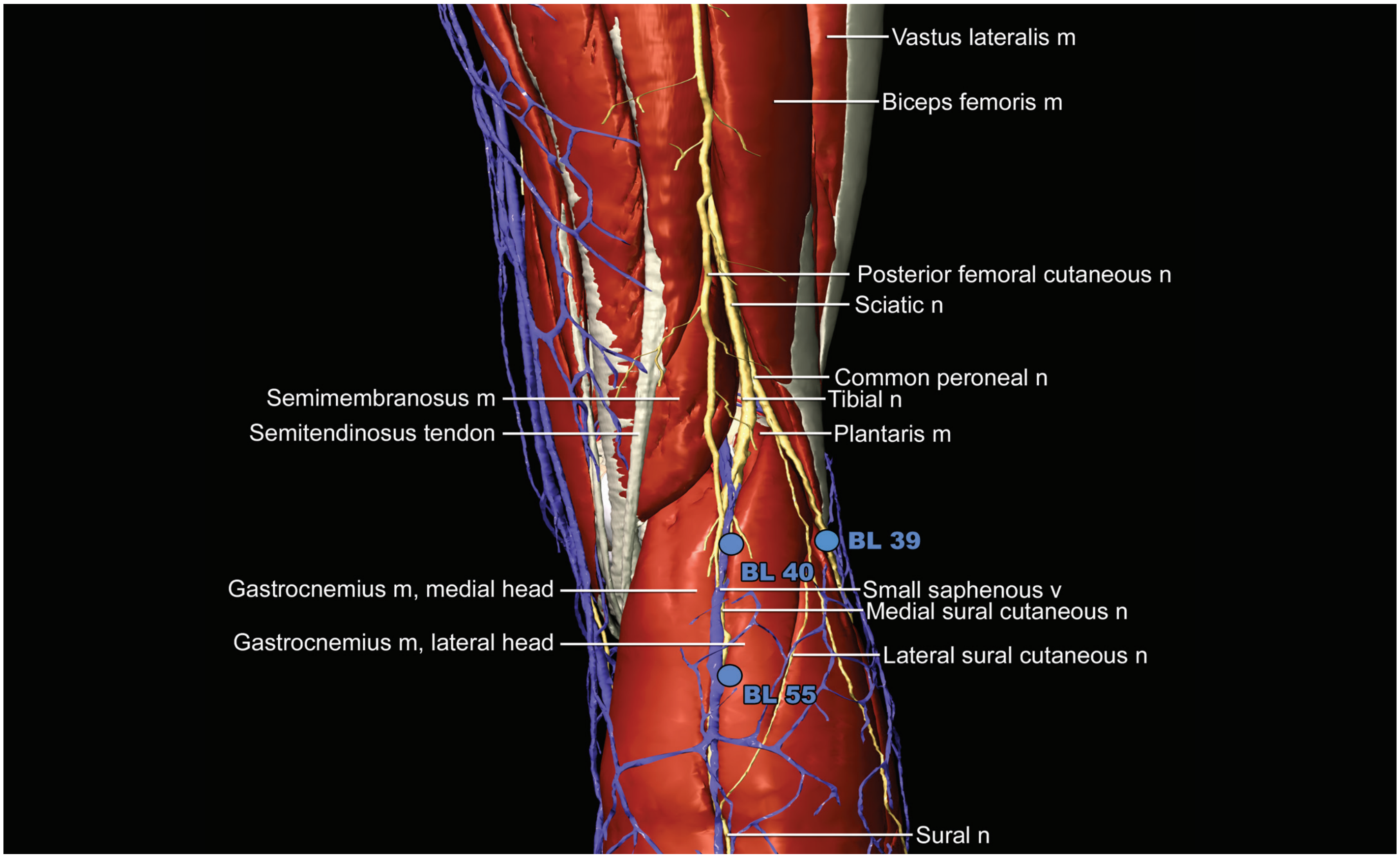


Figure 7-108. The two points, BL 39 and BL 40, representing a divergence of the Bladder channel at the popliteal crease, join together at BL 55, "Yang Union". The term "Yang Union" may also refer to the way in which branches of nerves affiliated with those points blend to form the sural nerve. The sural nerve delineates the neuroanatomic trajectory of the distal BL channel.

controls subtle movements in the knee, tantamount to a three-dimensional dynamic guidance system.[4] The popliteus musculotendinous complex and adjoining structures stabilize the knee by monitoring and controlling tibial external rotation, posterior translation during eccentric function (protecting the posterior cruciate ligament), and by causing tibial internal rotation and posterior translation during concentric function (protecting the anterior cruciate ligament). In short, BL 55 represents an access point through which to influence popliteus function.

Nerves

- **Medial sural cutaneous nerve (S2):** Innervates the skin and subcutaneous tissue of the calf. The medial sural cutaneous nerve arises from the tibial and joins with the ramus communicans of the lateral cutaneous sural nerve from the common fibular nerve.[5]
- **Sural nerve ("short saphenous nerve"):** The sural nerve forms as the union of the medial sural cutaneous nerve from the tibia and the lateral cutaneous sural nerve from the common fibular nerve. It courses between the two heads of the gastrocnemius muscle deep to the crural fascia. At about the junction of the middle and distal thirds of the calf, the nerve exits the fascia to run distad near the small saphenous vein, lateral to the calcaneal tendon and coincident with the BL channel. At this point, the sural nerve anastomoses with the common fibular nerve. It continues on toward the to by passing caudal to the lateral malleolus and the lateral heel and foot, again following the BL channel.
- **Tibial nerve (L4, L5, S1, and S2):** The S1 and S2 branches innervate the plantaris, soleus, and gastrocnemius muscles, while the L4, L5, and S1 branches innervate the popliteus muscle.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). This explains why points such as SP 6 and KI 3 appear more routinely in needling formulae for voiding dysfunction than, for example, BL 40 or BL 55, which would be supplied by more cranial spinal segments that have a less direct relationship with the pelvic organs than do more caudal spinal segments.

Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[6] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[7]

Extrinsic compression of the sural nerve can occur when wearing tight ski boots or a cast on the leg. The crural fascia will, at times, accentuate nerve damage by acting as either a point of compression or fixation, whereupon running or track sports can produce excessive stretch on the tethered nerve.

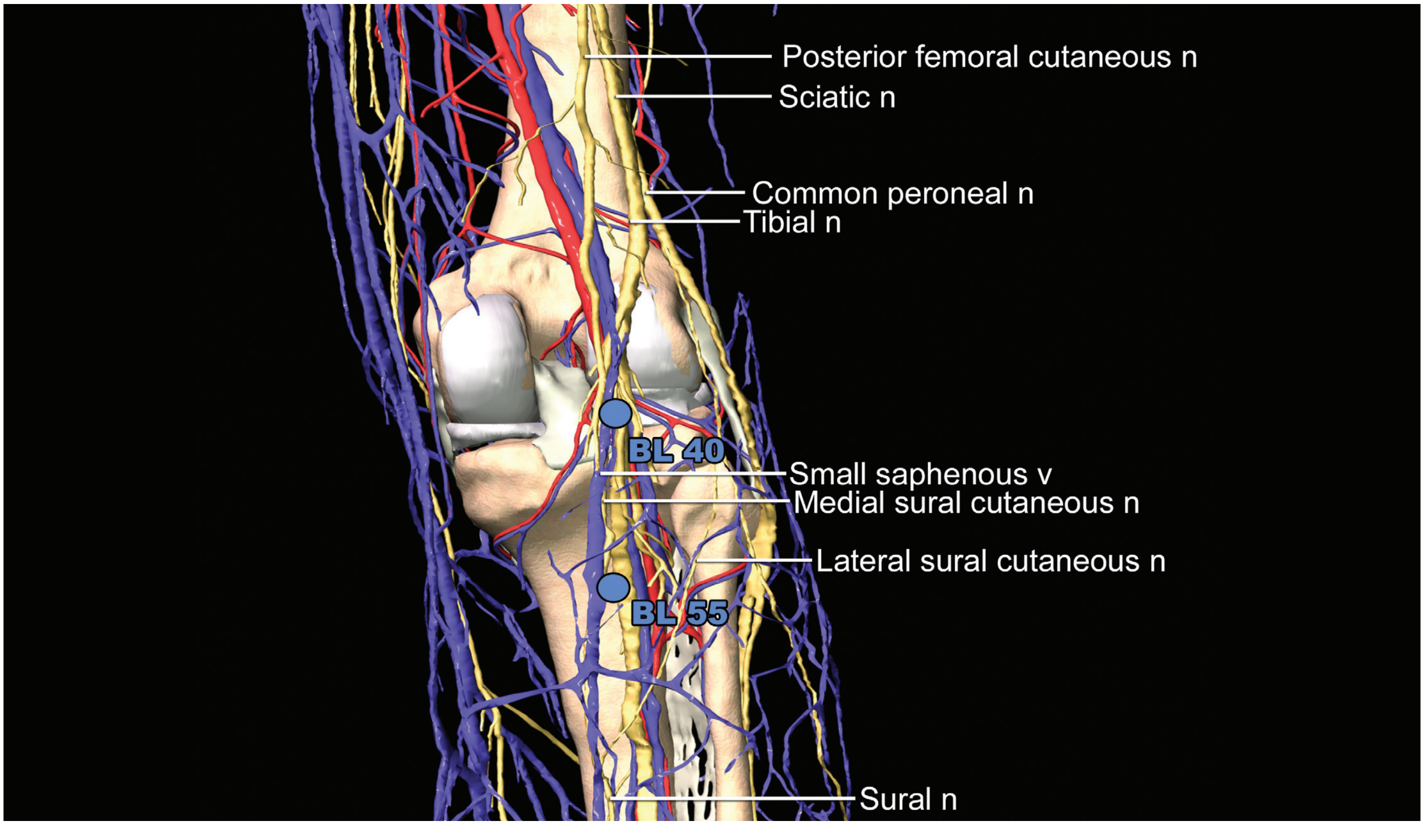


Figure 7-109. BL 55 and BL 40 follow similar neurovascular structures, as shown here.

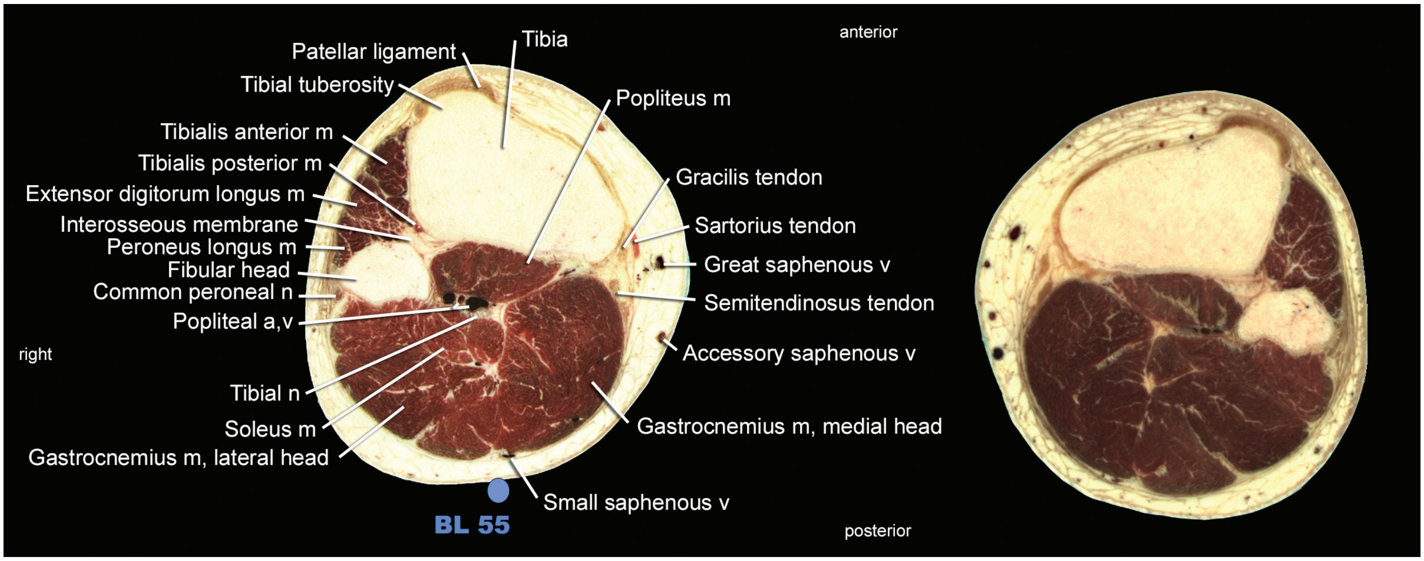


Figure 7-110. The proximity of BL 55 to the small saphenous vein in this cross-section reminds us of the early vascular basis of acupuncture channels, when the intended goal of needling was phlebotomy rather than neuromodulation, even though neuromodulation occurred anyway.

Sports or other activities that predispose a patient to repetitive ankle inversion injury can also cause fibrosis and entrapment of the sural nerve. Patients with sural nerve entrapment report shooting pain or dysesthesia in the distribution of the nerve branch(es) affected. Some confuse the neurogenic pain arising from entrapment with calcaneal tendinopathy; they may be given the diagnosis of recurrent Achilles tendonitis or tears, though the tendon is not the problem.

Vessels

- **Popliteal artery, becoming the anterior and posterior tibial arteries:** The popliteal artery supplies the knee. The anterior tibial artery supplies the anterior compartment of the leg. The posterior tibial artery provides blood to the posterior and lateral compartments of the leg, joins the anastomosis around the knee, and gives off a nutrient artery that passes to the tibia.
- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: Considerable variations exist in the branching of the popliteal artery into its tibial branches. In the same way that fascial bundles and borders entrap nerves, connective tissue structures and anomalous muscles can compress and entrap popliteal vessels and its branches.[8] Acupuncture and related techniques alleviate fascial restriction to improve circulation. Diabetic patients typically develop atherosclerosis in the tibial arteries; this can cause severe critical limb ischemia.[9] Treatment with physical medicine methods aids this patient population as well; laser can be especially beneficial in diabetic circulatory dysfunction.

Indications and Potential Point Combinations

- **Paresis of the pelvic limb:** BL 55, BL 40, BL 36, BL 54, BL 28, BL 23.
- **Lumbar stiffness and pain:** BL 55, BL 40, BL 25, BL 23, GV 4.
- **Gastrocnemius or soleus pain, pain that radiates to the bottom of the foot, mimicking heel spur pain:** BL 55, LR 7, KI 2, other local points.
- **Knee "locking":** The popliteus muscle, the "bent knee trouble-maker", refers pain to the popliteal fossa. The trigger point for this problem lies in the belly of the popliteus muscle, near BL 55.

References

1. Staubli H-U and Birrer S. The popliteal tendon and its fascicles at the popliteal hiatus: gross anatomy and functional arthroscopic evaluation with and without anterior cruciate ligament deficiency. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 1990;6(3):209-220.
2. Jones CDS, Keene GCR, and Christie AD. The popliteus as a retractor of the lateral meniscus of the knee. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 1995;11(3):270-274.
3. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology.* 2002;224:112-119.
4. Nyland J, Lachman N, Kocabey Y, et al. Anatomy, function, and rehabilitation of the popliteus musculotendinous complex. *J Orthop Sports Phys Ther.* 2005;35:165-179.
5. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
6. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.
7. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery.* 2012;56(1):181-188.
8. Rodrigues V, Nayak BS, Mohandas KG, et al. Anomalous muscle from the fascia around popliteal vessels. *Bratisl Lek Listy.* 2012;113(7):451-453.
9. Sayed A, Taha A, Elkholy M, et al. Tibial angioplasty in diabetic patients: should all vessels be treated? *Int Angiol.* 2012;31(3):239-244.

BL 56

Cheng Jin "Sinew Support" or "Receive the Tendon"

On the caudal calf between the medial and lateral heads of the gastrocnemius muscle, 5 cun distal to the popliteal crease (and BL 40), on a line connecting BL 40 and BL 57. Midway between BL 55 and BL 57.

Muscles and Tendons

- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended, raises the heel during ambulation, and flexes the leg at the knee joint.
- **Soleus muscle:** Plantarflexes the ankle independently of the knee's position, and steadies the leg on the foot.
- **Plantaris tendon:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.

Clinical Relevance: The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to "tennis leg", a calf injury identified by a "snapping" in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[1] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients

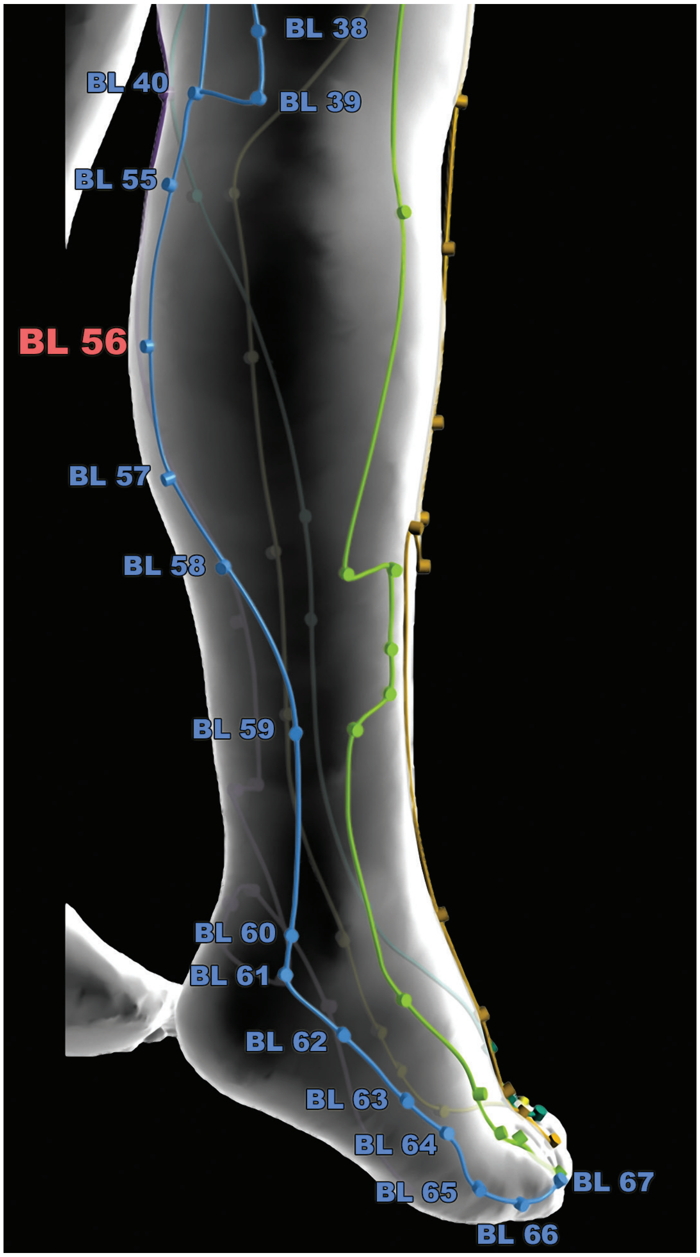


Figure 7-111A. BL 56, "Support the Sinews", lands at a tender spot on the bulge of the calf. The term "sinews" in Chinese medicine encompasses a diverse group of tissues, including fascia, tendons, ligaments, subcutaneous tissue, muscle, joint capsules, and cartilage. This fleshy part of the calf at BL 56 contains many of these tissue types, shown by Figure 7-112 in cross-section.

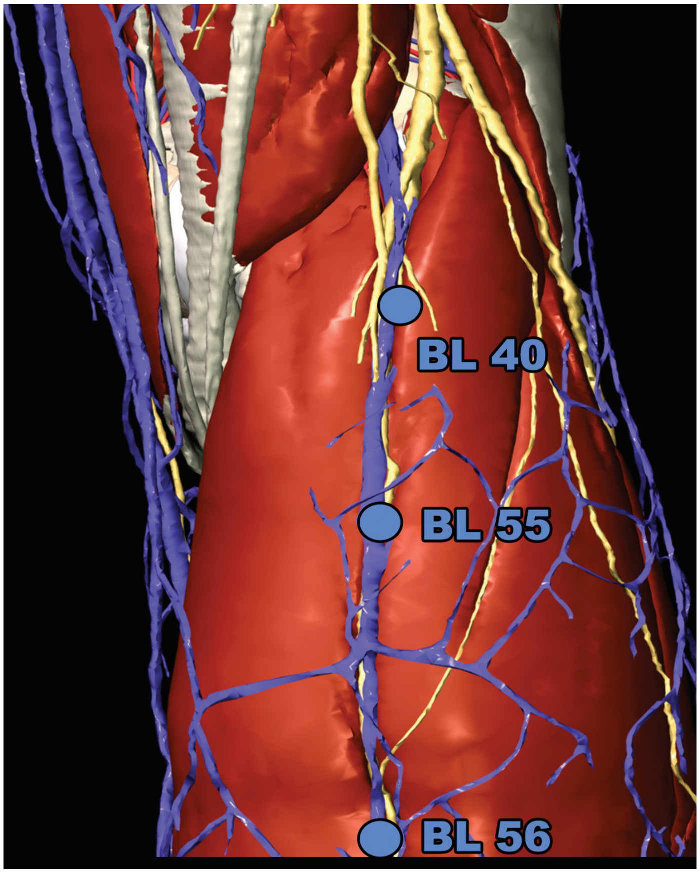


Figure 7-111B. BL 56, "Sinew Support", impacts the triceps surae, defined as the two heads of the gastrocnemius and the soleus muscle. Note how BL 56 lands at the bottom of the biggest part of the bulge in this image. The blue linear structure connecting BL 40, BL 55, and BL 56 is the small saphenous vein, conveniently defining the BL channel trajectory. The yellow nerve fiber coursing beneath the vein is the sural nerve.

maintain the structural integrity of their original design.

A soleus trigger point at BL 56 radiates pain distad to BL 57 and proximad to BL 40.

A tibialis posterior trigger point at BL 56 sends pain to the calf at BL 57, then to the calcaneal tendon, the heel, and the bottom of the foot.

Nerves

- **Medial sural cutaneous nerve (S2):** Innervates the skin and subcutaneous tissue of the calf. The medial sural cutaneous nerve arises from the tibial and joins with the ramus communicans of the lateral cutaneous sural nerve from the common fibular nerve.[2]
- **Sural nerve ("short saphenous nerve"):** The sural nerve forms as the union of the medial sural cutaneous nerve from the tibia and the lateral cutaneous sural nerve from the common fibular nerve. It courses between the two heads of the gastrocnemius muscle deep to the crural fascia. At about the junction of the middle and distal thirds of the calf, the nerve exits the fascia to run distad near the small saphenous vein, lateral to the calcaneal tendon and coincident with the BL channel. At this point, the sural nerve anastomoses with the common fibular nerve. It continues on toward the to by passing caudal to the lateral malleolus and the lateral heel and foot, again following the BL channel. The sural nerve supplies sensation to the skin of the caudal calf, lateral distal leg, and lateral foot.
- **Tibial nerve (S1,S2):** Innervates the soleus and gastrocnemius, as well as all the muscles in the caudal compartment of the leg. muscles.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). This explains why points such as SP 6 and KI 3 appear more routinely in needling formulae for voiding dysfunction than, for example, BL 40 or BL 56, which would be supplied by more cranial spinal segments that have a less direct relationship with the pelvic organs than do more caudal spinal segments.

Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[3] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[4]

Extrinsic compression of the sural nerve can occur when wearing tight ski boots or a cast on the leg. The crural fascia will, at times, accentuate nerve damage by acting as either a point of compression or fixation, whereupon running or track sports can produce excessive stretch on the tethered nerve. Sports or other activities that predispose a patient to repetitive ankle inversion injury can also cause fibrosis and entrapment of the sural nerve. Patients with sural nerve entrapment report shooting pain or dysesthesia in the distribution of the nerve branch(es) affected. Some confuse the neurogenic pain arising from entrapment with calcaneal tendinopathy; they may be given the diagnosis of recurrent Achilles tendonitis or tears, though the tendon is not the problem.

Vessels

- **Posterior tibial artery:** The posterior tibial artery provides blood to the posterior and lateral compartments of the leg, joins the anastomosis around the knee, and gives off a nutrient artery that passes to the tibia.
- **Fibular (peroneal) artery:** The largest and most important branch of the posterior tibial artery, it supplies the muscles in the posterior and lateral leg compartments. It also provides a

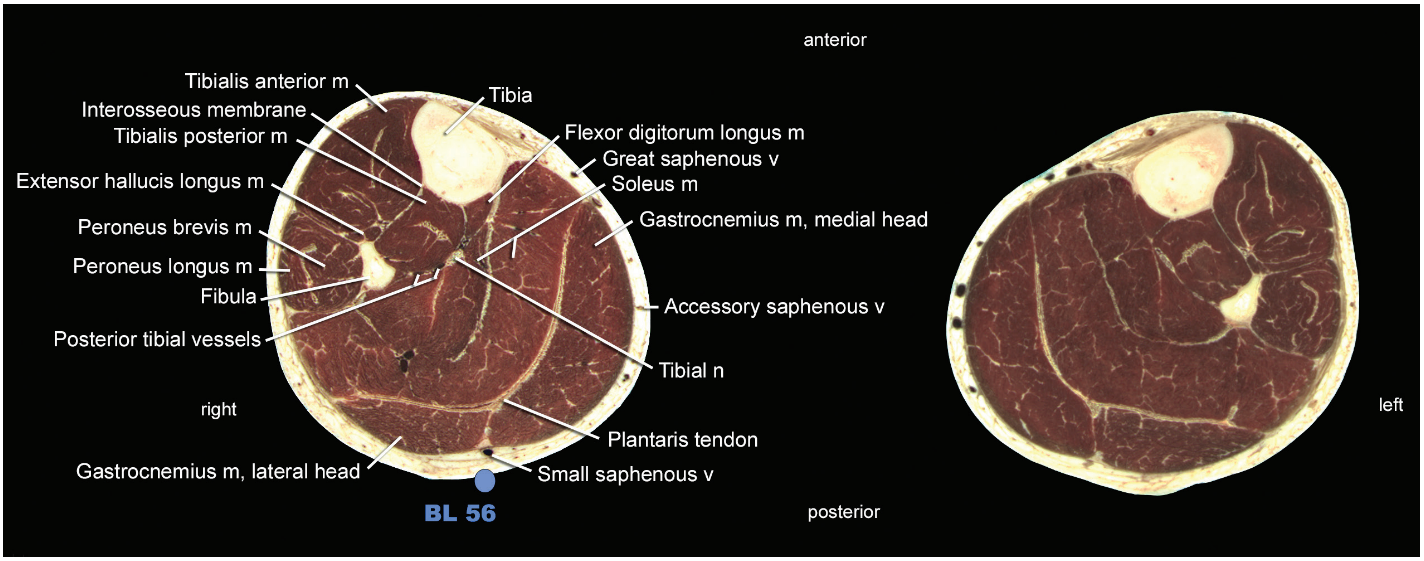


Figure 7-112. BL 56 describes a site on the leg rich with trigger points (in the gastrocnemius and soleus) that can cause local pain as well as discomfort referred proximad to the ipsilateral sacroiliac joint or distad to the heel.

nutrient artery to the fibula. Most often, it pierces the interosseous membrane and passes to the dorsum of the foot, forming an anastomosis with the arcuate artery.

- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: The small saphenous vein, if visible, serves as a landmark for palpating the plantaris tendon, in the event of traumatic injury to the plantaris (see Figure 7-112). The vein also provides a target for estimating the location of the sural nerve, as indicated in Figure 7-111B, where the small saphenous vein and sural nerve both describe the course of the BL channel on the caudal calf.

Indications and Potential Point Combinations

- **Leg and calf pain:** BL 56, BL 55, BL 58, BL 60, KI 3.
- **Lumbar or lumbosacral stiffness and pain:** BL 56, BL 32, BL 27, BL 23.
- **Hemorrhoids:** BL 56, GV 1, GV 2.

References

1. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology*. 2002;224:112-119.
2. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
3. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery*. 2012;26(3):386-391.
4. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery*. 2012;56(1):181-188.

BL 57

Cheng Shan "Support the Mountain"

On the posterior surface of the leg, in the depression formed by the lower limit of the two bellies of the flexed gastrocnemius muscle, at the musculotendinous junction. Approximately 8 cun distal to BL 40 at the popliteal crease; midway between BL 40 and BL 60. Locate by running a finger in a proximal direction from the Achilles tendon along the midline of the crus, until it enters a depression between the two bellies of the gastrocnemius muscle.

Muscles and Tendons

- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended, raises the heel during ambulation, and flexes the leg at the knee joint.
- **Soleus muscle:** Plantarflexes the ankle independently of the knee's position, and steadies the leg on the foot.
- **Plantaris tendon:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle.

Clinical Relevance: The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to "tennis leg", a calf injury identified by a "snapping" in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[6] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

A soleus muscle trigger point at BL 57 may radiate pain to the ipsilateral sacroiliac joint.

Nerves

- **Medial sural cutaneous nerve (S1, S2):** Innervates the skin on the posterior and lateral leg and lateral side of the foot; forms the sural nerve if it joins with the lateral sural cutaneous nerve. Accompanies the small saphenous vein.
- **Sural nerve ("short saphenous nerve"):** The sural nerve forms as the union of the medial sural cutaneous nerve from the tibia and the lateral cutaneous sural nerve from the common fibular nerve. It courses between the two heads of the gastrocnemius muscle deep to the crural fascia. At about the junction of the middle and distal thirds of the calf, the nerve exits the fascia to run distad near the small saphenous vein, lateral to the calcaneal tendon and coincident with the BL channel. At this point, the sural nerve anastomoses with the common fibular nerve. It continues on toward the to by passing caudal to the lateral malleolus and the lateral heel and foot, again following the BL channel. The sural nerve supplies sensation to the skin of the caudal calf, lateral distal leg, and lateral foot.
- **Tibial nerve (L4, L5, S1-S3):** Innervates the soleus and gastrocnemius, as well as all the muscles in the caudal compartment of the leg.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). This explains why points such as SP 6 and KI 3 appear more routinely in needling formulae for voiding dysfunction than, for example, BL 40 or BL 57, which would be supplied by more cranial spinal segments that have a less direct relationship with the pelvic organs than do more caudal spinal segments. However, note as well that the cross-section appearing in Figure 7-114 indicates the growing prominence of the flexor hallucis longus, supplied by S2 and S3, the most caudal spinal segments comprising the tibial nerve. This lends insight into the association of BL 57 with rectal disorders such as hemorrhoids and rectal hypersensitivity.

Tibial nerve entrapment produces gastrocnemius muscle

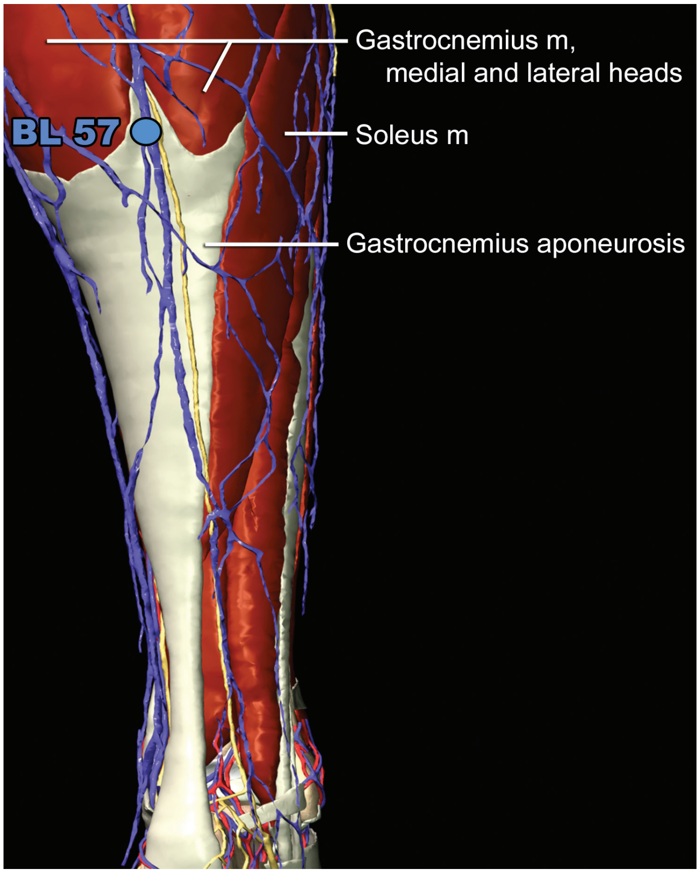

Gastrocnemius m, medial and lateral heads
BL 57
Soleus m
Gastrocnemius aponeurosis

Figure 7-113. This image shows how BL 57, "Mountain Support", nestles in a valley distal to the gastrocnemius muscle, as though supporting it.

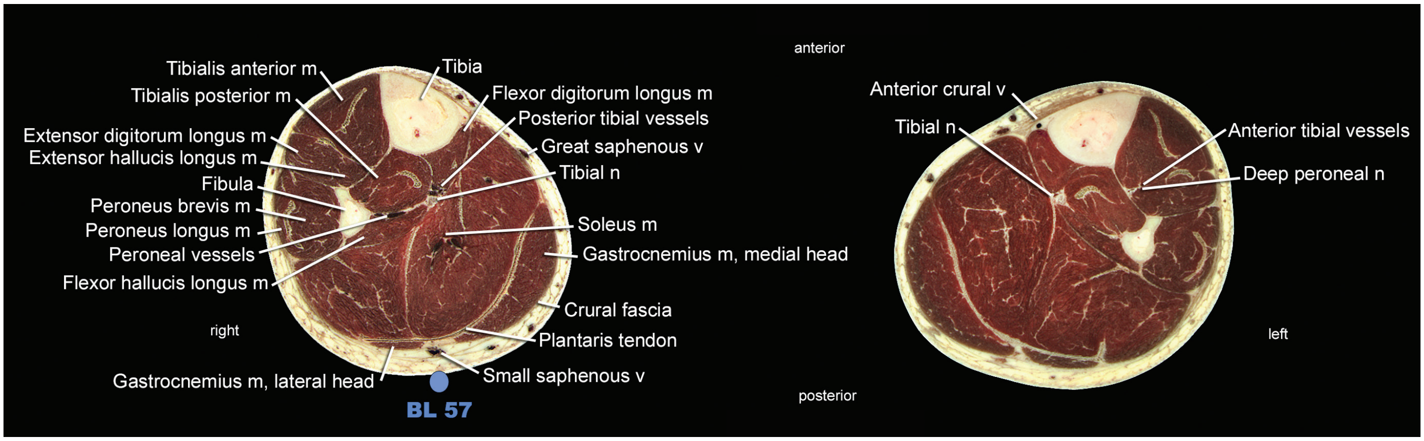

Tibialis anterior m
Tibia
Tibialis posterior m
Flexor digitorum longus m
Posterior tibial vessels
Extensor digitorum longus m
Extensor hallucis longus m
Great saphenous v
Tibial n
Fibula
Peroneus brevis m
Peroneus longus m
Soleus m
Peroneal vessels
Gastrocnemius m, medial head
Flexor hallucis longus m
Crural fascia
right
Plantaris tendon
Small saphenous v
Gastrocnemius m, lateral head
BL 57
anterior
Anterior crural v
Tibial n
Anterior tibial vessels
Deep peroneal n
left
posterior

Figure 7-114. At the level of BL 57, the mass comprising the mound of "sinew" at BL 56 has dwindled as the gastrocnemius muscle meets its aponeurosis. The soleus remains hefty and supplies the majority of muscle afferents activated by treating BL 57.

atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[7] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[8] Small saphenous vein stripping can also damage the fibular nerve, though less commonly because of its depth.[9]

Extrinsic compression of the sural nerve can occur when wearing tight ski boots or a cast on the leg. The crural fascia will, at times, accentuate nerve damage by acting as either a point of compression or fixation, whereupon running or track sports can produce excessive stretch on the tethered nerve. Sports or other activities that predispose a patient to repetitive ankle inversion injury can also cause fibrosis and entrapment of the sural nerve. Patients with sural nerve entrapment report shooting pain or dysesthesia in the distribution of the nerve branch(es) affected. Some confuse the neurogenic pain arising from entrapment with calcaneal tendinopathy; they may be given the diagnosis of recurrent Achilles tendonitis or tears, though the tendon is not the problem.

Vessels

- **Posterior tibial artery:** The posterior tibial artery provides blood to the posterior and lateral compartments of the leg, joins the anastomosis around the knee, and gives off a nutrient artery that passes to the tibia.
- **Fibular (peroneal) artery:** The largest and most important branch of the posterior tibial artery, it supplies the muscles in the posterior and lateral leg compartments. It also provides a nutrient artery to the fibula. Most often, it pierces the interosseous membrane and passes to the dorsum of the foot, forming an anastomosis with the arcuate artery.
- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: The small saphenous vein, if visible, serves as a landmark for palpating the plantaris tendon, in the event of traumatic injury to the plantaris (see Figure 7-114). However, as this image indicates, the plantaris tendon is moving mediad in relation to the small saphenous vein, whereas at BL 56, the tendon lies deep to the point. The vein also provides a target for estimating the location of the sural nerve, as indicated in Figure 7-113, where the small saphenous vein and sural nerve both describe the course of the BL channel on the caudal calf.

Indications and Potential Point Combinations

- **Kidney or lumbar pain:** BL 57, BL 23, BL 52, GV 4.
- **Constipation:** BL 57, ST 36.
- **Anal stricture, rectal prolapse, hemorrhoids:** BL 57, BL 54, GV 2, GV 1.[10]
- **Calf cramps:** BL 57, BL 55, BL 56, KI 3, BL 60.
- **Restless legs syndrome:** BL 57, LR 3.[11]
- **Knee pain:** BL 57, in addition to ST 34, ST 36, SP 10, Xiyan (Eyes of the Knee), SP 9, and BL 40.[12]
- **Face and jaw pain:** BL 57 as a trigger point in the soleus muscle. Travell & Simons describe a "rare trigger point" in the ipsilateral soleus muscle that refers pain to the face and jaw.

This argues for the neuroreflexive connection between the distal pelvic limb and the trigeminal nerve, perhaps serving as an evolutionary historic means of coordinating running while keeping prey in the mouth.[1]

Evidence-Based Applications

- Electroacupuncture at BL 40 and BL 57 relieved local ankle spasticity in a child with mild spastic hemiplegic **cerebral palsy.**[2]
- Transcutaneous electrical nerve stimulation (TENS) at LI 4, LU 10, BL 57, and ST 36 effectively reduced rectal hypersensitivity in diarrhea-predominant **irritable bowel syndrome.**[3]
- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[4]
- Electroacupuncture at ST 36 + SP 6 was compared to GB 34

+ BL 57, in order to study differences in **brain activation** from acupuncture points located in the same spinal segments. Both overlapping and distinct cerebral response patterns from stimulation of the two pairs were observed. Both pairs of points (ST 36/SP 6 and GB 34/BL 57) activated the primary and secondary somatosensory areas, insula, ventral thalamus, parietal Brodmann Area 40, temporal lobe, putamen, and cerebellum; both deactivated the amygdala. However, ST 36/SP 6 specifically activated the orbital frontal cortex and deactivated the hippocampus, while GB 34/BL 57 activated the dorsal thalamus and inhibited the primary motor area and premotor cortex. These cerebral response differences may help explain why ST 36/SP 6 is indicated more for visceral disorders and pain while GB 34/BL 57 are important points for modulation of muscle and tendon function and motor output.[5]

References

1. Travell JG and Simons DG. Volume 2. Myofascial Pain and Dysfunction. *The Trigger Point Manual*. The Lower Extremities. Baltimore: Williams & Wilkins, 1983, p. 430.
2. Svedberg L, Nordahl G, and Lundeberg T. Electroa-acupuncture in a child with mild spastic hemiplegic cerebral palsy. *Developmental Medicine & Child Neurology*. 2003;45:503-504.
3. Xiao W-B and Liu Y-L. Rectal hypersensitivity reduced by acupoint TENS in patients with diarrhea-predominant irritable bowel syndrome: a pilot study. *Digestive Diseases and Sciences*. 2004;49(2):312-319.
4. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain*. 2001;17:296-305.
5. Zhang W-T, Jin Z, Luo F, Zhang L, Zeng Y-W, and Han J-S. Evidence from brain imaging with fMRI supporting functional specificity of acupoints in humans. *Neuroscience Letters*. 2004;354:50-53.
6. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology*. 2002;224:112-119.
7. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery*. 2012;26(3):386-391.
8. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery*. 2012;56(1):181-188.
9. Yoshida RdA, Yoshida WB, Sardenberg T, et al. Fibular nerve injury after small saphenous vein surgery. *Ann Vasc Surg*. 2012;26:729.e11-729.e15.
10. Li N, He HB, Wang CW, et al. Observation on therapeutic effect of electroacupuncture at Chengshan (BL 57) and Changqiang (GV 1) on hemorrhoidal pain. *Zhongguo Zhen Jiu*. 2008;28(11):790-794.
11. Cripps M. Acupuncture for restless legs syndrome in patients previously treated with dopaminergic drugs. *Acupuncture in Medicine.* 2011;29(3):240-241.
12. Mei ZG, Cheng CG, and Zheng JF. Observations on curative effect of high-frequency electric sparkle and point-injection therapy on knee osteoarthritis. *J Tradit Chin Med*. 2011;31(4):311-315.

BL 58

Fei Yang "Soaring Upward" or "Taking Flight"

Between the caudal border of the fibula and the aponeurosis of the gastrocnemius muscle, 7 cun proximal to the lateral malleolus (and BL 60), approximately 1 cun distal and lateral to BL 57.

Muscles

- **Soleus muscle:** Plantarflexes the ankle, independent of the knee's position, and steadies the leg on the foot.
- **Flexor hallucis longus muscle:** Flexes the great toe. Weakly plantarflexes the ankle. Supports the longitudinal arches of the foot.

Clinical Relevance: A soleus muscle trigger point at BL 58 may radiate pain to the ipsilateral sacroiliac joint. Trigger point pathology in the flexor hallucis longus muscle at BL 58 radiates strongly to the plantar aspect of the distal 1st metatarsal and the hallux, or big toe.

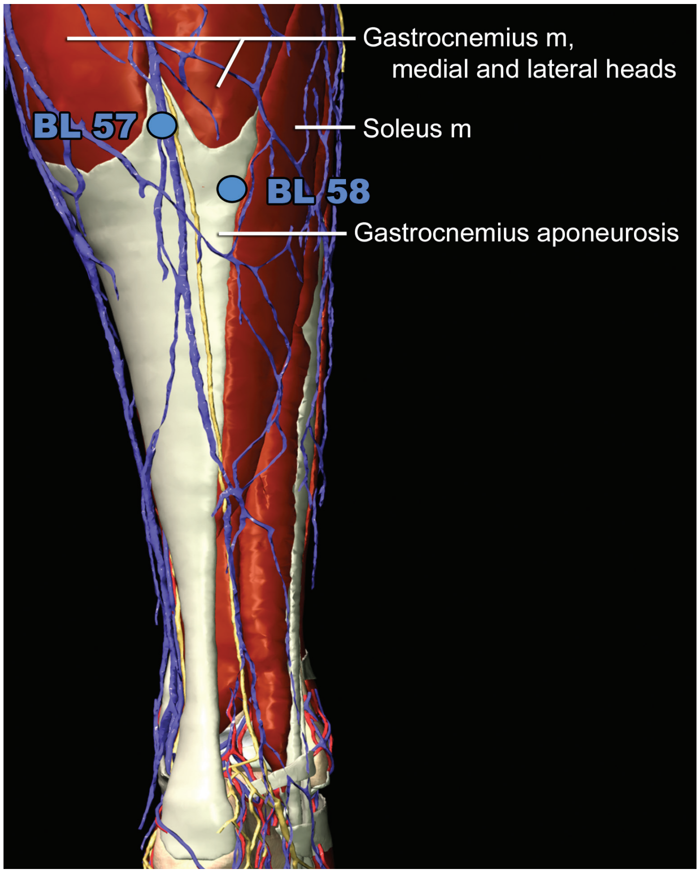

Gastrocnemius m, medial and lateral heads
BL 57
Soleus m
BL 58
Gastrocnemius aponeurosis

Figure 7-115. BL 58, "Soaring Upward" lands at a site on the caudal calf where muscle activation would support jumping upward. The thick fascial layer at this level along with the indications for distal BL points related to cephalalgia (headache) cause one to consider the role of fascial fixations between the forehead and the feet that follow this trajectory. That is, in addition to its neuromodulatory actions on the brain, spinal cord, and autonomic nervous system, treatment of distal BL points release tension in the fascia that might be triggering pain in neck and head connections.

Nerves

- **Lateral sural cutaneous nerve:** Supplies the skin and subcutaneous tissue on the lateral calf from the proximal knee to the distal-midcalf region.
- **Sural nerve ("short saphenous nerve"):** The sural nerve forms as the union of the medial sural cutaneous nerve from the tibia and the lateral cutaneous sural nerve from the common fibular nerve. It courses between the two heads of the gastrocnemius muscle deep to the crural fascia. At about the junction of the middle and distal thirds of the calf, the nerve exits the fascia to run distad near the small saphenous vein, lateral to the calcaneal tendon and coincident with the BL channel. At this point, the sural nerve anastomoses with the common fibular nerve. It continues on toward the to by passing caudal to the lateral malleolus and the lateral heel and foot, again following the BL channel. The sural nerve supplies sensation to the skin of the caudal calf, lateral distal leg, and lateral foot.
- **Tibial nerve (L4, L5, S1-S3):** Innervates the soleus and gastrocnemius, as well as all the muscles in the caudal compartment of the leg.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus.

Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[1] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[2] Small saphenous vein stripping can also damage the fibular nerve, though less commonly because of its depth.[3]

Extrinsic compression of the sural nerve can occur when wearing tight ski boots or a cast on the leg. The crural fascia will, at times, accentuate nerve damage by acting as either a point of compression or fixation, whereupon running or track sports can produce excessive stretch on the tethered nerve. Sports or other activities that predispose a patient to repetitive ankle inversion injury can also cause fibrosis and entrapment of the sural nerve. Patients with sural nerve entrapment report shooting pain or dysesthesia in the distribution of the nerve branch(es) affected. Some confuse the neurogenic pain arising from entrapment with calcaneal tendinopathy; they may be given the diagnosis of recurrent Achilles tendonitis or tears, though the tendon is not the problem.

Vessels

- **Fibular (peroneal) artery:** The largest and most important branch of the posterior tibial artery, it supplies the muscles in the posterior and lateral leg compartments. It also provides a nutrient artery to the fibula. Most often, it pierces the interosseous membrane and passes to the dorsum of the foot, forming an anastomosis with the arcuate artery.

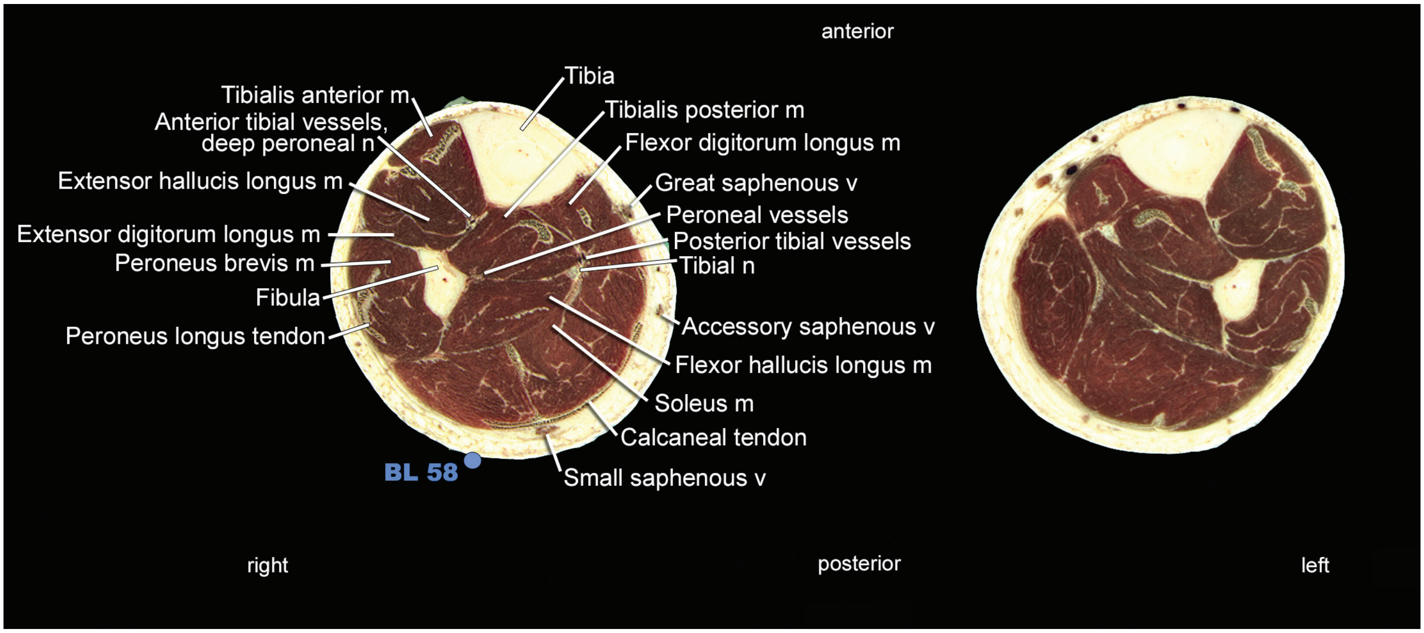

anterior
Tibia
Tibialis anterior m
Anterior tibial vessels, deep peroneal n
Tibialis posterior m
Flexor digitorum longus m
Extensor hallucis longus m
Great saphenous v
Peroneal vessels
Extensor digitorum longus m
Posterior tibial vessels
Peroneus brevis m
Tibial n
Fibula
Peroneus longus tendon
Accessory saphenous v
Flexor hallucis longus m
Soleus m
Calcaneal tendon
BL 58
Small saphenous v
right
posterior
left

Figure 7-116. With BL 58, the BL channel has now moved off the midline of the calf, venturing toward the lateral aspect of the distal pelvic limb toward its destination of the little toe.

- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: Damage to the local neurovascular supply during venous stripping or other surgical approaches warrant consideration of neuromodulation and support of tissue restoration by means of acupuncture and related techniques.

Indications and Potential Point Combinations

- **Headache, dizziness:** BL 58, BL 10, GB 20, LR 3, LI 4.
- **Muscle stiffness:** BL 58, GB 34.
- **Back pain:** BL 58, back pain trigger points, BL paraspinal points and GV points as indicated by palpation exam, affected spinal segments, nature or origin of pain.
- **Leg pain, numbness, or weakness:** BL 58. Identify source of pain, involvement of neuropathic nerves, distribution of pain according to neurologic involvement and myofascial trigger points. For sciatic involvement, consider adding BL 24, BL 25, BL 26, BL 53, BL 54, BL 40, KI 3.

References

1. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery*. 2012;26(3):386-391.
2. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery*. 2012;56(1):181-188.
3. Yoshida RdA, Yoshida WB, Sardenberg T, et al. Fibular nerve injury after small saphenous vein surgery. *Ann Vasc Surg*. 2012;26:729.e11-729.e15.

BL 59

Fu Yang “Instep Yang”

Proximal to the ankle, between the Achilles and peroneus brevis muscle (see Figure 7-118). 3 cun superior to BL 60, or the most prominent point of the lateral malleolus.

Tendons

- **Calcaneal (Achilles) tendon:** The common tendon of the “triceps surae” muscle, which includes the two-headed gastrocnemius muscle and the soleus muscle.

Clinical Relevance: Calcaneal tendon rupture can become a recurring problem because the tendinous tissue has a high degree of disorganization. Pulsed low level laser therapy remodels tissue and improves tendon healing by increasing matrix metalloproteinase activity and collagen synthesis.[1] Quinolones may also injure the calcaneal tendon, perhaps through ischemic processes, oxidative damage, and direct collagen toxicity.[2] Patients with calcaneal tendinopathy exhibit pain, swelling, and possibly crepitus at the tendon, at or between BL 59 and BL 60.[3] Acupuncture improves blood circulation and healing to the tendon through systemic/generalized effects.[4]

Muscles

- **Flexor hallucis longus muscle:** Flexes the great toe at all joints. Weakly plantarflexes the ankle. Also, supports the medial longitudinal pedal arches.
- **Peroneus (Fibularis) brevis muscle:** Plantarflexes and everts the foot.

Clinical Relevance: Patients with flexor hallucis longus tendinopathy have pain and swelling over the caudomedial ankle, distal to BL 59. Dancers (ballet) and athletes who repeatedly use the push-off maneuver risk developing flexor hallucis longus tendinopathy. They may complain of pain with resistive flexion of the great toe. Peroneal (fibular) tendinopathy produces pain and swelling caudal to the lateral malleolus. Pain worsens with active eversion and resistive dorsiflexion. Peroneal tendinopathy can follow or co-occur with chronic lateral ankle pain and instability. Trigger point pathology in the peroneal muscles and tendons accentuate instability of the ankle, as they contribute to active stabilization of the joint.[5] Peroneus brevis and calcaneal tendon injuries are frequently encountered in patients who practice yoga.[6]

Nerves

- **Lateral sural cutaneous nerve:** Supplies the skin and subcutaneous tissue on the lateral calf from the proximal knee to the

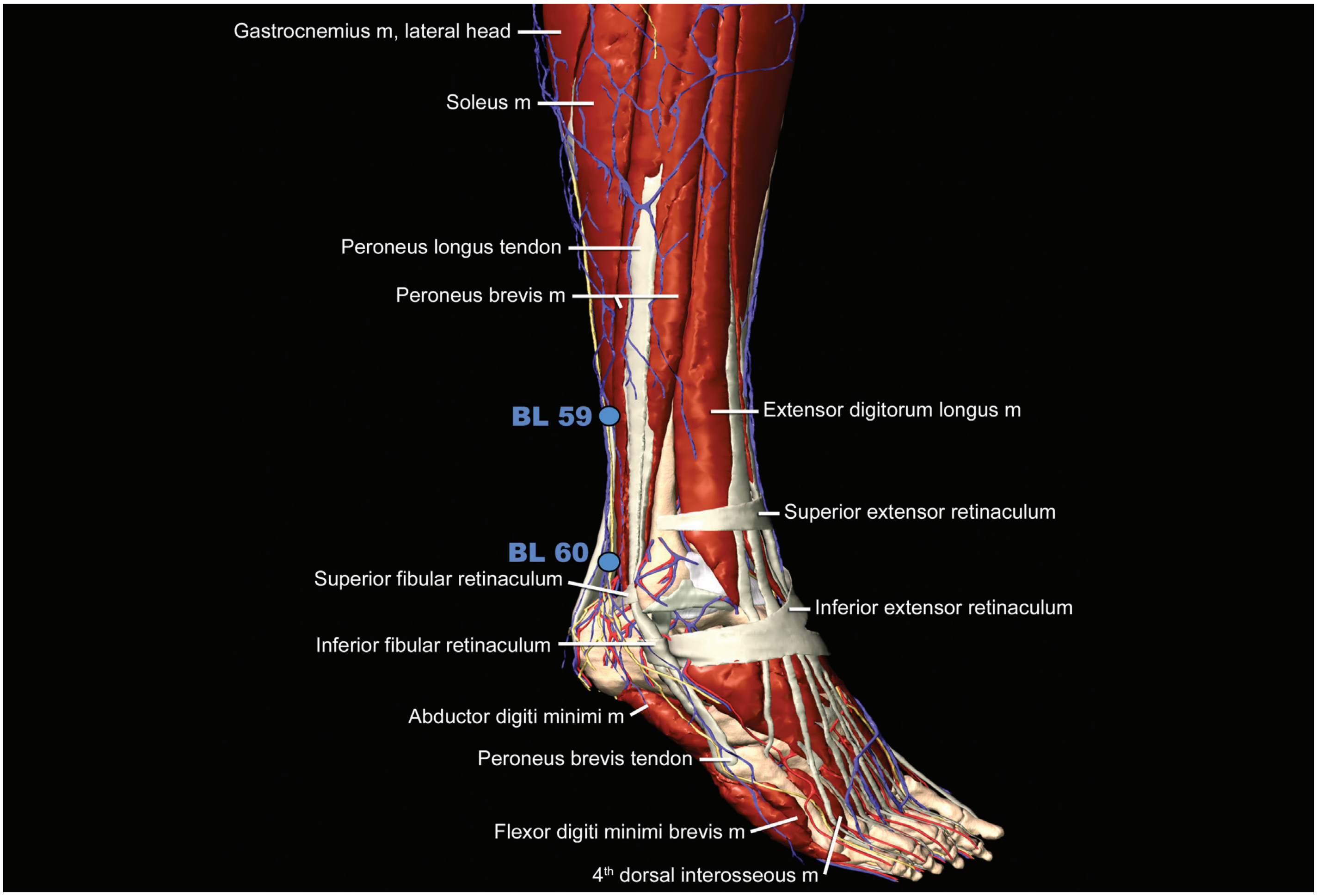

Gastrocnemius m, lateral head
Soleus m
Peroneus longus tendon
Peroneus brevis m
BL 59
Extensor digitorum longus m
Superior extensor retinaculum
BL 60
Superior fibular retinaculum
Inferior extensor retinaculum
Inferior fibular retinaculum
Abductor digiti minimi m
Peroneus brevis tendon
Flexor digiti minimi brevis m
4th dorsal interosseous m

Figure 7-117. The “instep” in “Instep Yang” refers to the “Yang” component of the metatarsus, i.e., its dorsolateral aspect, where trigger points from the fibularis (peroneus) brevis muscle refer pain.

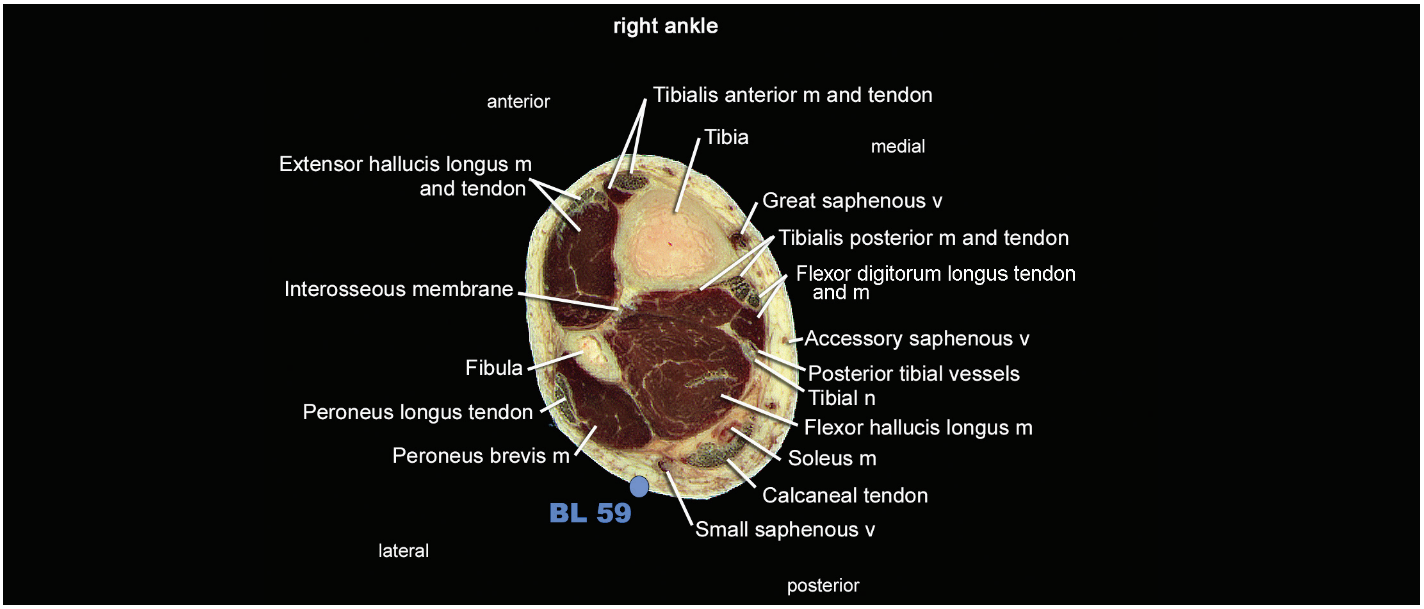


Figure 7-118. This cross-section illustrates how needling can affect structures innervated by both the fibular and tibial nerves, depending on angle and depth of needling. BL 59 also provides access to trigger points in the peroneus brevis and flexor hallucis longus muscles.. This could impact the ankle-stabilizing capacity of both muscles.

distal-midcalf region.

- **Sural nerve ("short saphenous nerve"):** The sural nerve forms as the union of the medial sural cutaneous nerve from the tibia and the lateral cutaneous sural nerve from the common fibular nerve. It courses between the two heads of the gastrocnemius muscle deep to the crural fascia. At about the junction of the middle and distal thirds of the calf, the nerve exits the fascia to run distad near the small saphenous vein, lateral to the calcaneal tendon and coincident with the BL channel. At this point, the sural nerve anastomoses with the common fibular nerve. It continues on toward the to by passing caudal to the lateral malleolus and the lateral heel and foot, again following the BL channel. The sural nerve supplies sensation to the skin of the caudal calf, lateral distal leg, and lateral foot.
- **Tibial nerve (L4, L5, S1-S3):** Supplies all the muscles in the caudal compartment of the leg.
- **Superficial peroneal (fibular) nerve:** Supplies the peroneal (fibularis) longus and brevis muscles, as well as the skin over most of the dorsum of the pes (foot) aside from the area inhabited by LR 2 and LR 3, innervated by the deep peroneal (fibular) nerve.

Clinical Relevance: The intimate relationship between the sural nerve and saphenous vein continues at BL 59. In addition, Figure 7-118 shows the proximity of this neurovascular pairing to the calcaneal tendon. Surgical repair of the tendon may damage the sural nerve.[7]

Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Depending on the tibial nerve branch affected, neuromodulation of the tibial nerve may confer differential effects on somatovisceral reflexes.

Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Post-saphenectomy in cases of saphenous vein stripping or endovenous thermal ablation may cause problems in the nerves coursing through the popliteal fossa such as the sural nerve.[8] The overlapping territory shared by both the small saphenous vein and the sural nerve describe much of the course of the BL channel on the leg.[9] Small saphenous vein stripping can also damage the fibular nerve, though less commonly because of its depth.[10]

Extrinsic compression of the sural nerve can occur when wearing tight ski boots or a cast on the leg. The crural fascia will, at times, accentuate nerve damage by acting as either a point of compression or fixation, whereupon running or track sports can produce excessive stretch on the tethered nerve. Sports or other activities that predispose a patient to repetitive ankle inversion injury can also cause fibrosis and entrapment of the sural nerve. Patients with sural nerve entrapment report shooting pain or dysesthesia in the distribution of the nerve branch(es) affected. Some confuse the neurogenic pain arising from entrapment with calcaneal tendinopathy; they may be given the diagnosis of recurrent Achilles tendonitis or tears, though the tendon is not the problem.

The superficial peroneal (fibular) nerve pierces the deep fascia in the distal leg, emerging to supply the fibular muscles and skin of the craniolateral crus, ankle, and foot. Entrapments or other sources of compression can cause pain, muscular dysfunction, and sensory impairments.

Vessels

- **Fibular (peroneal) artery:** The largest and most important branch of the posterior tibial artery, it supplies the muscles in the posterior and lateral leg compartments. It also provides a nutrient artery to the fibula. Most often, it pierces the interosseous membrane and passes to the dorsum of the foot, forming an anastomosis with the arcuate artery.

- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: Damage to the local neurovascular supply during venous stripping or other surgical approaches warrant consideration of neuromodulation and support of tissue restoration by means of acupuncture and related techniques.

After calcaneal tendon injury, acupuncture and hyperthermia may improve microcirculation in local vessels supplying the tendon whose blood flow promotes repair and recovery of function.[11,12]

Indications and Potential Point Combinations

- **Heaviness in the head, headache:** BL 59, isolate source and trajectory of head discomfort. For occipitofrontalis pain, add BL 10, GV 20.
- **Pain in kidney region:** BL 59, ST 36, SP 6, KI 3, BL 23, BL 52.
- **Acute lumbar sprain:** BL 59[13]
- **Edema of the lateral malleolar area:** BL 59, ST 40, SP 6, SP 7, SP 10.
- **Heel pain:** BL 59, check for peroneus tertius trigger point as well near GB 39 that may cause pain to refer to the lateral heel.
- **Ankle weakness:** BL 59, KI 7.

References

1. Da Re Guerra F, Vieira CP, Almeida MS, et al. LLLT improves tendon healing through increase of MMP activity and collagen synthesis. *Lasers Med Sci.*

2. Takeda S-I, Imai T, Chaki Y, et al. Four consecutive cases of Achilles tendon disorders associated with levofloxacin treatment in hemodialysis patients. *Clin Exp Nephrol.* 2012;16(6):977-978.

3. Simpson MR and Howard TM. Tendinopathies of the foot and ankle. *Am Fam Physician.* 2009;80(10):1107-1114,

4. Kubo K, Yajima H, Takayama M, et al. Changes in blood circulation of the contralateral Achilles tendon during and after acupuncture and heating. *Int J Sports Med.* 2011;32(10):807-813.

5. Ziai P, Benca E, von Skrbensky G, et al. The role of the peroneal tendons in passive stabilization of the ankle joint: an in vitro study. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(6):1404-1408.

6. Le Corroller T, Vertinsky AT, Hargunani R, et al. Musculoskeletal injuries related to yoga: imaging observations. *American Journal of Roentgenology.* 2012;199:413-418.

7. Blackmon JA, Atsas S, Clarkson MJ, et al. Locating the sural nerve during calcaneal (Achilles) tendon repair with confidence: a cadaveric study with clinical applications. *J Foot Ankle Surg.* 2013;52(1):42-47.

8. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.

9. Kerver ALA, Van der Ham AC, Theenwes HP, et al. The surgical anatomy of the small saphenous vein and adjacent nerves in relation to endovenous thermal ablation. *Journal of Vascular Surgery.* 2012;56(1):181-188.

10. Yoshida RdA, Yoshida WB, Sardenberg T, et al. Fibular nerve injury after small saphenous vein surgery. *Ann Vasc Surg.* 2012;26:729.e11-729.e15.

11. Kraemer R, Vogt PM, and Knobloch K. Microcirculatory effects of acupuncture and hyperthermia on Achilles tendon microcirculation. *Eur J Appl Physiol.* 2010;109:1007-1008.

12. Kubo K, Yajima H, Takayama M, et al. Effects of acupuncture and heating on blood volume and oxygen saturation of human Achilles tendon in vivo. *Eur J Appl Physiol.* 2010;109(3):545-550.

13. Hu R. Treatment of acute lumbar sprain with acupuncture at Fuyang (UB 59). *J Tradit Chin Med.* 1993;13(4):264-265.

BL 60

Kun Lun "Kunlun Mountains"

On the lateral ankle, in a depression midway between the most prominent point of the lateral malleolus and the caudal border of the calcaneal tendon.

Nerves

- **Sural nerve:** Arises from the tibial and common fibular nerves (usually). Supplies the skin on the caudal and lateral aspects of the leg as well asthe lateral foot.
- **Tibial nerve (L4, L5, S1-S3):** Supplies all the muscles in the caudal compartment of the leg and the calcaneal tendon.

Clinical Relevance: In addition to neuromodulating somatic nerve activities, acupuncture and related techniques influence autonomic fibers traversing with those nerves. Sympathetic fibers reach their destination by way of both nerves and vessels, not only in the foot, but elsewhere as well, such as the head and neck. Because the foot contains extensive sympathetic nerve supply[7], numerous opportunities for both local and systemic autonomic neuromodulation exist, helping to explain the value of points such as BL 60, LR 3, KI 1, ST 45, and more for distant and homeostatic effects.

Vessels

- **Fibular (peroneal) artery:** The largest and most important branch of the posterior tibial artery, it supplies the muscles in the posterior and lateral leg compartments. It also provides a nutrient artery to the fibula. Most often, it pierces the interosseous membrane and passes to the dorsum of the foot, forming an anastomosis with the arcuate artery.
- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: Damage to the local neurovascular supply during venous stripping or other surgical approaches warrant consideration of neuromodulation and support of tissue restoration by means of acupuncture and related techniques.

After calcaneal tendon injury, acupuncture and hyperthermia may improve microcirculation in local vessels supplying the tendon whose blood flow promotes repair and recovery of function.[8,9]

Note how the BL channel remains faithful to the small saphenous vein, as indicated by the cross-section in Figure 7-120. Too, notice the network of vascular anastomoses around the caudal ankle joint in Figure 7-119, revealing a rich supply of vessels and, as such, opportunities for autonomic neuromodulation that affects not only local tissues (e.g., calcaneal and other tendinous attachments) but also the body *in toto* by means of supraspinal reflexes.

Indications and Potential Point Combinations

- **Distal point for most pain problems, given its location at the caudal limit of the spinal cord segments supplying most of the body.**
- **Headache:** BL 60, ST 36, LI 4, GV 20.
- **Stiff neck:** BL 60, BL 10, GB 21, GV 20, appropriate trigger points.
- **Thoracic or lumbar pain:** BL 60, BL 23, BL 18, GV 14, GV 4.
- **Ankle or foot pain:** BL 60, isolate source of pain and its pattern and treat accordingly.
- **Sciatica:** BL 60, BL 23, BL 25, BL 40, GB 30, local trigger points.[10]

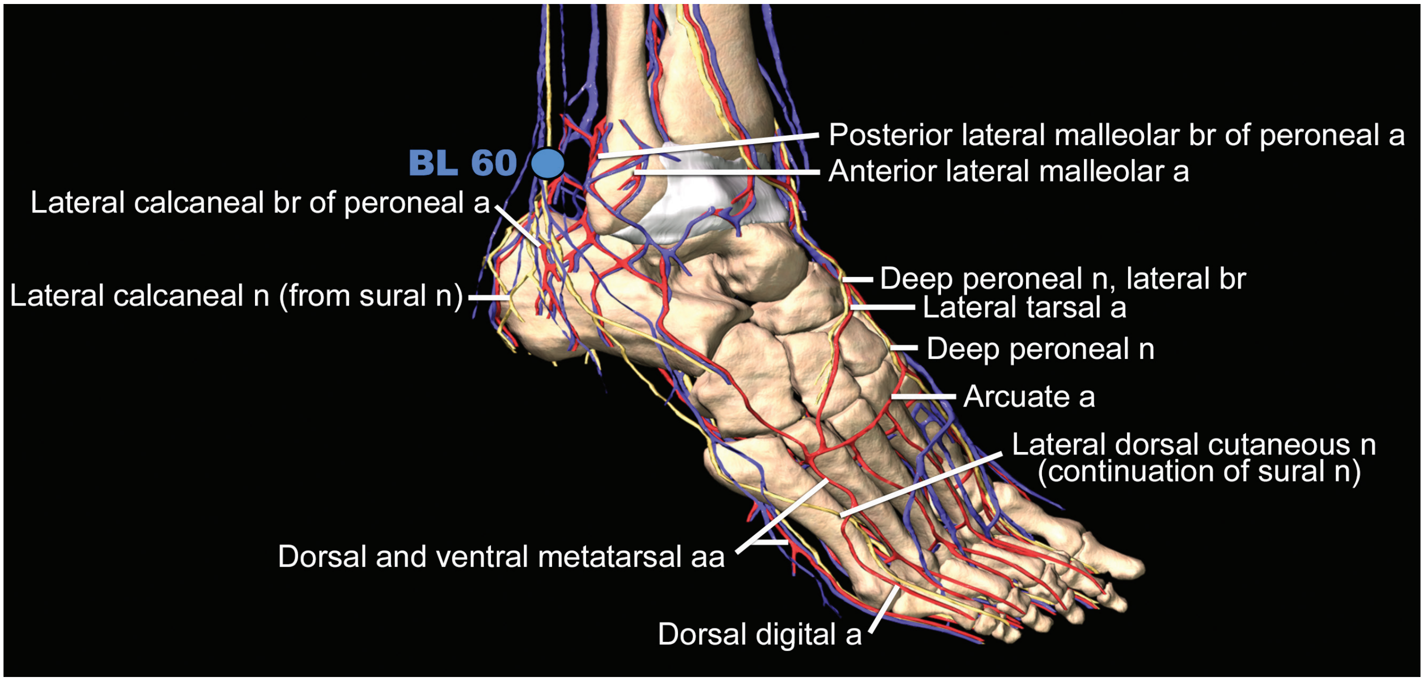

Posterior lateral malleolar br of peroneal a
BL 60
Anterior lateral malleolar a
Lateral calcaneal br of peroneal a
Deep peroneal n, lateral br
Lateral calcaneal n (from sural n)
Lateral tarsal a
Deep peroneal n
Arcuate a
Lateral dorsal cutaneous n (continuation of sural n)
Dorsal and ventral metatarsal aa
Dorsal digital a

Figure 7-119. The descriptive title for BL 60, "Kunlun Mountains" metaphorically refers to the lateral malleolus as a mountain.

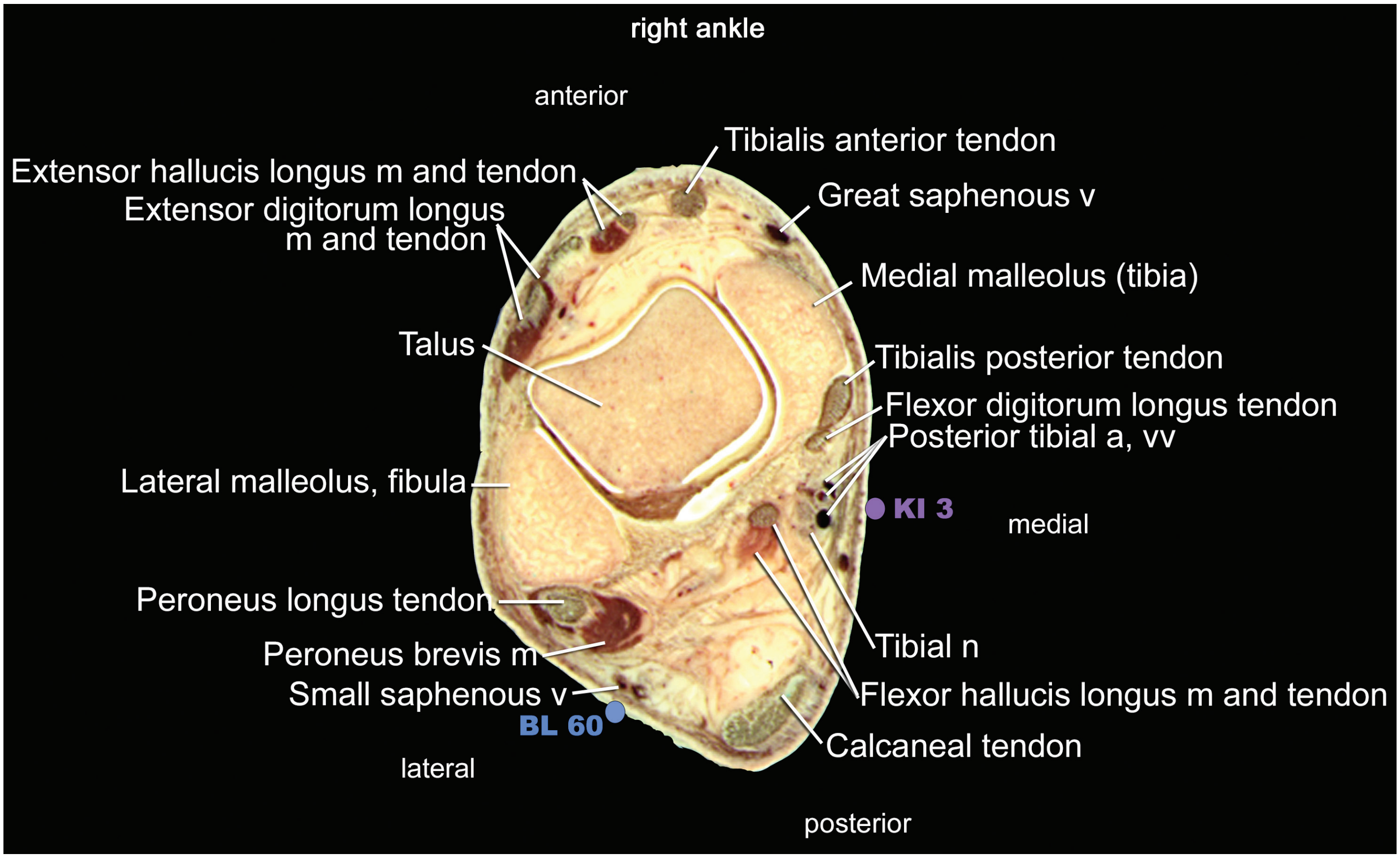

right ankle
anterior
Tibialis anterior tendon
Extensor hallucis longus m and tendon
Great saphenous v
Extensor digitorum longus m and tendon
Medial malleolus (tibia)
Talus
Tibialis posterior tendon
Flexor digitorum longus tendon
Posterior tibial a, vv
Lateral malleolus, fibula
KI 3
medial
Peroneus longus tendon
Tibial n
Peroneus brevis m
Small saphenous v
Flexor hallucis longus m and tendon
BL 60
Calcaneal tendon
lateral
posterior

Figure 7-120. The cross section at BL 60 reveals the continued connection between the BL channel and the small saphenous vein as well as the anatomic relationships of BL 60 to the peroneal (fibularis) tendons and the calcaneal tendon. Needle angle and depth depends on anatomic goals and clinical condition treated. That is, one might angle the insertion toward the tendons for proprioceptive adjustment and tendonitis pain or perpendicularly into the connective tissue for channel-based influences.

- **Chronic low back pain:** BL 60, BL 23, BL 40, BL 54, GB 34, Huatuojiaji, local trigger points.[11]

Evidence-Based Applications

- **HIV-related peripheral neuropathy** improved with electroacupuncture on BL 60, ST 36, KI 1, and LR 3.[1]
- Acupuncture at BL 24, BL 25, BL 26, BL 40, BL 57, BL 60, Huatuojiaji at L4 and L5, Yaoyan, LI 4, and LI 11 provided long-term relief in patients with **chronic low back pain.**[2]
- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) improved the orthopedic management of **chronic low back pain.**[3]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[4]
- Acupuncture at ST 36 and BL 60 provided safe and effective analgesia for **extracorporeal shock wave lithotripsy.**[5]
- Treating BL 60, ST 36, LR 3, and GB 34 with transcutaneous electrical stimulation decreased ankle spasticity and improved muscle function in patients after **acute stroke.**[6]
- Non-invasive stimulation of BL 60, KI 3, LR 3, and LI 4 reduced **acute post-operative pain** in hospitalized children.[12]

References

1. Galantino MLA, Eke-Okoro ST, Findley TW, and Condoluci D. Use of noninvasive electroacupuncture for the treatment of HIV-related peripheral neuropathy: a pilot study. *Journal of Alternative and Complementary Medicine.* 1999;5(2):135-142.
2. Carlsson CPO and Sjöglund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *The Clinical Journal of Pain.* 2001;17:296-305.
3. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.
4. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1-6.
5. Agah M and Falihi A. The efficacy of acupuncture in extracorporeal shock wave lithotripsy. *Urology Journal.* 2004;1(3):195-199.
6. Yan T and Hui-Chan CWY. Transcutaneous electrical stimulation on acupuncture points improves muscle function in subjects after acute stroke: a randomized controlled trial. *J Rehabil Med.* 2009;41:312-316.
7. Dellon AL, Hoke A, Williams CG, et al. The sympathetic innervation of the human foot. *Plast Reconstr Surg.* 2012;129(4):905-909.
8. Kraemer R, Vogt PM, and Knobloch K. Microcirculatory effects of acupuncture and hyperthermia on Achilles tendon microcirculation. *Eur J Appl Physiol.* 2010;109:1007-1008.
9. Kubo K, Yajima H, Takayama M, et al. Effects of acupuncture and heating on blood volume and oxygen saturation of human Achilles tendon in vivo. *Eur J Appl Physiol.* 2010;109(3):545-550.
10. Chen M, Wang P, Cheng G, et al. The warming acupuncture for treatment of sciatica in 30 cases. *Journal of Tradit Chin Med.* 2009;29(1):50-53.
11. Molsberger AF, Zhou J, Amdt D, et al. Chinese acupuncture for chronic low back pain: an international expert survey. *The Journal of Alternative and Complementary Medicine.* 2008;14(9):1089-1095.
12. Wu S, Sapru A, Stewart MA, et al. Using acupuncture for acute pain in hospitalized children. *Pediatr Crit Care Med.* 2009;10(3):291-296.

BL 61

Pu Can “Subservient Visitor”

On the lateral foot, in a tender depression on the lateral aspect of the calcaneus, approximately 1.5 cun distal and caudal to the lateral malleolus. Directly distal to BL 60 on the proximal border of the calcaneus.

Fat Pad

- **Lateral inframalleolar fat pad:** This poorly understood structure consists of a classical unilocular fatty tissue pad distinct from the subcutaneous plane. It lies deep to BL 61 and receives a medial perforating vessel from the small (or short) saphenous vein.

Clinical Relevance: The sural nerve courses superficial to the fat pad. Injury or swelling involving the lateral inframalleolar fat pad may incite neuralgia affecting the lateral 5th toe and 4th interspace between the digits.[1] Conversely, the fat pad may cushion the local neurovascular entities and protect them from compression injury.

Nerves

- **Sural nerve (S1, S2):** Arises from the tibial and common fibular nerves (usually). Supplies the skin on the caudal and the lateral aspects of the leg, and on the lateral foot by means of its branch, the lateral dorsal cutaneous nerve. Lateral calcaneal branches supply sensation to the heel.
- **Tibial nerve (L4, L5, S1-S3):** Supplies all the muscles in the caudal compartment of the leg and the calcaneal tendon. Branches into the medial and lateral plantar nerves, the nerve for the abductor digiti minimi, the medial calcaneal branch, and a branch for the quadratus plantae muscle.[2]

Clinical Relevance: The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression. Heel pain accompanied by tingling, burning, or loss of sensation suggest neuropathic injury by compression, traction, or other causes.[3]

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[4]

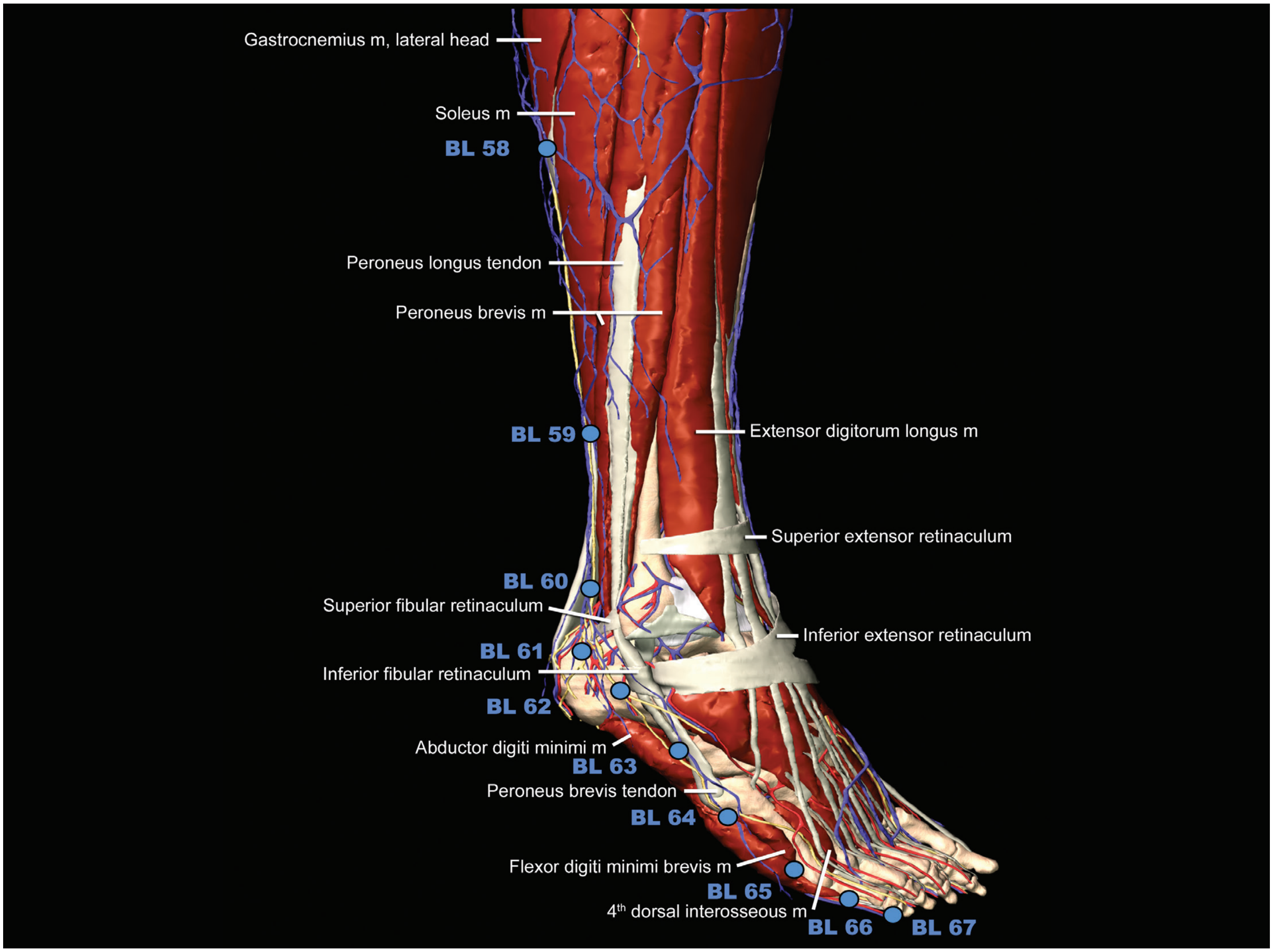

Gastrocnemius m, lateral head
Soleus m
BL 58
Peroneus longus tendon
Peroneus brevis m
BL 59
Extensor digitorum longus m
Superior extensor retinaculum
BL 60
Superior fibular retinaculum
Inferior extensor retinaculum
BL 61
Inferior fibular retinaculum
BL 62
Abductor digiti minimi m
BL 63
Peroneus brevis tendon
BL 64
Flexor digiti minimi brevis m
BL 65
4th dorsal interosseous m
BL 66
BL 67

Figure 7-121A. In ancient times, a visitor of inferior rank would kneel in front of the host, touching the site demarcated by BL 61; hence the name “Subservient Visitor”.[6] That said, the true significance of BL 61 rests with its relationship with the sural nerve and branches. This image depicts the course of the BL channel and its partner, the sural nerve, from its emergence through fascia at BL 58 to the terminal sural branches at BL 67. Patients with entrapment neuropathy of this nerve report pain and sensory loss along the distal BL channel.[7]

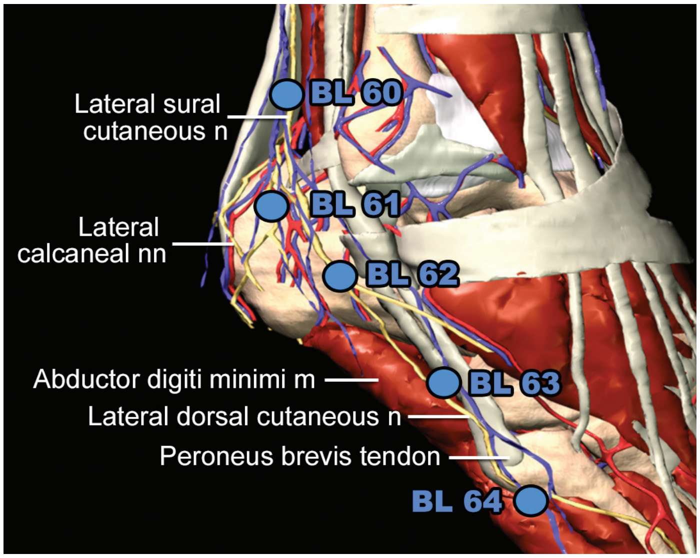


Figure 7-121B. This close-up examination of the nerves accessible to acupuncture at BL 61 reveals its value for calcaneal pain. A variety of mechanical stressors impact the calcaneus during the entire gait cycle.[8] Lateral heel pain from lateral calcaneal neuritis produces discomfort that radiates along the nerve as shown here; the pain may be difficult to localize in some cases. This contrasts with calcaneal stress fracture that leads to pain over the entire calcaneus or peroneal (fibularis) tendon disorders that cause pain on the lateral calcaneus and peroneal tubercle.

The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-121B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Vessels

- **Fibular (peroneal) artery, lateral branch:** Provides blood to the vicinity of the lateral malleolus.
- **Small saphenous vein:** Arises on the lateral side of the foot from the juncture of the dorsal venous arch with the dorsal vein of the little toe, ascends posterior to the lateral malleolus and along the lateral border of the calcaneal tendon. It ascends to the midline of the fibula and enters the deep fascia. It then ascends between the two heads of the gastrocnemius muscle and finally empties into the popliteal vein in the popliteal fossa.

Clinical Relevance: Neurovascular compression syndromes affect the lower limbs due to the anatomic configuration of vessels and nerves, as well as the orthostatic impact of the biped's upright position.[5] Vascular changes that lead to nerve compression include varicose veins, post-saphenectomy fibrotic adhesions, deep vein thrombosis, and previous phlebitis with subsequent fibrosis or scarring. Aneurysms, pseudoaneurysms, and hemangiomata can also compress nerves. Although neurovascular compression syndromes appear less commonly in the lateral ankle and foot than elsewhere on the distal limb, a patient who complains of pain, or expresses symptoms of hyperalgesia, allodynia, and paresthesias along the nerve course may be describing the sequelae of nerve entrapment due to vascular enlargement.

Indications and Potential Point Combinations

- **Swelling and pain in leg, knee, or heel:** BL 61, check for trigger points in the peroneus brevis and peroneus tertius muscles that refer to the heel.
- **Lateral heel pain:** BL 61, palpate for trigger points. Consider BL 59, BL 60, and BL 64.
- **Lateral dorsal cutaneous neuropathy:** BL 61, palpate for source of compression from BL 57 to BL 64, and needle, massage, or treat with laser therapy accordingly.

References

1. Bremond-Gignac D, Copin H, Kohler C, et al. The lateral inframalleolar fat pad: a poorly recognized anatomical structure. *Surg Radiol Anat.* 2001;23(5):325-329.
2. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.
3. Tu P and Bytomski JR. Diagnosis of heel pain. *American Family Physician.* 2011;84(8):909-916.
4. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
5. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.
6. Ellis A, Wiseman N, and Boss N. Grasping the Wind. Brookline: Paradigm Publications, 1989. P. 189.
7. Madhavi C, Isaac B, Antoniswamy B, et al. Anatomical variations of the cutaneous innervation patterns of the sural nerve on the dorsum of the foot. *Clinical Anatomy.* 2005;18:206-209.
8. Doxey GE. Calcaneal pain: a review of various disorders. *Journal of Orthopaedic and Sports Physical Therapy.* 1987;9(1):26-32.

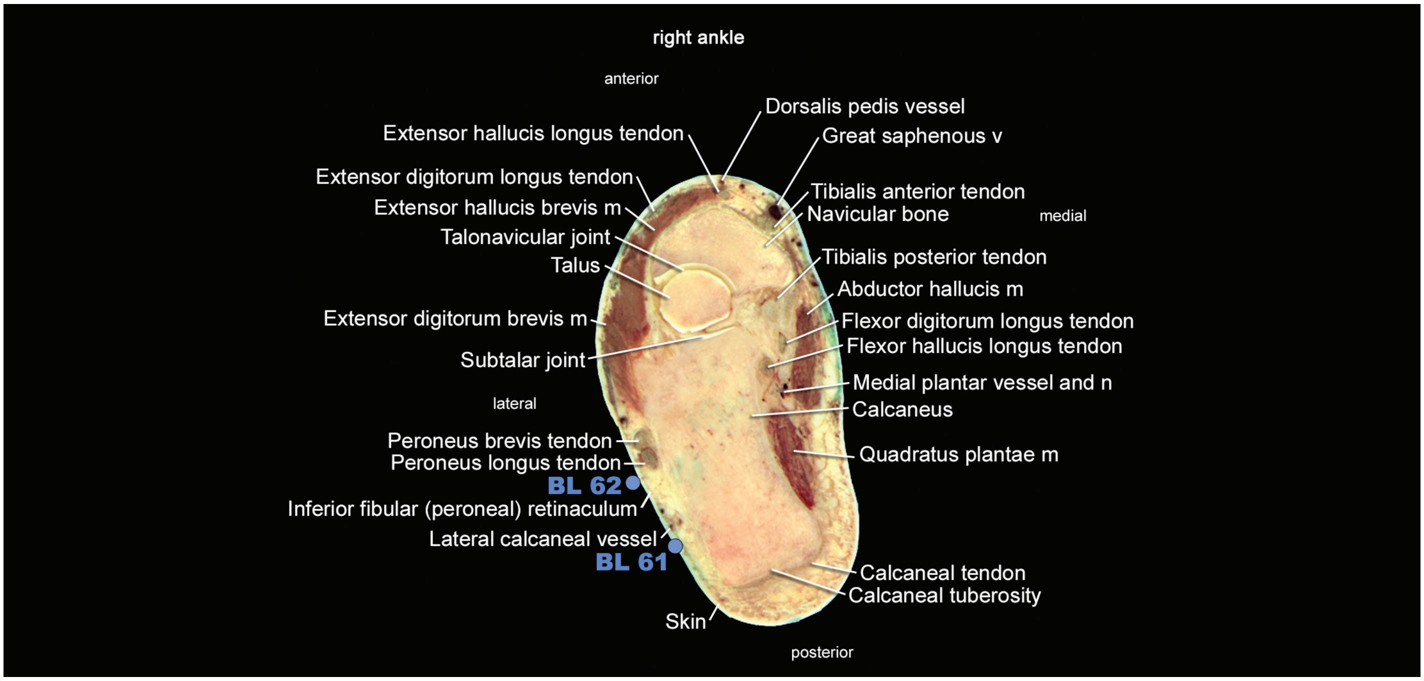

right ankle
anterior
Dorsalis pedis vessel
Extensor hallucis longus tendon
Great saphenous v
Extensor digitorum longus tendon
Tibialis anterior tendon
Extensor hallucis brevis m
Navicular bone
medial
Talonavicular joint
Talus
Tibialis posterior tendon
Abductor hallucis m
Extensor digitorum brevis m
Flexor digitorum longus tendon
Flexor hallucis longus tendon
Subtalar joint
Medial plantar vessel and n
lateral
Calcaneus
Peroneus brevis tendon
Peroneus longus tendon
Quadratus plantae m
BL 62
Inferior fibular (peroneal) retinaculum
Lateral calcaneal vessel
BL 61
Calcaneal tendon
Calcaneal tuberosity
Skin
posterior

Figure 7-122. Although little myotendinous tissue exists at this level, nerves supplying the joint as well as BL 61 and BL 62 provide proprioceptive input for joint stability and strength. Note the lateral calcaneal vessel in this image and the fatty tissue it accompanies. The lateral inframalleolar fat pad will be found in this locale.

BL 62

Shen Mai "Extending Vessel"

On the lateral side of the foot, in a depression distal to the lateral malleolus, just caudal to the peroneus (fibularis) longus and brevis tendons.

Alternate location: At the dorsal-plantar skin junction (where the skin color changes); this point is called BL 62'.

Bony Protuberance

- **Calcaneal peroneal tubercle:** An extremely variable, inconsistently present (in about 50% of feet) bony prominence constituting an embryonic remnant.[3]

Clinical Relevance: The size of the calcaneal peroneal tubercle varies in size from a small nodule less than 1 mm high to a prominent spur measuring 1 cm in elevation. Calcaneal peroneal tubercle hypertrophy can cause stenosing tenosynovitis of the peroneal tendons. Note the relationship of the tubercle to BL 62 in Figure 7-123.

Nerves

- **Sural nerve (S1, S2):** Arises from the tibial and common fibular nerves (usually). Supplies sensation to the skin on the caudal and the lateral aspects of the leg, and on the lateral foot by means of its branch, the lateral dorsal cutaneous nerve. Lateral calcaneal branches supply sensation to the heel.

Clinical Relevance: The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression. Heel pain accompanied by tingling, burning, or loss of sensation suggest neuropathic injury by compression, traction, or other causes.[4]

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[5] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-121B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Lateral heel pain from lateral calcaneal neuritis produces discomfort that radiates along the nerve as shown here; the pain may be difficult to localize in some cases. This contrasts with calcaneal stress fracture that leads to pain over the entire calcaneus or peroneal (fibularis) tendon disorders that cause pain on the lateral calcaneus and peroneal tubercle.

The yoga position "downward dog" may stretch the lateral sural cutaneous nerve and produce neuropathic pain or dysesthesia.[6]

Vessels

- **Anterior lateral malleolar artery and vein:** Supply and drain the lateral ankle rgion.

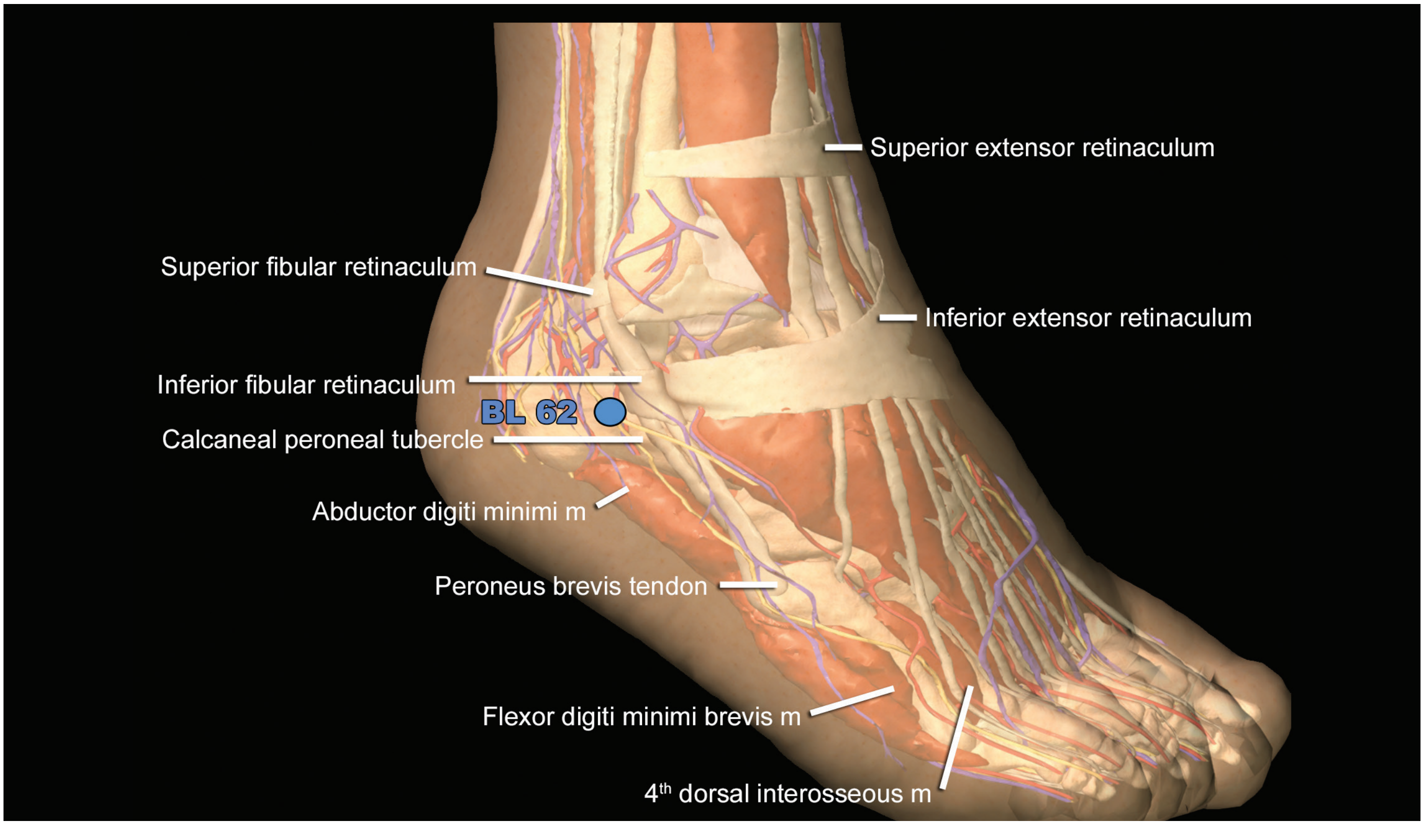

Superior extensor retinaculum
Superior fibular retinaculum
Inferior extensor retinaculum
Inferior fibular retinaculum
BL 62
Calcaneal peroneal tubercle
Abductor digiti minimi m
Peroneus brevis tendon
Flexor digiti minimi brevis m
4th dorsal interosseous m

Figure 7-123. BL 62, the "Extending Vessel" point sits at the juncture of intersecting neurovascular structures situated over the lateral dorsal cutaneous nerve and accompanying vessels. BL 62 and its coupled point, SI 3, also supposedly connect with the Governor Vessel, or Du Mai, consisting of the azygous network of veins and perispinal plexuses.

Clinical Relevance: Fractures of the proximal 5th metatarsal bone are some of the most common fractures that affect the foot; mechanisms involve falling from standing height or ankle twist with fixed forefoot.[7] Repetitive, cyclic loading can induce stress fractures of the 5th metatarsal. Inadequate circulation to this lateral portion of the foot contributes to incomplete or delayed fracture healing. Medical acupuncture, massage, and laser therapy support restoration of blood flow, resolution of pain, and bone healing.

Indications and Potential Point Combinations

- **Sore feet, supposedly "fallen arches" that may actually reflect the pain of active trigger points in muscles of the foot:** BL 62, trigger points in muscles identified as dysfunctional. Trigger points in the abductor digiti minimi radiate pain to the bottom of the foot in the distal 5th metatarsal region. For foot pain on the medial aspect, palpate for trigger points in the abductor hallucis muscle.

Flexor digitorum brevis muscle trigger points produce pain on the plantar surface of the foot. Check for trigger points in the calf as well, including the tibialis posterior, which may radiate pain to the plantar aspect of the foot.

- **Swelling and pain in leg, knee, or heel:** BL 62, BL 61, check for trigger points in the peroneus brevis and peroneus tertius muscles that refer to the heel.
- **Lateral heel pain:** BL 62, BL 61, palpate for trigger points. Consider BL 59, BL 60, and BL 64.
- **Lateral dorsal cutaneous neuropathy:** BL 62, palpate for source of compression from BL 57 to BL 64, and needle, massage, or treat with laser therapy accordingly.
- **Headaches:** BL 62, SI 3, GV 20, isolate trigger points and neuropathic nerves responsible for radiating pain to the head. Address trigeminal or vagal input to the dura if necessary.
- **Vertigo:** BL 62, SI 3, BL 10, GB 20, GV 20.
- **Back pain, especially in the lumbar region:** BL 62, BL 60, BL 40, BL 23, BL 25, BL 54, GB 30.
- **Cerebrovascular disease, spinal cord injury:** BL 62, SI 3, GV points at the level of injury.

Evidence-Based Applications

- Electroacupuncture applied to SI 3, BL 62, and four locations on the ear relating to the spinal cord contributed significantly to neurologic and functional recoveries in patients with spinal cord injuries.[1]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with lumbar disc protrusion resulted in significant pain reduction.[2]
- Consecutive stimulation of BL 62 activates the contralateral cerebellum and ipsilateral inferior parietal hemisphere.[8]

References

1. Wong AMK, Leong CP, SU TY, Yu SW, Tsai WC, and Chen CPC. Clinical trial of acupuncture for patients with spinal cord injuries. *American Journal of Physical Medicine & Rehabilitation*. 2003;82:21-27.
2. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Med*. 2000;28(1):25-33.
3. Heller E and Robinson D. Traumatic pathologies of the calcaneal peroneal tubercle. *The Foot*. 2010;20:96-98.
4. Tu P and Bytomski JR. Diagnosis of heel pain. *American Family Physician*. 2011;84(8): 909-916.
5. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res*. 2009;196:217-227.
6. Heaslet M and Patel D. Entrapment involving the lateral calcaneal branch of the sural nerve. *J Am Podiatr Med Assoc*. 2012;102(1):75-77.
7. Ding BC, Weatherall JM, Mroczek KJ, et al. Fractures of the proximal fifth metatarsal: keeping up with the Joneses. *Bull NYU Hosp Jt Dis*. 2012;70(1):49-55.
8. Yeo S, Choe IH, van den Noort M, et al. Consecutive acupuncture stimulations lead to significantly decreased neural responses. *J Altern Complement Med*. 2010;16(4):481-487.

BL 63

Jin Men "Golden Gate"

On the lateral foot, in the depression proximal to the tuberosity of the 5th metatarsal bone, plantar to the calcaneocuboid joint, at the dorsal/plantar skin junction where the skin color changes.

Tendons and Muscles

- **Peroneus (Fibularis) longus and brevis tendons:** Evert the ankle, stabilize its subtalar motion. Maximally contract with side-to-side movement and jumping. Provide proprioceptive information regarding joint position.
- **Abductor digiti minimi muscle:** Abducts and flexes the 5th digit.

Clinical Relevance: Peroneal tendon injuries occur commonly but are frequently misdiagnosed as lateral ankle sprains. The tendinopathy can become chronic and dramatically compromise foot function. In that both tendons course through the territory described by BL 63, this point becomes significant in treating lateral ankle and foot pain arising subsequent to ankle inversion injuries. Faulty biomechanics of the core and pelvic limb predispose patients to chronic atraumatic peroneal tendinopathy. Ankle instability can produce chronic tendon pathology. Peroneal tendon subluxation causes snapping along the lateral ankle, possibly accompanied by ankle weakening and pain.

Nerves

- **Superficial peroneal (fibular) nerve (L5, S1, S2):** Innervates the peroneal (fibularis) longus and brevis muscles, and provides sensation to the skin on the distal third of the anterior surface of the leg and dorsum of the foot.
- **Lateral plantar nerve (S2, S3):** Innervates the abductor digiti minimi muscle, the quadratus plantae, and the flexor digiti minimi brevis mm; a deep branch supplies the plantar and dorsal interossei muscle, the lateral three lumbrical muscles, and the adductor hallucis muscle. It also supplies the skin on the sole of the lateral one and a half digits. The inferior calcaneal nerve, the first branch of the lateral plantar nerve, supplies the abductor digiti minimi muscle at its proximal attachment to the lateral tarsus.
- **Sural nerve (S1, S2):** Arises from the tibial and common fibular nerves (usually). Supplies sensation to the skin on the caudal and the lateral aspects of the leg, and on the lateral foot by means of its branch, the lateral dorsal cutaneous nerve. Lateral calcaneal branches supply sensation to the heel.

Clinical Relevance: The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression.

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[1] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-124A) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

The yoga position "downward dog" may stretch the lateral sural cutaneous nerve and produce neuropathic pain or dysesthesia.[2]

Entrapment and neuropathy of the inferior calcaneal nerve, the first branch of the lateral plantar nerve that supplies the abductor digiti minimi muscle, can produce medial heel pain

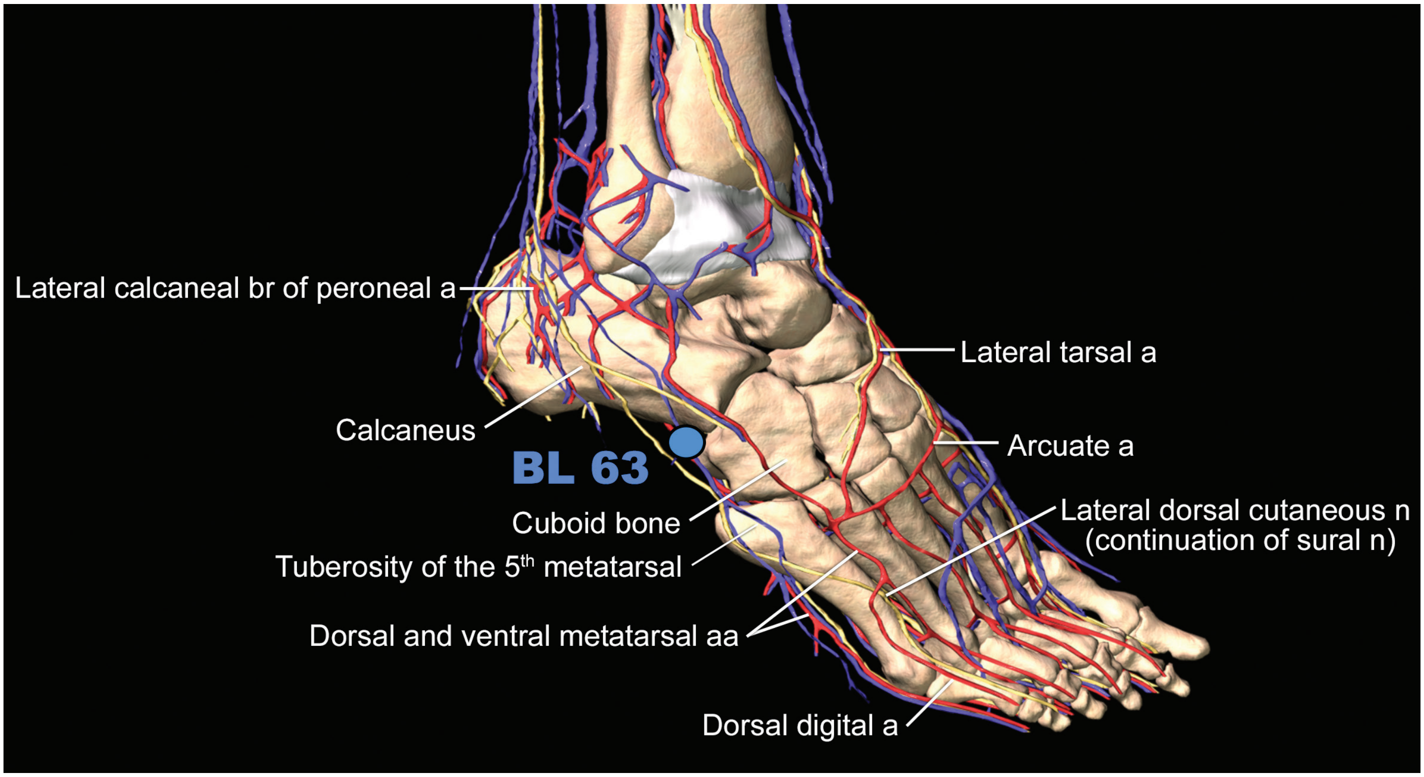

Lateral calcaneal br of peroneal a
Lateral tarsal a
Calcaneus
Arcuate a
BL 63
Lateral dorsal cutaneous n (continuation of sural n)
Cuboid bone
Tuberosity of the 5th metatarsal
Dorsal and ventral metatarsal aa
Dorsal digital a

Figure 7-124A. The arch beneath BL63, the "Golden Gate", evokes the image of the Golden Gate bridge.

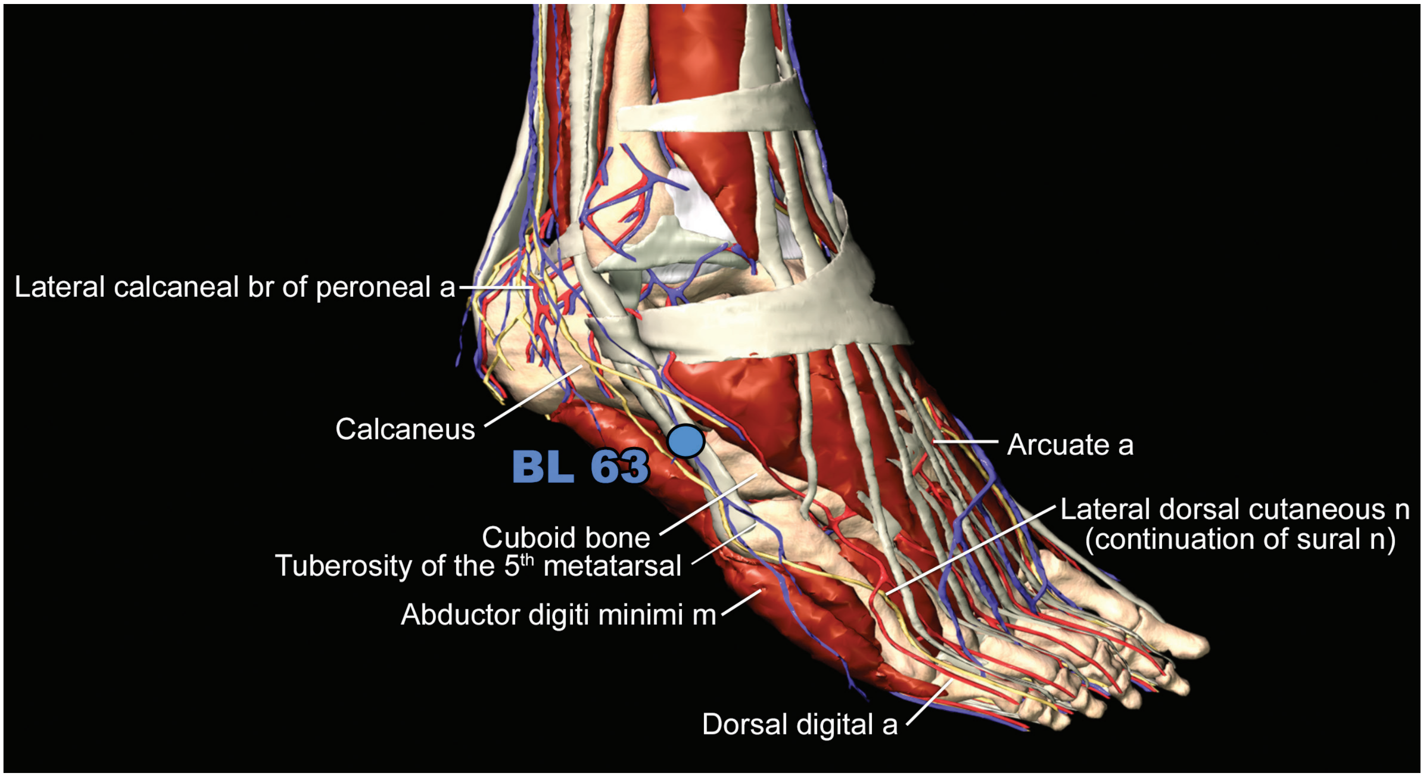

Lateral calcaneal br of peroneal a
Calcaneus
BL 63
Arcuate a
Lateral dorsal cutaneous n (continuation of sural n)
Cuboid bone
Tuberosity of the 5th metatarsal
Abductor digiti minimi m
Dorsal digital a

Figure 7-124B. This view reveals the importance of BL 63 for fibularis tendinopathy, abductor digiti minimi dysfunction, and lateral dorsal cutaneous nerve injury or entrapment. Its proximity to local vessels emphasizes its potential value for promoting blood supply to the 5th metatarsal in cases of trauma and/or fracture.

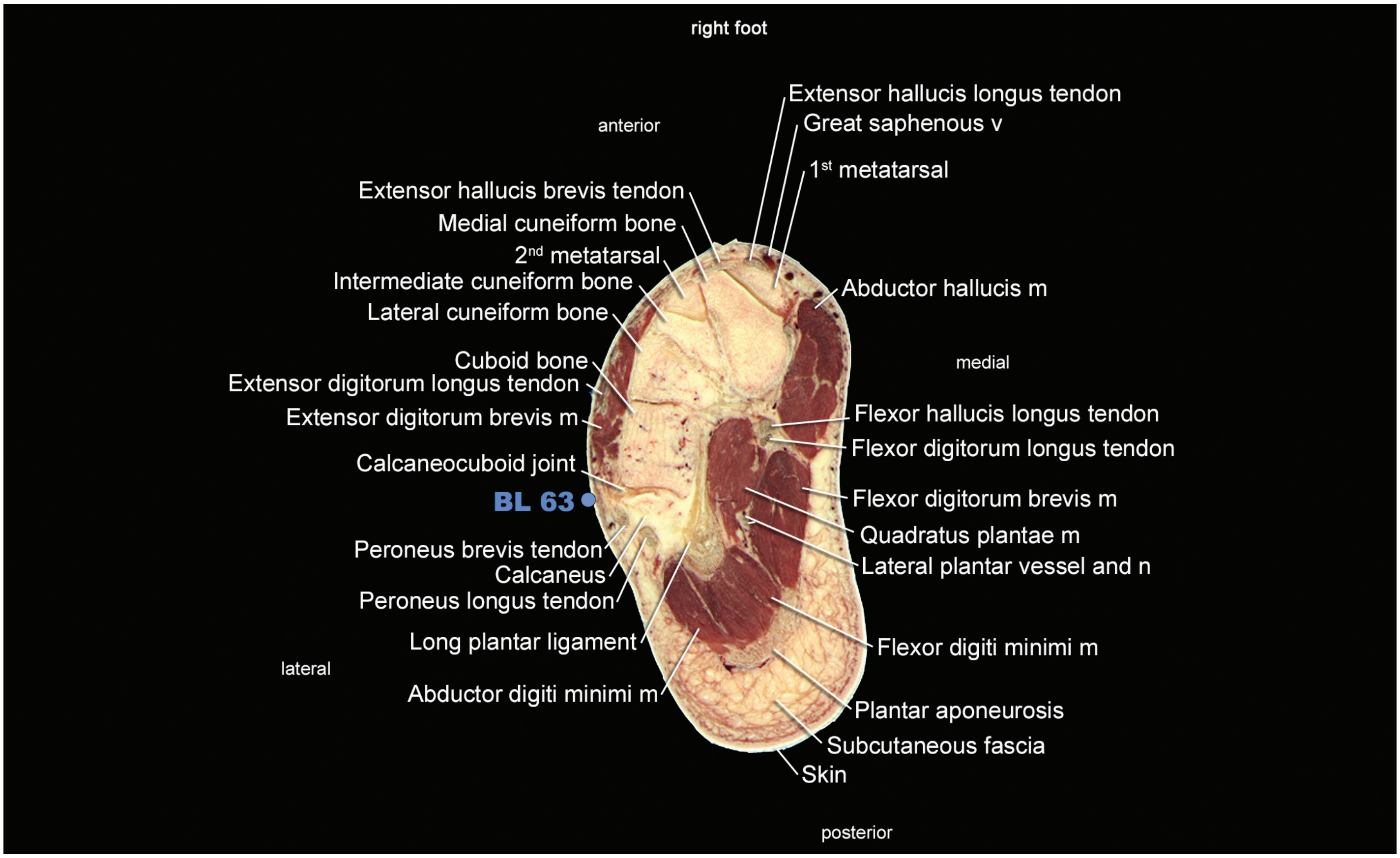

right foot
anterior
Extensor hallucis longus tendon
Great saphenous v
1st metatarsal
Extensor hallucis brevis tendon
Medial cuneiform bone
2nd metatarsal
Intermediate cuneiform bone
Lateral cuneiform bone
Abductor hallucis m
Cuboid bone
Extensor digitorum longus tendon
medial
Extensor digitorum brevis m
Flexor hallucis longus tendon
Flexor digitorum longus tendon
Calcaneocuboid joint
BL 63
Flexor digitorum brevis m
Peroneus brevis tendon
Quadratus plantae m
Calcaneus
Lateral plantar vessel and n
Peroneus longus tendon
Long plantar ligament
Flexor digiti minimi m
lateral
Abductor digiti minimi m
Plantar aponeurosis
Subcutaneous fascia
Skin
posterior

Figure 7-125. The anatomic proximity of BL 63 to the calcaneocuboid joint illustrates its value for calcaneocuboid pain (cuboid syndrome). Note that the location for BL 63 may land either atop the two tendons, providing for neuromodulation of the Golgi tendon organs they contain, or over the joint to influence arthrokinematics and joint labra (fibroadipose synovial folds) that could contribute to cuboid syndrome.

indistinguishable from plantar fasciitis. Another term for nerve entrapment of the inferior calcaneal nerve is "Baxter's neuropathy".[3] The cause of this neuropathy involves altered biomechanics due to a number of problems, including calcaneal tendinosis or posterior tibial tendon dysfunction.[4] Other causes include fallen arch, plantar calcaneal enthesophytes, and plantar fasciitis itself. Patients exhibit atrophy of the abductor digiti minimi muscle after chronic compression of the inferior calcaneal nerve. Conservative treatment measures for Baxter's neuropathy include acupuncture and laser therapy, as well as manual therapies to address plantar fascial restrictions and contributions from calcaneal tendinopathy.

Vessels

- **Anterior lateral malleolar artery and vein:** Supply and drain the lateral ankle region.

Clinical Relevance: Fractures of the proximal 5th metatarsal bone are some of the most common fractures that affect the foot; mechanisms involve falling from standing height or ankle twist with fixed forefoot. Repetitive, cyclic loading can induce stress fractures of the 5th metatarsal. Inadequate circulation to this lateral portion of the foot contributes to incomplete or delayed fracture healing. Medical acupuncture, massage, and laser therapy support restoration of blood flow, resolution of pain, and bone healing.

Indications and Potential Point Combinations

- **Lateral ankle or foot pain:** BL 63, BL 62, BL 60, BL 65.
- **Ankle instability:** BL 63, BL 62, KI 3, KI 6, relevant trigger points.
- **Atrophy of the abductor digiti minimi muscle:** BL 63, BL 60, BL 65, KI 6, KI 2, KI 3, and relevant trigger points.
- **Cuboid syndrome (calcaneocuboid joint dysfunction, causing lateral midfoot pain):** BL 63, BL 62, manual therapy may be of value unless contraindicated .

References

1. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
2. Heaslet M and Patel D. Entrapment involving the lateral calcaneal branch of the sural nerve. *J Am Podiatr Med Assoc.* 2012;102(1):75-77.
3. Dirim B, Resnick D, and Ozenler NK. Bilateral Baxter's neuropathy secondary to plantar fasciitis. *Med Sci Monit.* 2010;16(4):CS50-CS53.
4. Chundru U, Liebeskind A, Seidelmann F, et al. Plantar fasciitis and calcaneal spur formation are associated with abductor digiti minimi atrophy on MRI of the foot. *Skeletal Radiol.* 2008;37:505-510.
5. Ding BC, Weatherall JM, Mroczek KJ, et al. Fractures of the proximal fifth metatarsal: keeping up with the Joneses. *Bull NYU Hosp Jt Dis.* 2012;70(1):49-55.
6. Durall CJ. Examination and treatment of cuboid syndrome. *Sports Health.* 2011;3(6):514-519.

BL 64

Jing Gu "Capital Bone"

On the lateral foot, in a depression distal to the tuberosity of the 5th metatarsal bone, at the dorsal/plantar skin junction. The tuberosity of the 5th metatarsal bone is the most prominent bony prominence on the lateral mid-foot.

Muscles

- **Abductor digiti minimi muscle:** Abducts and flexes the 5th digit.
- **Flexor digiti minimi brevis muscle:** Flexes the proximal phalanx of the 5th digit, thereby assisting with flexion.

Clinical Relevance: Pain stemming from myofascial dysfunction in either the abductor digiti minimi or flexor digiti minimi brevis muscles may produce pain while ambulating as well as paresthesias and edema of the foot. Causes include wearing shoes that are too small for the foot, traumatic injury to the foot or toes, or wearing a cast or boot that disturbs proper foot biomechanics.

Nerves

- **Lateral dorsal cutaneous nerve of the foot (termination of the sural nerve, which usually arises from both the tibial and peroneal nerves – S1):** Provides sensation to the lateral portion of the foot.
- **Lateral plantar nerve (from tibial nerve – S1, S2):** Supplies the following muscles – quadratus plantae, abductor digiti minimi, flexor digiti minimi brevis, plantar and dorsal interosseous, lateral three lumbricals, and adductor hallucis. Supplies the skin of the sole, lateral to the midline of the 4th digit.

Clinical Relevance: From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[2] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-126) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Vessels

- Anterior lateral malleolar artery and vein: Supply and drain the lateral ankle region.

Clinical Relevance: Fractures of the proximal 5th metatarsal bone are some of the most common fractures that affect the foot; mechanisms involve falling from standing height or ankle twist with fixed forefoot.[3] Repetitive, cyclic loading can induce stress fractures of the 5th metatarsal. Inadequate circulation to this lateral portion of the foot contributes to incomplete or delayed fracture healing. Medical acupuncture, massage, and laser therapy support restoration of blood flow, resolution of pain, and bone healing.

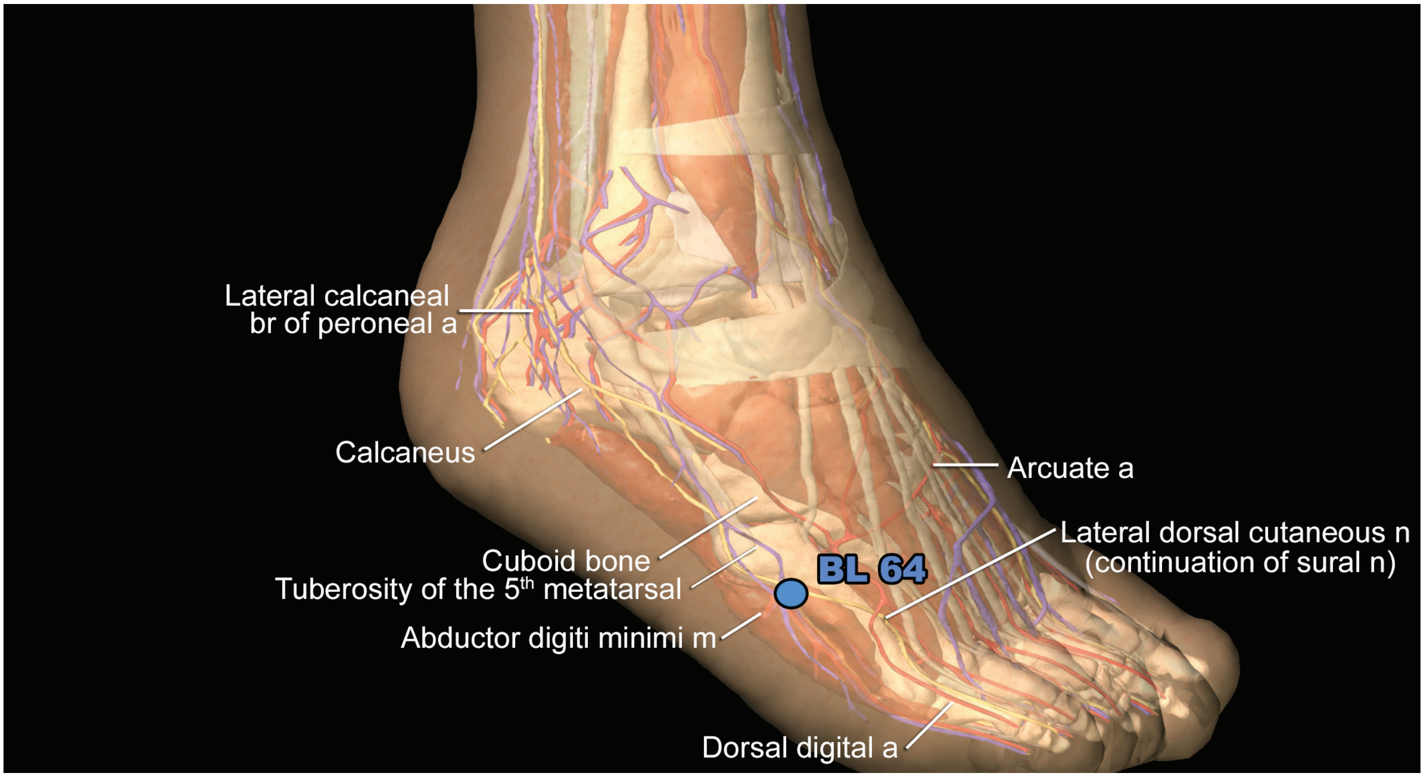

Lateral calcaneal br of peroneal a
Calcaneus
Arcuate a
Lateral dorsal cutaneous n (continuation of sural n)
Cuboid bone
BL 64
Tuberosity of the 5th metatarsal
Abductor digiti minimi m
Dorsal digital a

Figure 7-126. BL 64, the "Capital Bone" point, resides in the depression distal to the tuberosity of the 5th metatarsal, known as the "capital" bone in ancient China.[4] Note that indications for BL 64 are beginning to include non-foot problems related to sympathetic overactivation. The relatively higher proportion of sympathetic innervation to distal acupuncture points produces a greater impact on systemic autonomic neurmodulation than that afforded by more proximal sites of stimulation.

Indications and Potential Point Combinations

- **Headache, neck stiffness, low back pain, knee pain:** BL 64, BL 60, KI 10, BL 10, plus focal points for the pain itself and sources of radiation.
- **Hypertension:** BL 64, ST 36, LR 3, GV 20.
- **Tachycardia:** BL 64, ST 36, HT 3, HT 7.
- **Seizures:** BL 64, LR 3, KI 7, BL 10, GV 20, PC 6.
- **Lateral midfoot pain:** Palpate for trigger points in the abductor digiti minimi and flexor digiti minimi brevis muscles. Needle accordingly. Consider BL 64.

Evidence-Based Application

- Low frequency EA to BL 64 and BL 65 induced neuronal nitric oxide synthase (nNOS) in the gracile nucleus; enhanced neuronal nitric oxide synthase in this region may mediate **somatosympathetic reflexes.**[1]

References

1. Ma S-X. Increased neuronal nitric oxide synthase expression in the gracile nucleus of brainstem following electroacupuncture given between cutaneous hindlimb acupuncture points BL 64 & BL 65 in rats. *Acupuncture & Electro-Therapeutics Res., Int J.* 2002;27:157-169.
2. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
3. Ding BC, Weatherall JM, Mroczek KJ, et al. Fractures of the proximal fifth metatarsal: keeping up with the Joneses. *Bull NYU Hosp Jt Dis.* 2012;70(1):49-55.
4. Ellis A, Wiseman N, and Boss K. Grasping the Wind. Brookline: Paradigm Publications, 1989. P. 192

BL 65

Shu Gu "Restraining Bone" or "Bundle Bone"

On the lateral foot, in a depression proximal and plantar to the 5th metatarsophalangeal (MTP) joint, at the dorsal/plantar skin border. Locate by running the finger in a distal direction along the lateral aspect of the foot, starting from BL 64, until the finger falls into a nook proximal to the MTP joint.

Muscles

- **Abductor digiti minimi muscle:** Abducts and flexes the 5th digit.
- **Flexor digiti minimi brevis muscle:** Flexes the proximal phalanx of the 5th digit, thereby assisting with flexion.

Clinical Relevance: Pain stemming from myofascial dysfunction in either the abductor digiti minimi or flexor digiti minimi brevis muscles may produce pain while ambulating as well as paresthesias and edema of the foot. Causes include wearing shoes that are too small for the foot, traumatic injury to the foot or toes, or wearing a cast or boot that disturbs proper foot biomechanics.

Nerves

- **Lateral dorsal cutaneous nerve of the foot (termination of the sural nerve, which usually arises from both the tibial and peroneal nerves – S1):** Provides sensation to the lateral portion of the foot.
- **Lateral plantar nerve (from tibial nerve – S1, S2):** Supplies the following muscles – quadratus plantae, abductor digiti minimi, flexor digiti minimi brevis, plantar and dorsal interosseous, lateral three lumbricals, and adductor hallucis. Supplies the skin of the sole, lateral to the midline of the 4th digit.

Clinical Relevance: The lateral plantar nerve is the main nerve stimulated when walking.[2] From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[3] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-128B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Subcalcaneal pain may arise due to compression of the nerves to either the abductor digiti minimi or flexor digiti minimi brevis, branches of the lateral plantar nerve. Causes of compression include calcaneal spurs, fascial features of the foot, or myofascial restriction from other intrinsic muscles of the foot such as the quadratus plantae.[4]

Soft tissue restriction and stiffening, as occurs with diabetes mellitus and gout, negatively impacts the spatial distribution of stress.[5] A stiff foot receives less tissue nourishment and elimination of metabolic waste as a result of circulatory compromise. Injuries in the pathologic foot may begin in the deep tissues of the foot and affect, as a consequence, more superficial structures such as the plantar aponeurosis. This argues for the incorporation of acupuncture, massage, and laser therapy in systemic conditions that secondarily impact soft tissue flexibility, as it may encourage ambulation and exercise that improves overall health.

Vessels

- **Plantar metatarsal artery, from the plantar arterial arch:** Supply skin, fascia, and muscles in the foot.

Clinical Relevance: Surgery of the forefoot risks damaging the metatarsal heads by traumatizing blood supply.[6] Too, disease states such as diabetes mellitus that increase stiffness in the soft tissues of the feet show blood flow reduction due to myofascial restriction of about 28%.[7] Acupuncture and related techniques may help support recovery of microcirculation.

Indications and Potential Point Combinations

- **Headache, dizziness, stiff neck:** BL 65, BL 10.
- **Low back pain:** BL 65, BL 23, GV 4.
- **Sciatica:** BL 65, BL 36, BL 40, BL 60, KI 3.
- **Foot pain in the 5th metatarsophalangeal region:** BL 65.

Check for trigger points in the BL 63 and BL 64 regions from the abductor digiti minimi and flexor digiti minimi brevis muscles.

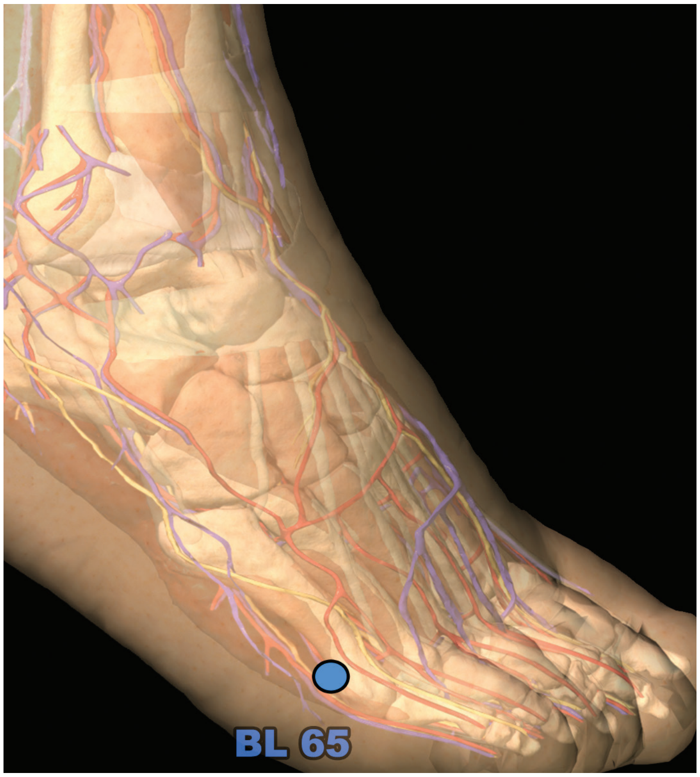


Figure 7-127. "Restraining bone" for BL 65 refers to the head of the 5th metatarsal bone where the hands reach out to when tying shoes.[8] "Bundle Bone" describes the pressure imparted onto the 5th MTP joint when wearing tight shoes.

Evidence-Based Applications

- Low frequency EA to BL 64 and BL 65 induced neuronal nitric oxide synthase (nNOS) in the gracile nucleus; enhanced nNOS in this region may mediate **somatosympathetic reflexes.**[1]

References

1. Ma S-X. Increased neuronal nitric oxide synthase expression in the gracile nucleus of brainstem following electroacupuncture given between cutaneous hindlimb acupuncture points BL 64 & BL 65 in rats. *Acupuncture & Electro-Therapeutics Res., Int J.* 2002;27:157-169.
2. Fernandez JW, Ul Haque MZ, Hunter PJ, et al. Mechanics of the foot Part 1: A continuum framework for evaluating soft tissue stiffening in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1056-1070.
3. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
4. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.
5. Fernandez JW, Ul Haque MZ, Hunter PJ, et al. Mechanics of the foot Part 1: A continuum framework for evaluating soft tissue stiffening in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1056-1070.
6. Petersen WJ, Lankes JM, Paulsen F, et al. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot Ankle Int.* 2002;23(6):491-495.
7. Mithraratne K, Ho H, Hunter PJ, et al. Mechanics of the foot Part 2: A coupled solid-fluid model to investigate blood transport in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1071-1081.
8. Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications.* Stuttgart: Thieme, 2008. P. 104.

BL 66

Tong Gu "Foot Connecting Valley" or "Valley Passage"

On the foot, in a depression distal and inferior to the 5th metatarsophalangeal joint, at the dorsal/plantar skin border. Find BL 65 first, then run the finger over the joint, into a depression at the base of the fifth toe.

Muscles

- **Abductor digiti minimi muscle:** Abducts and flexes the 5th digit.
- **Flexor digiti minimi brevis muscle:** Flexes the proximal phalanx of the 5th digit, thereby assisting with flexion. Distal to the 5th MTP, only a few fibers insert onto the lateral aspect of the base of the proximal phalanx of the little toe. These fibers have been assumed to be a separate muscle and called "opponens digiti quinti" by some anatomists, or "opponens digiti minimi" by others.

Clinical Relevance: Pain stemming from myofascial dysfunction in either the abductor digiti minimi or flexor digiti minimi brevis muscles may produce pain while ambulating as well as paresthesias and edema of the foot. Causes include wearing shoes that are too small for the foot, traumatic injury to the foot or toes, or wearing a cast or boot that disturbs proper foot biomechanics.

Nerves

- **Lateral dorsal cutaneous nerve of the foot (termination of the sural nerve, which usually arises from both the tibial and peroneal nerves – S1):** Provides sensation to the lateral portion of the foot.
- **Lateral plantar nerve (from tibial nerve – S1, S2):** Supplies the following muscles – quadratus plantae, abductor digiti minimi, flexor digiti minimi brevis, plantar and dorsal interosseous, lateral three lumbricals, and adductor hallucis. Supplies the skin of the sole, lateral to the midline of the 4th digit.

Clinical Relevance: The lateral plantar nerve is the main nerve stimulated when walking.[2] From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[3] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-128B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Subcalcaneal pain may arise due to compression of the nerves to either the abductor digiti minimi or flexor digiti minimi brevis, branches of the lateral plantar nerve. Causes of compression include calcaneal spurs, fascial features of the foot, or myofascial restriction from other intrinsic muscles of the foot such as the quadratus plantae.[4]

Soft tissue restriction and stiffening, as occurs with diabetes mellitus and gout, negatively impacts the spatial distribution of stress.[5] A stiff foot receives less tissue nourishment and elimination of metabolic waste as a result of circulatory compromise. Injuries in the pathologic foot may begin in the deep tissues of the foot and affect, as a consequence, more superficial structures such as the plantar aponeurosis. This argues for the incorporation of acupuncture, massage, and laser therapy in systemic conditions that secondarily impact soft tissue flexibility, as it may encourage ambulation and exercise that improves overall health.

Vessels

- **Dorsal and plantar digital arteries and accompanying veins:** Respectively supply and drain blood from the digits from and to their arches.

Clinical Relevance: Surgery of the forefoot risks damaging the

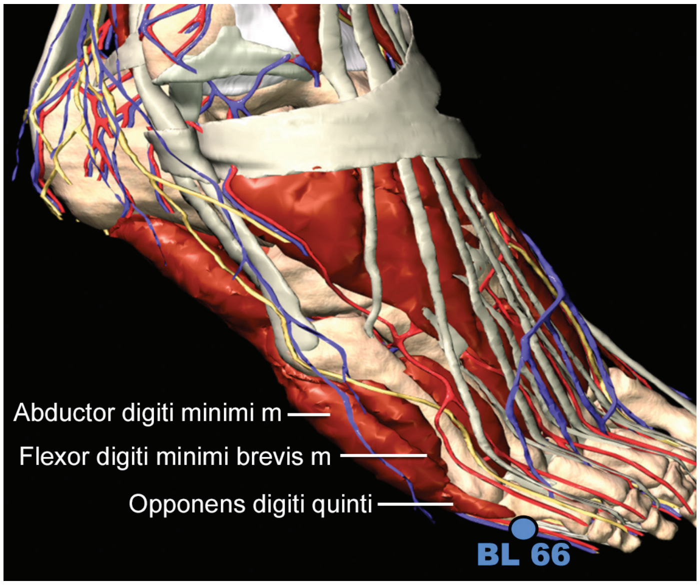


Figure 7-128A. Note the distal attachment of the opponens digiti quinti muscle at BL 66; often considered a component of the flexor digiti minimi brevis muscle. Its myotendinous attachment houses Golgi tendon organs that support proper foot mechanics and weight distribution.

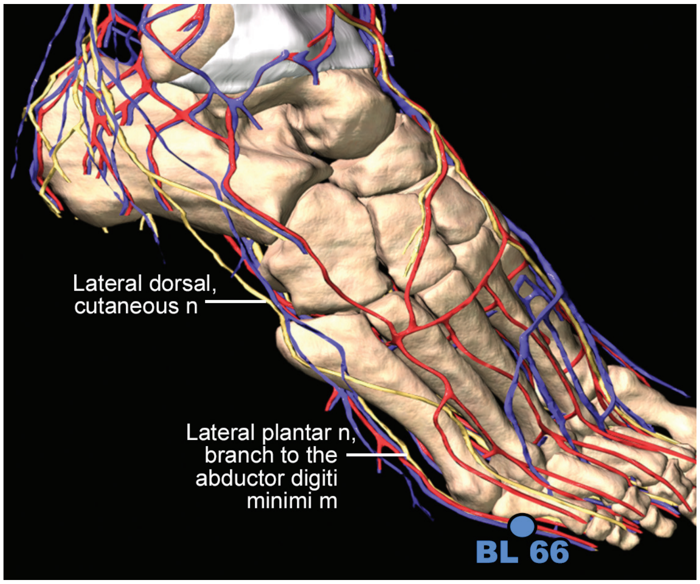

Lateral dorsal, cutaneous n
Lateral plantar n, branch to the abductor digiti minimi m
BL 66

Figure 7-128B. The name "Valley Passage" for BL 66 refers to the bony valley distal to the 5th metatarsophalangeal joint, that, by dint of its location on the lateral foot, speaks to two groups of nerves and vessels, on the dorsal and plantar aspects, as indicated here.

metatarsal heads by traumatizing blood supply.[6] Disease states such as diabetes mellitus that stiffen the soft tissues of the feet show blood flow reduction of about 28%.[7] Acupuncture and related techniques may help support recovery of microcirculation.

The distal acupuncture points on the hands and feet acquire extra importance in acupuncture due to the robust sympathetic innervation supplying vessels in these areas. The ting (most distal points) on each channel except for KI land in vessel beds packed with microvasculature as arteries transition to veins. Flow in these microvessels is dynamic; signals received by afferents in these vessels transmit information to higher centers that govern autonomic balance. As such, the clinical effects of distal points typically include hemodynamic conditions such as neck pain and vascular headache, especially for BL points, considering its trajectory to the head and neck. These influences contrast with those conferred by distal points on the ST line that treat sinusitis and dental pain, in keeping with the course of its channel over the sinuses and face. The neuroanatomic substrates for the channels' trajectories reside in the spinal cord, cranial nerves, and brain. They integrate and refine sensorimotor and autonomic control over movement and response; the acupuncture channels serve to highlight and connect the components of these neural representations of the network controlling somatic structures.

Indications and Potential Point Combinations

- **Neck stiffness, headache:** BL 66, BL 10, GB 21, SI 3.
- **Lateral foot pain:** BL 66, check for trigger points in the abductor digiti minimi muscle.

Evidence-Based Application

- Acupuncture stimulation of HT 8, BL 66, and LR 2 effectively reduced elevated body temperature induced by **bacterial inflammation,** in part by suppressing hypothalamic production of pro-inflammatory cytokines.[1]

References

1. Son Y-S, Park H-J, Kwon O-B, Jung S-C, Shin H-C, and Lim S. Antipyretic effects of acupuncture on the lipopolysaccharide-induced fever and expression of interleukin-6 and interleukin-1β mRNAs in the hypothalamus of rats. *Neuroscience Letters*. 2002;319:45-48.
2. Fernandez JW, Ul Haque MZ, Hunter PJ, et al. Mechanics of the foot Part 1: A continuum framework for evaluating soft tissue stiffening in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1056-1070.
3. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
4. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.
5. Fernandez JW, Ul Haque MZ, Hunter PJ, et al. Mechanics of the foot Part 1: A continuum framework for evaluating soft tissue stiffening in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1056-1070.
6. Petersen WJ, Lankes JM, Paulsen F, et al. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot Ankle Int.* 2002;23(6):491-495.
7. Mithraratne K, Ho H, Hunter PJ, et al. Mechanics of the foot Part 2: A coupled solid-fluid model to investigate blood transport in the pathologic foot. *Int J Numer Meth Biomed Engng.* 2012;28:1071-1081.

BL 67
Zhi Yin "Reaching Yin"

Lateral to the base of the nail of the little toe, in line with the lateral border of the nail. Otherwise known as located at the "width of a Chinese leek leaf from the corner of the nail".

Nerves

- **Lateral dorsal cutaneous nerve of the foot (termination of the sural nerve, which usually arises from both the tibial and peroneal nerves – S1):** Provides sensation to the lateral portion of the foot.
- **Dorsal digital branches of proper plantar digital nerve:** Arise from the common plantar digital nerve; supply the plantar portion of the little toe and part of the dorsal surface of the distal phalanx.

Clinical Relevance: Involved in autonomic neuromodulation, recovery of sensation to toes damaged by trauma or iatrogenic maneuvers. Connections to the lumbosacral spinal cord segments provide opportunities for neuromodulation of pelvic organ function, as shown in the ability of BL 67 to correct breech presentation through affects on the uterus and its contents.

Vessels

- **Dorsal digital branches of proper plantar digital artery and anastomosis with terminal branches of dorsal digital artery, all for the 5th toe:** Supply the dorsum of the distal phalanx and the nail bed.
- **Dorsal digital veins:** Assist in venous drainage from the foot. Terminate in the dorsal venous arch.

Clinical Relevance: Produce local and systemic autonomic neuromodulation and hemodynamic regulation through nervi vasorum supplying small vessels and connect to higher centers governing hemodynamic homeostasis.

Indications and Potential Point Combinations

- **Headache:** BL 67, BL 10, GV 20.
- **Pain or weakness in the pelvic limbs:** BL 67, ST 36, BL 40, BL 54.
- **Eye pain:** BL 67, GB 1, TH 23.
- **Heat in the soles of the feet:** BL 67, LR 3, SP 3.
- **Nasal congestion:** BL 67, LI 20, GV 24.5 (Yintang).
- **Malposition of the fetus:** Moxibustion at BL 67.
- **Placental retention:** BL 67.

Evidence-Based Applications

- Needling of BL 67 and CV 3 effectively treated **retained placenta** in a case series.[1]
- Needling GB 34, ST 36, SP 6, and BL 67 may help decrease the need for **labor induction and cesarean section.**[2]
- Acupressure at LI 4 and BL 67 significantly decreased **labor pain** during the active phase of the first stage of labor.[3]
- Acupuncture plus moxibustion, or moxibustion alone, at BL 67 safely helps reposition the fetus in cases of **breech presentation.**[4,5, 10,11]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[6]
- Acupuncture at BL 67 **activated the occipital lobe of the brain, or visual cortex.**[7] Likewise, acupuncture stimulation of BL 67 in rats caused an increase in the number of c-fos-positive cells in the primary visual cortex of binocularly deprived rats, in contrast to stimulation of BL 54, which had little effect.[8]
- Laser acupuncture at BL 67 activates the **cuneus** (corresponding to Brodmann Area 18) and the **medial occipital gyrus** (Brodmann Area 19) of the **ipsilateral visual cortex.**[9]
- Laser acupuncture at BL 67 **increased blood flow velocity in the posterior cerebral artery** with minimal changes in the anterior cerebral artery.[12]

References

1. Chauhan PA, Gasser FJ, and Chauhan AM. Clinical investigation on the use of acupuncture for treatment of placental retention. *American Journal of Acupuncture.* 1998;26(1):19-25.
2. Duke K and Don M. Acupuncture use for pre-birth treatment. A literature review and audit-based research. *Complementary Therapies in Clinical Practice.* 2005;11:121-126.
3. Chung U-L, Hung L-C, Kuo S-C, and Huang C-L. Effects of LI 4 and BL 67 acupressure on labor pain and uterine contractions in the first stage of labor. *Journal of Nursing Research.* 2003;11(4):251-259.
4. Neri I, Airola G, Contu G, Allais G, Facchinetti F, and Benedetto C. Acupuncture plus moxibustion to resolve breech presentation: a randomized controlled study. *Journal of Maternal-Fetal and Neonatal Medicine.* 2004;15:247-252.
5. Cardini F and Weixin H. Moxibustion for correction of breech presentation. *JAMA.* 1998;280(18):1580-1584.
6. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.
7. Cho ZH, Chung SC, Jones JP, Park JB, Park HJ, Lee HJ, Wong EK, and Min BI. New findings of the correlation between acupoints and corresponding brain cortices using functional MRI. *Proc Natl Acad Sci USA.* 1998;95:2670-2673.
8. Lee H, Park H-J, Kim SA, Lee HJ, Kim MJ, Kim C-J, Chung J-H, and Lee H. Acupuncture stimulation of the vision-related acupoint (BL-67) increases c-fos expression in the visual cortex of binocularly deprived rat pups. *American Journal of Chinese Medicine.* 2002;30(2&3):379-385.

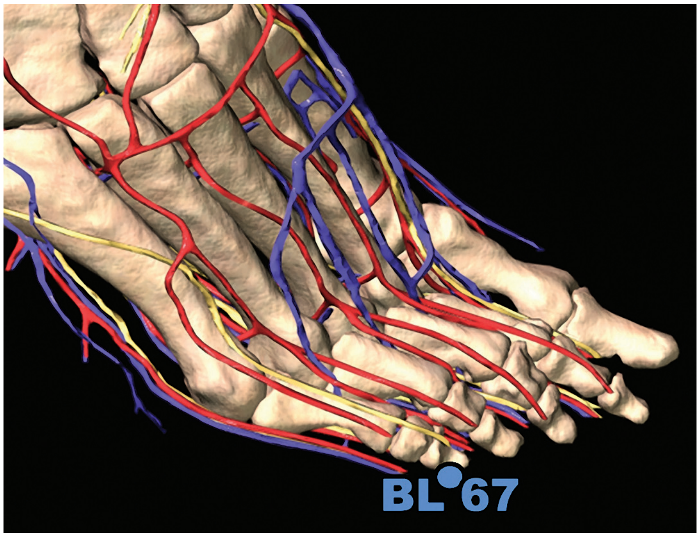
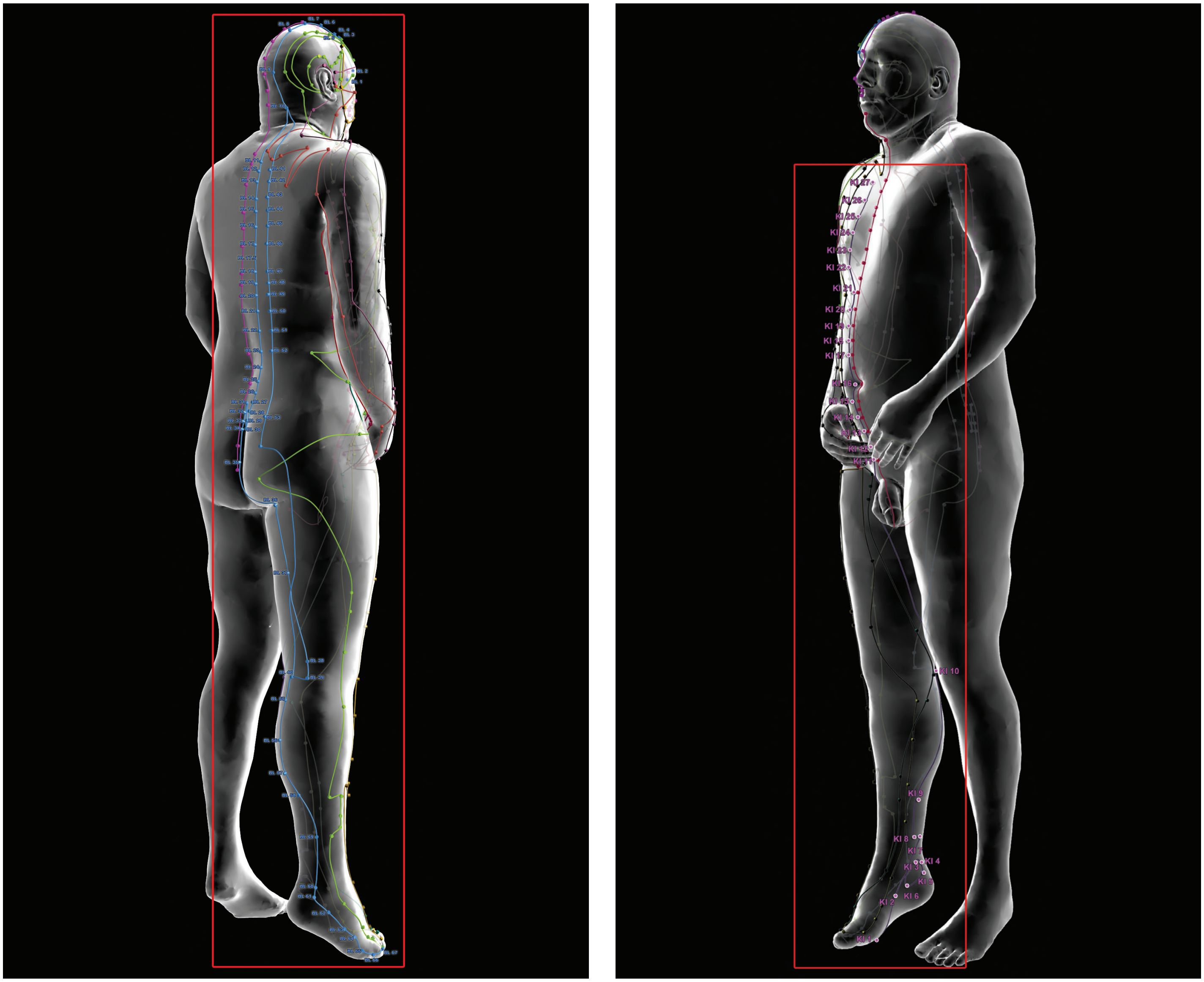


Figure 7-129. As the most distal point on the BL channel, BL 67 "reaches Yin" by contacting the ground and embarking on the next "step" as the trajectory demarcating Tai Yang of the Leg joins with Shao Yin of the Leg, i.e., the KI channel.

9. Siedentopf CM, Golaszewski SM, Mottaghy FM, Ruff CC, Felber S, and Schlager A. Functional magnetic resonance imaging detects activation of the visual association cortex during laser acupuncture of the foot in humans. *Neuroscience Letters*. 2002;327:53-56.
10. Van den Berg I, Kaandorp GC, Bosch JL, et al. Cost-effectiveness of breech version by acupuncture-type interventions on BL 67, including moxibustion, for women with a breech foetus at 33 weeks gestation: a modeling approach. *Complementary Therapies in Medicine.* 2010;18:67-77.
11. Guittier MJ, Klein TJ, Dong H, et al. Side-effects of moxibustion for cephalic version of breech presentation. *J Altern Complement Med.* 2008;14(10):1231-1233.
12. Litscher G. Cerebral and peripheral effects of laserneedle®-stimulation. *Neurol Res*. 2003;25:722-728.

Channel 8:: The Kidney (KI)

After the BL channel (below, in blue, on the left-hand image) ends on the lateral aspect of the little toe, the Kidney (KI) channel (below, in purple, on the right-hand image) picks up the trajectory on the bottom of the foot. As it travels north, the KI line encircles the medial malleolus, courses over the medial pelvic limb, and arrives at the pubis just off midline. It remains paramedian as it ascends the abdomen and thorax until it ends at the sternoclavicular junction.


KI 27
KI 26
KI 25
KI 24
KI 23
KI 22
KI 21
KI 20
KI 19
KI 18
KI 17
KI 16
KI 15
KI 14
KI 13
KI 12
KI 11
KI 10
KI 9
KI 8
KI 7
KI 4
KI 3
KI 5
KI 6
KI 2
KI 1

This side-by-side comparison illustrates the similarity of the ways in which both the BL (in blue, on the left) and KI (in purple, on the right) channels reside adjacent to the midline pathways, GV and CV, respectively.

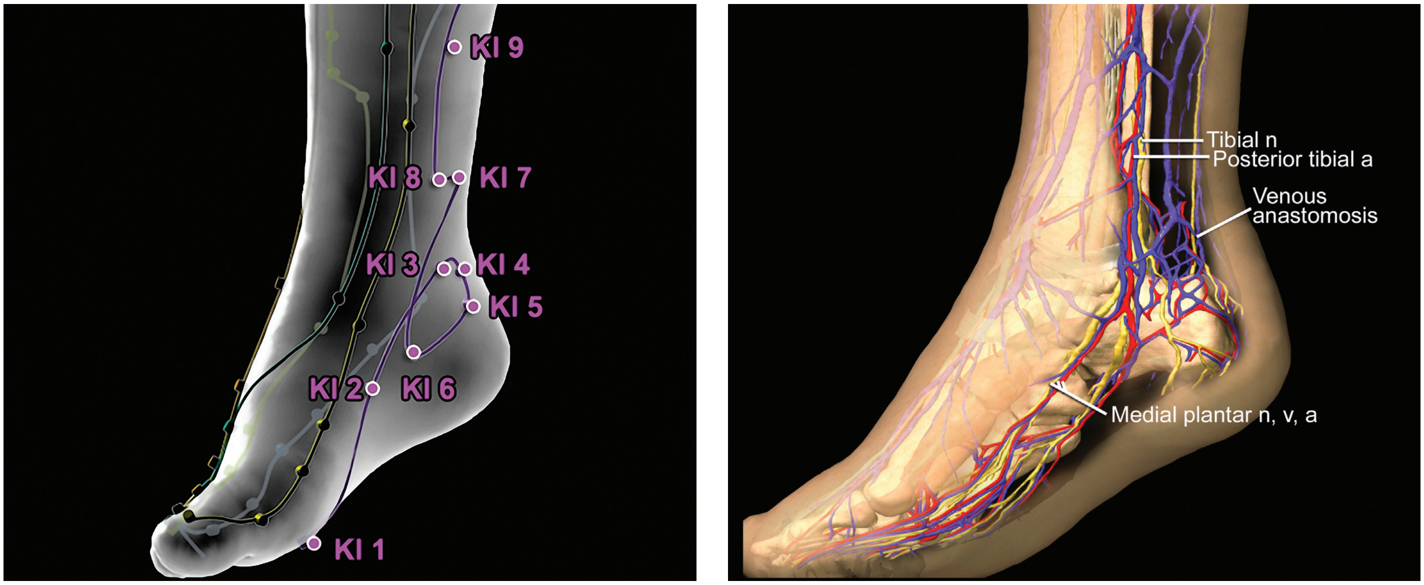
Neural Basis of the KI Channel

The fourteen channels form seven pairs: LU-LI, ST-SP, HT-SI, BL-KI, PC-TH, GB-LR, and GV-CV. Each pair exhibits anatomical complementarity, whether neural, vascular, bony, and/or myofascial. Chinese Medicine considers these Yin-Yang pairs, with Yin channels travel over more fleshy territory vulnerable to injury. Yang surfaces exhibit more dense muscularity.

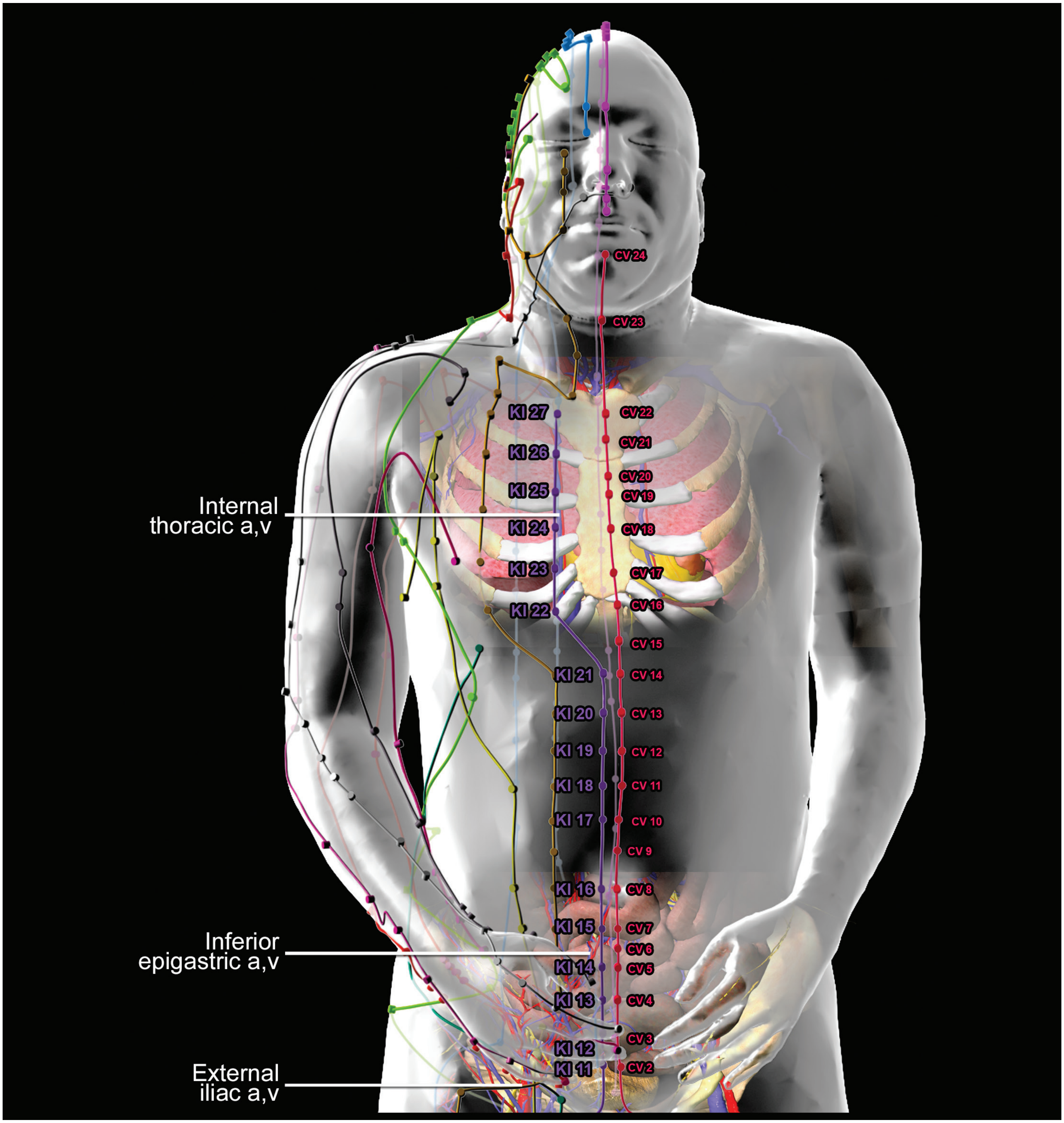
KI and BL enjoy similar parallels, as noted by comparing the two channels' trajectories in the full-length images above. Both course close to the midline over sites of spinal nerve branching. KI points on the trunk denote locations where *ventral rami* branch. Conversely, BL points correspond to loci of *dorsal* rami divisions. On the pelvic limb, KI and BL points partner with "Yin" and "Yang" divisions of the sciatic nerve, respectively. That is, KI hugs the medial (Yin) surface and tibial nerve while BL accompanies the fibular nerve more faithfully on the lateral (Yang) leg and foot.

Vascular Basis of the KI Channel

The vascular basis of the KI channel comprises the medial plantar, posterior tibial, inferior epigastric, and internal thoracic vessels, illustrated in the following images.



This comparison illustrates how the medial plantar and posterior tibial vessels follow the KI trajectory, even recapitulating the circle near the medial malleolus with a venous anastomosis.


CV 24
CV 23
KI 27
CV 22
KI 26
CV 21
KI 25
CV 20
CV 19
Internal thoracic a,v
KI 24
CV 18
KI 23
CV 17
KI 22
CV 16
CV 15
KI 21
CV 14
KI 20
CV 13
KI 19
CV 12
KI 18
CV 11
KI 17
CV 10
CV 9
KI 16
CV 8
KI 15
CV 7
Inferior epigastric a,v
CV 6
KI 14
CV 5
KI 13
CV 4
CV 3
KI 12
KI 11
CV 2
External iliac a,v

From the groin to the sternoclavicular junction, the vascular basis of the KI channel corresponds to the collateral vessel network on the thoracoabdominal wall, where inferior epigastric join internal thoracic vessels. These connections provide alternate routes for blood to bypass blockages. In the case of aortoiliac occlusion, for example, arterial blood to the pelvic limb would encourage the opening of access to these collateral channels.

KI 1

Yong Quan"Gushing Spring"

On the plantar foot, between the 2nd and 3rd metatarsal bones, in a depression that forms behind the ball of the foot when the foot is plantarflexed. Approximately 1/3 the distance from the base of the 2nd toe to the heel.[1]

An alternative location for KI 1, at the medial nail angle of the little toe, obviates the need to needle the bottom of the foot. However, structures affected differ markedly, as illustrated by Figure 8-2.

NOTE: Use judiciously; painful to needle. Consider laser therapy or myofascial work as an alternative method of stimulation.

Connective Tissues

- **Plantar aponeurosis:** The central portion of the plantar fascia that forms a thick and strong plantar aponeurosis. These longitudinally arranged bands of dense connective tissue exhibit a thick central portion, flanked on each side by weaker zones. The plantar fascia maintains the structure of the foot by supporting the longitudinal arch; its strength helps protect the plantar surface from injury.

Clinical Relevance: A number of pathologies affect the plantar aponeurosis; many lead to changes in the texture, thickness, and health of the structure.[6] When it dysfunctions, the mechanical properties of the aponeurosis become affected and, as such, changes take place in its normal deformation properties during walking and running, the interaction between the foot and footwear, and the ability of neural receptors in the aponeurosis to signal information about pressure.[7] This unique fascial structure stores part of the strain energy imparted during ambulation; it returns a portion to the foot in a quasi-elastic recoil effect that assists in maintaining the longitudinal arch of the medial foot. As such, surgical release of the plantar aponeurosis leads to arch height decrease and foot elongation.

While actual cases of plantar fasciitis result from excessive and repeated loading focused on the plantar aponeurosis,[8] the phrase "plantar fasciitis" has become a catchall diagnosis for pain affecting the sole of the foot. Not all cases of plantar pain involve the plantar aponeurosis, plantar fascia, or inflammation. In actuality, as described below in the "Muscles" section below, a number of trigger points refer pain to the plantar region. They respond remarkably well to acupuncture, massage, and laser therapy. Even in cases of actual inflammation of the plantar fascia, nonsurgical therapy should precede fasciotomy or fasciectomy, in the hope of avoiding either maneuver.[9]

Muscles and Tendons

- **Flexor digitorum brevis muscle (for the 2nd and 3rd digits):** Flexes the lateral four pedal digits (toes).

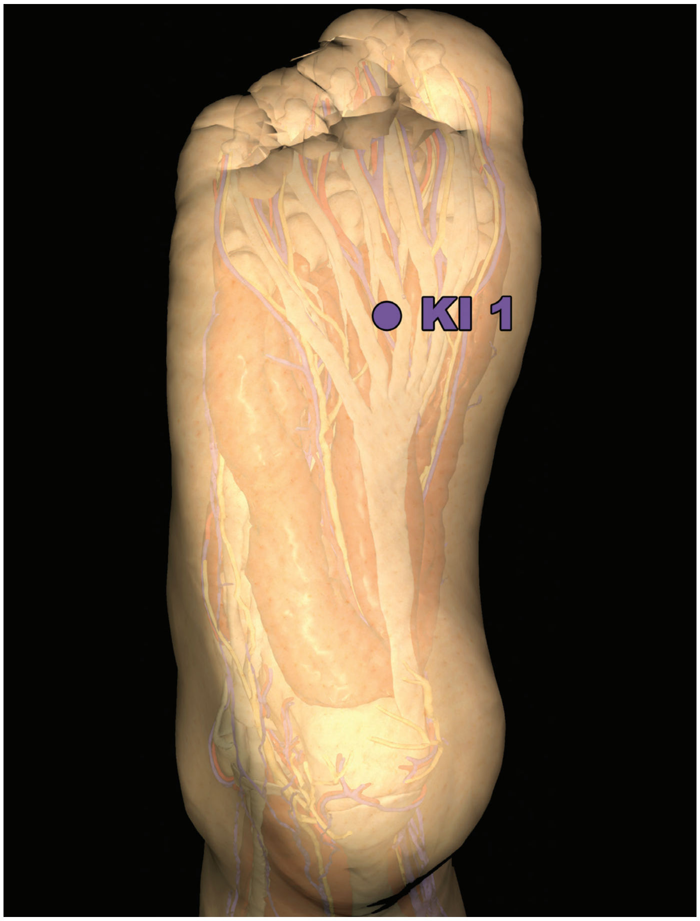


Figure 8-1. One finds KI 1, "Gushing Spring", in the well of the sole, just behind the ball of the foot.

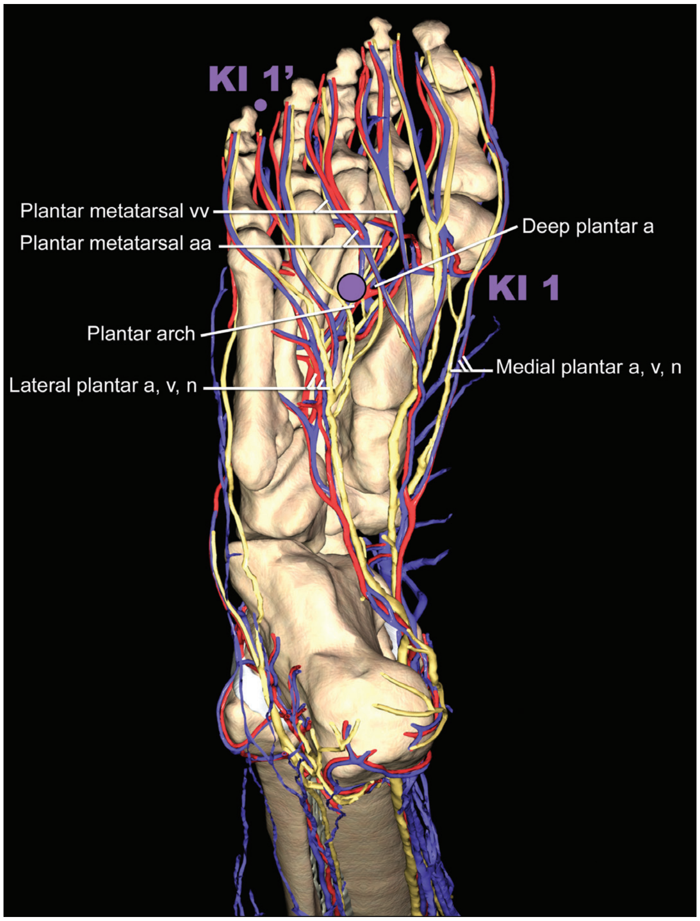


Figure 8-2. The fluid pushing through "Gushing Spring" pulsates through the deep plantar artery, shown here. This image also depicts the location of KI 1', which would one would find on the dorsum of the little toe. "KI 1'" is the alternate location for KI 1.

- **Flexor hallucis longus tendon:** Flexes both joints of the great toe, assists in plantarflexion of the ankle.
- **Flexor hallucis brevis muscle:** Flexes the hallux, or great toe.
- **1st and 2nd lumbrical muscles:** Flex the proximal phalanges and extends the middle and distal phalanges.
- **Adductor hallucis muscle, transverse head:** Adducts the great toe.
- **1st plantar interosseous muscle:** Adducts the digits and flexes the metatarsophalangeal joints.

Clinical Relevance: Muscles that refer pain to the KI 1 region include the adductor hallucis, flexor digitorum brevis, flexor digitorum longus, tibialis posterior, soleus, 1st dorsal interosseous, and even the gastrocnemius muscle. View Figure 8-4 to analyze which muscles and from which direction and depth muscles of the foot are accessible for trigger point activation by treating KI 1.

Patients bedridden for months display disuse atrophy in many muscles of the pelvic limb, but after bed rest ends, the flexor hallucis longus, flexor digitorum longus, and lateral gastrocnemius require longer than three months to recover.[10] As such, when treating patients who have been bedridden for months, return to ambulation may cause stress on weakened structures, thus more susceptible to myofascial dysfunction.

Nerves

- **Medial plantar nerve (larger terminal branch of tibial nerve):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle.
- **Lateral plantar nerve (smaller terminal branch of tibial nerve):** The lateral plantar nerve supplies the skin on the lateral sole, lateral to a line bisecting the fourth digit. It also supplies the following muscles: quadratus plantae, abductor digiti minimi, flexor digiti minimi brevis, plantar and dorsal interossei, lateral three lumbricals, and adductor hallucis.
- **The common plantar digital nerve between 2nd and 3rd toes:** Supplies the skin of the plantar surface of the toes. The dorsal surfaces of the distal tips of the toes (as in the nail bed regions) receive branches from the proper plantar digital nerves.

Clinical Relevance: Tibial nerve compression in the tarsal tunnel causes neuropathy that, in diabetic patients, can increase risk of pedal ulceration, pain, and sensory loss.[11] This may affect nerves coursing to KI 1.

Branches of the tibial nerve, including the medial plantar nerve, can become compressed by compartment syndrome in the foot. Crush injury of the foot commonly increases pressure in the foot compartments. Compression of the structures coursing through the calcaneal compartment predisposes patients to claw toes secondary to contracture of the quadratus plantae muscle.[12] Entrapment of the medial plantar nerve as it courses through the calcaneal tunnel may follow, perhaps leading to hallux varus as a complication.

The nervi vasorum of the vessels supplying KI 1 activate the autonomic neuromodulatory effects that influence local and systemic hemodynamic balance. Deep, sustained stimulation of KI 1 may invoke the "Lazarus" phenomenon of reviving individuals after cardiopulmonary arrest (when conventional measures have failed) through activation of sympathetic nerve pathways.[13]

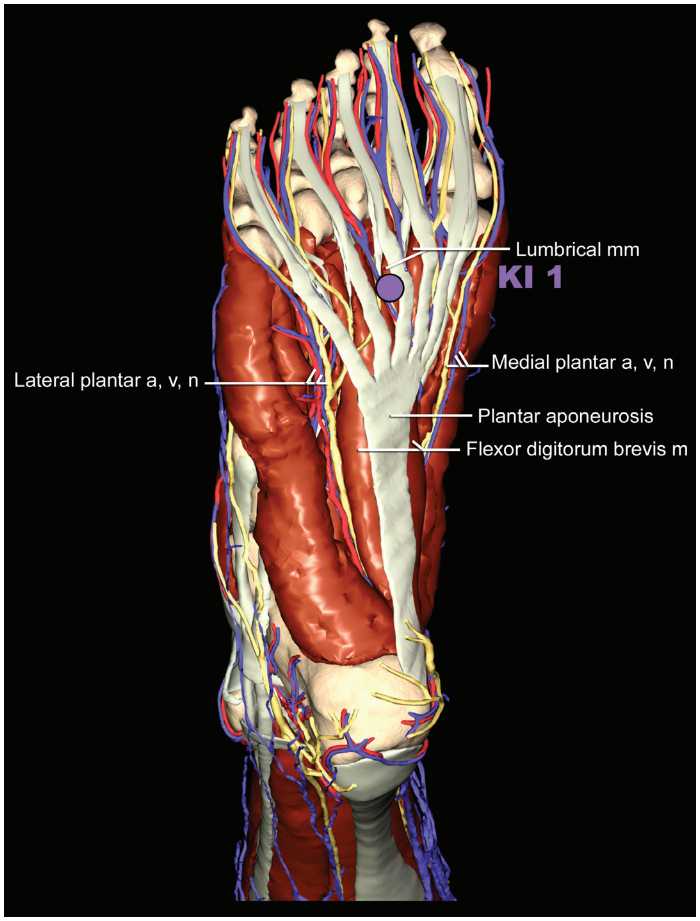


Figure 8-3. Painful disorders of the plantar aponeurosis include plantar fasciitis, calcaneal enthesophytes, rheumatoid nodules, infection, and plantar fibromatosis. However, trigger points in the deep intrinsic muscles of the foot can cause local pain mimicking other problems. In addition, referred pain from trigger points from the flexor digitorum longus, soleus, and tibialis posterior muscles may also produce significant plantar pain. Careful myofascial palpation that identifies trigger points in the adductor hallucis and flexor hallucis brevis muscles (intrinsic foot muscles) as well as more proximal sights assists in defining the source of pain. Patients may then avoid surgery through proper diagnosis and treatment with trigger point deactivation.

Vessels

- **Plantar metatarsal artery and plantar arterial arch:** The plantar arterial arch provides four plantar metatarsal arteries and three perforating arteries. These vessels supply numerous branches to the skin, fascia, and muscles of the foot. They adjoin the superficial branches of the lateral and medial plantar arteries to supply the digits through plantar digital arteries.
- **Plantar metatarsal veins and plantar venous arch:** Join the great saphenous vein.
- **Lateral plantar artery:** Unites the medial plantar artery and deep plantar artery to form the plantar arch.

Clinical Relevance: Diabetes mellitus appears to decrease the density of perivascular nerve fibers and the reactivity of vascular

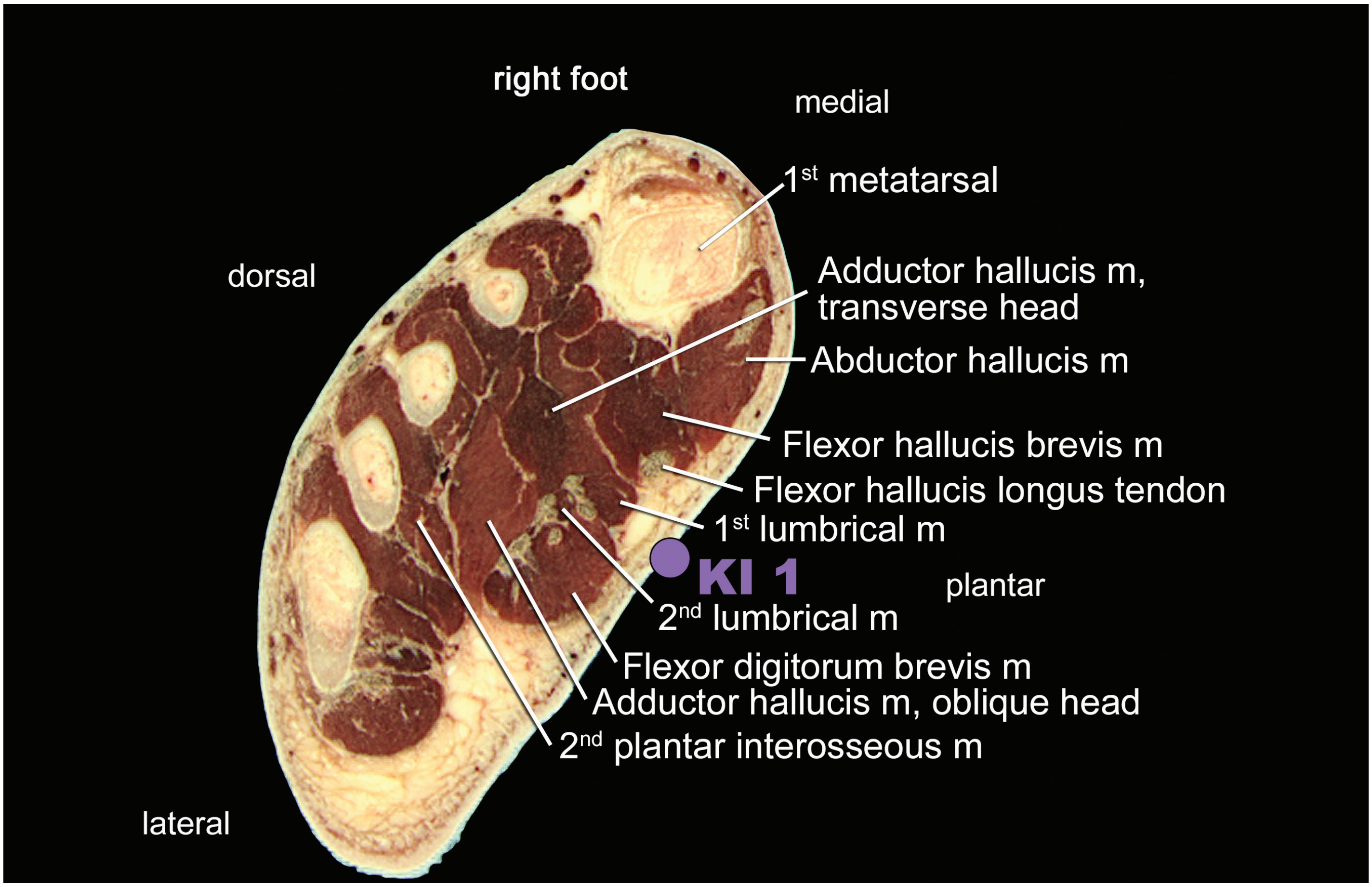

right foot
medial
1st metatarsal
dorsal
Adductor hallucis m, transverse head
Abductor hallucis m
Flexor hallucis brevis m
Flexor hallucis longus tendon
1st lumbrical m
KI 1
plantar
2nd lumbrical m
Flexor digitorum brevis m
Adductor hallucis m, oblique head
2nd plantar interosseous m
lateral

Figure 8-4. While one would not ordinarily needle KI 1 without strong cause, trigger points in the adductor hallucis and flexor hallucis brevis could produce foot pain in this region. Alternatives to needling include massage, acupressure, and laser therapy. Due to the profound sensitivity of the sole of the foot, deep needling may not be possible, although some patients tolerate this successfully. This cross-section depicts the depth and angle required to reach various trigger points in the foot with needling, laser, or manual means.

muscles in plantar metatarsal arteries.[14] This raises consideration of neuromodulation through acupuncture, laser therapy, and massage to exogenously improve circulation through similarly compromised vessels.

Reflux in foot veins is associated with venous toe and forefoot ulceration.[15] Although ulceration typically affects the dorsum of the toes and forefoot, pressure changes secondary to plantar compression and triceps surae contraction contribute to venous drainage of the foot and ankle. Neuromodulation and circulatory modulation by means of acupuncture, massage, and laser therapy should improve venous drainage and tissue maintenance.

Indications and Potential Point Combinations

- Typically reserved for extreme circumstances due to the discomfort of needling KI 1. Applications include **needle shock (i.e., vasovagal syncope after acupuncture), seizures, coma, and stroke.**
- **Plantar foot pain:** Palpate for myofascial trigger points in the adductor hallucis and flexor hallucis brevis muscles. Apply acupressure at KI1and the myofascial trigger points if found.
- **Pelvic limb paralysis:** KI 1, Bafeng, ST 36, affected nerves and spinal cord segments.
- **Memory impairment due to vascular dementia:** KI 1, LU 11, PC 9, and HT 9;[16] laser stimulation of KI 1.[17]
- Infant nasal obstruction: Pressure at KI 1.[18]

Evidence-Based Applications

- **HIV-related peripheral neuropathy** improved with electroacupuncture on BL 60, ST 36, KI 1, and LR 3.[2]
- Acupressure to KI 1, GB 34, ST 36, and SP 6 helped relieve fatigue in patients with **end-stage renal disease.**[3]
- A case series reports effectiveness of strong needling of KI 1 arousal from **coma.**[4]
- Acupressure at KI 1, HT 7, and auricular Shenmen improved both quality of sleep and quality of life among patients with **end-stage renal disease who suffered from sleep disturbance.**[5]
- **Cardiopulmonary resuscitation, unsuccessfully achieved by other means:** Place the thumbs of both hands on the patient's KI 1 of one foot with other fingers on the dorsum of the foot, also applying pressure. Apply for at least 5 minutes. As claimed by the author of a letter discussing this "Lazarus phenomenon" of producing "unexpected recovery of native circulation in apparently dead patients", thirty inpatients recovered even after other methods failed.[19] If strong thumb pressure is not an option, one can use the tip of a retracted or covered pain, the eraser end of a pencil, or the handle tip of a toothbrush.

References

1. Helms JM, Elorriaga Claraco A, and Ng A. Point Locations and Functions. Berkeley: Medical Acupuncture Publishers, 2000. P. 32.

2. Galantino MLA, Eke-Okoro ST, Findley TW, and Condoluci D. Use of noninvasive electroacupuncture for the treatment of HIV-related peripheral neuropathy: a pilot study. Journal of Alternative and Complementary Medicine. 1999;5(2):135-142.

3. Tsay S-L. Acupressure and fatigue in patients with end-stage renal disease – a randomized controlled trial. International Journal of Nursing Studies. 2004;41:99-106.

4. Liu Z, Liu H, Zhang H, and Sun S. Clinical application of the point Yongquan. Journal of Traditional Chinese Medicine. 2002;22(2):119-120.

5. Tsay S-L, Rong J-R, and Lin P-F. Acupoints massage in improving the quality of sleep and quality of life in patients with end-stage renal disease. Journal of Advanced Nursing. 2003;42(2):134-142.

6. Walker EA, Petscavage JM, Brian PL, et al. Imaging features of superficial and deep fibromatoses in the adult population. *Sarcoma.* 2012;201215810.

7. Pavan PG, Stecco C, Darwish S, et al. Investigation of the mechanical properties of the plantar aponeurosis. *Surg Radiol Anat.* 2011;33;905-911.

8. Lin S-C, Chen CPC, Tang SFT. Changes in windlass effect in response to different shoe and insole designs during walking. *Gait Posture.* 2013;37(2):235-241.]

9. Kiritsi O, Tsitas K, Malliaropoulos N, et al. Ultrasonographic evaluation of plantar fasciitis after low-level laser therapy: results of a double-blind, randomized, placebo-controlled trial. *Lasers Med Sci.* 2010;25:275-281.

10. Miokovic T, Armbrecht G, Felsenberg D, et al. Heterogeneous atrophy occurs within individual lower limb muscles during 60 days of bed rest. *J Appl Physiol.* 2012;113(10):1545-1559.

11. Gondring WH, Tarun PK, and Trepman E. Touch pressure and sensory density after tarsal tunnel release in diabetic neuropathy. *Foot and Ankle Surgery.* 2012;18:241-246.

12. Dayton P and Haulard JP. Hallux varus as complication of foot compartment syndrome. *The Journal of Foot & Ankle Surgery.* 2011;50:504-506.

13. Inchauspe A. Traditional Chinese medicine K1 Yongquan and resuscitation: another kind of "Lazarus phenomenon". *Resuscitation.* 2010;81:505-506.

14. Johansen NJ, Tripovic D, and Brock JA. Streptozotocin-induced diabetes differentially affects sympathetic innervation and control of plantar metatarsal and mesenteric arteries in the rat. *Am J Physiol Heart Circ Physiol.* 2013;304(2):H215-H228.

15. Van Bemmelen PS, Spivack D, and Kelly P. Reflux in foot veins is associated with venous toe and forefoot ulceration. *J Vasc Surg.* 2011;53:394-398.

16. He F. Influences of electro-acupuncture at related jing-well points in rats with vascular dementia. *J Tradit Chin Med.* 2012;32(2):238-242.

17. Hsieh CW, Wu JH, Hsieh CH, et al. Different brain network activations induced by modulation and nonmodulation laser acupuncture. *Evid Based Complement Alternat Med.* 2011; 011. pii: 951 011. pii: 951258. doi: 10.1155/2011/951258258. doi: 10.1155/2011/951258.

18. Xing XM. Observation on therapeutic effect of Yongquan (KI 1) acupoint sticking therapy on infantile nasal obstruction. *Zhongguo Zhen Jiu.* 2008;28(11):808-810.

19. Inchauspe A. Traditional Chinese medicine K1 Yongquan and resuscitation: another kind of "Lazarus phenomenon". *Resuscitation.* 2010;81:505-506.

KI 2

Ran Gu "Blazing Valley"

On the medial aspect of the foot, in a depression distal and inferior to the tuberosity of the navicular bone, at the dorsal/plantar skin junction.

Muscles

- **Abductor hallucis muscle:** Abducts the great toe.

Clinical Relevance: Tension and trigger point pathology of the medial foot frequently results in medial foot pain involving the abductor hallucis muscle. Trigger points in the abductor hallucis that land the vicinity of KI 2 refer pain strongly to the caudal calcaneus and along the medial foot at SP 3.

Whereas myofascial dysfunction of the abductor hallucis muscle responds quickly and dramatically to physical medicine maneuvers, compartment syndrome can constitute a surgical emergency. Compartment syndrome of the medial foot affecting the abductor hallucis muscle and neurovascular contents can follow surgery, fracture, crush injury, vascular insult, or even minor or unrecognized injury, especially in children.[1] Patients with compartment syndrome complain of the "7 P's", namely: pain, paresthesias, pulselessness, paralysis, pressure, pain with passive stretch, and induration with palpation.[2] Pain, out of proportion with the stimulus, may be the most sensitive clinical symptom.

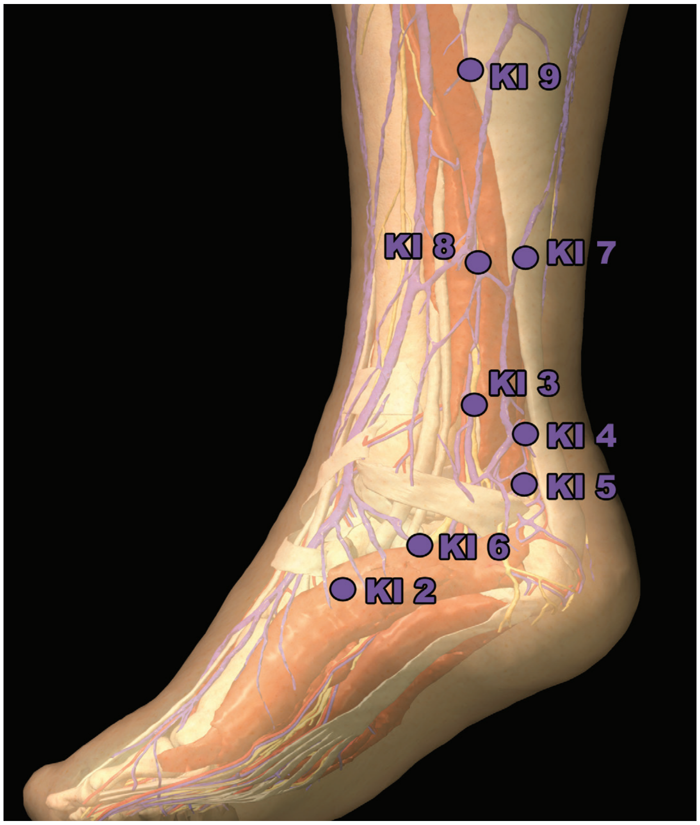


Figure 8-5. The abductor hallucis muscle, seen through semi-transparent skin in this image beneath KI 2, belongs to the group of superficial intrinsic muscles of the foot dubbed "sore foot muscles" by Travell and Simons. The pain pattern generated by myofascial trigger points in the area of KI 2 and KI 6 refer strongly to the heel, in the KI 3, KI 4, and KI 5 zone.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Medial plantar nerve (larger terminal branch of tibial nerve):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle. Figure 8-6 depicts and compares the courses of the medial and lateral plantar nerves and vessels. The tibial nerve branches into the medial and lateral plantar nerves that each travel through individual tunnels separated by a septum. The site of bifurcation of the tibial nerve into the plantar couple identifies a source of compression at the ankle. Inside the tunnel through which the medial plantar nerve courses, the abductor hallucis muscle forms the roof. Tension and contracture of the abductor hallucis muscle can compress the nerve, causing numbness, tingling, cramping, and burning pain on the plantar foot at the metatarsal heads and possibly the heel.[3] Symptoms of tarsal tunnel syndrome, which this condition is called, worsen with weight bearing and pressure applied to the tunnel. They improve with both rest and elevation of the foot. On neurologic examination, sensory examination may reveal reduction in two-point discrimination and vibratory perception of the great toe. Some patients report a history of surgical release for plantar fasciitis with insufficient relief; these individuals may have been experiencing plantar nerve compression misdiagnosed as plantar fasciitis. While surgical release of the tarsal tunnel serves as one option, many patients would prefer likely conservative approaches to reduce myofascial restriction.

Clinical Relevance: Tibial nerve compression in the tarsal tunnel causes neuropathy that, in diabetic patients, can increase risk of pedal ulceration, pain, and sensory loss.[4] This may affect nerves coursing through KI 2.

Branches of the tibial nerve, including the medial plantar nerve, can also experience compression during compartment syndrome in the foot. Crush injury of the foot commonly increases pressure in the foot compartments. Compression of the structures coursing through the calcaneal compartment predisposes patients to claw toes secondary to contracture of the quadratus plantae muscle.[5] Entrapment of the medial plantar nerve as it courses through the calcaneal tunnel may follow, perhaps leading to hallux varus as a complication.

Vessels

- **Medial plantar artery:** This small artery mainly supplies the muscles of the great toe, but most of the plantar digital arteries arise from the medial plantar artery. Its superficial branch provides circulation to the skin on the medial aspect of the sole.

This branch gives off digital branches which accompany the medial plantar nerve's digital nerve branches.

- **Medial marginal vein of the foot:** Joins the great saphenous vein, receiving blood from the superficial veins of the sole which form the plantar venous network.

Clinical Relevance: Diabetes mellitus decreases the density of perivascular nerve fibers and the reactivity of vascular muscles

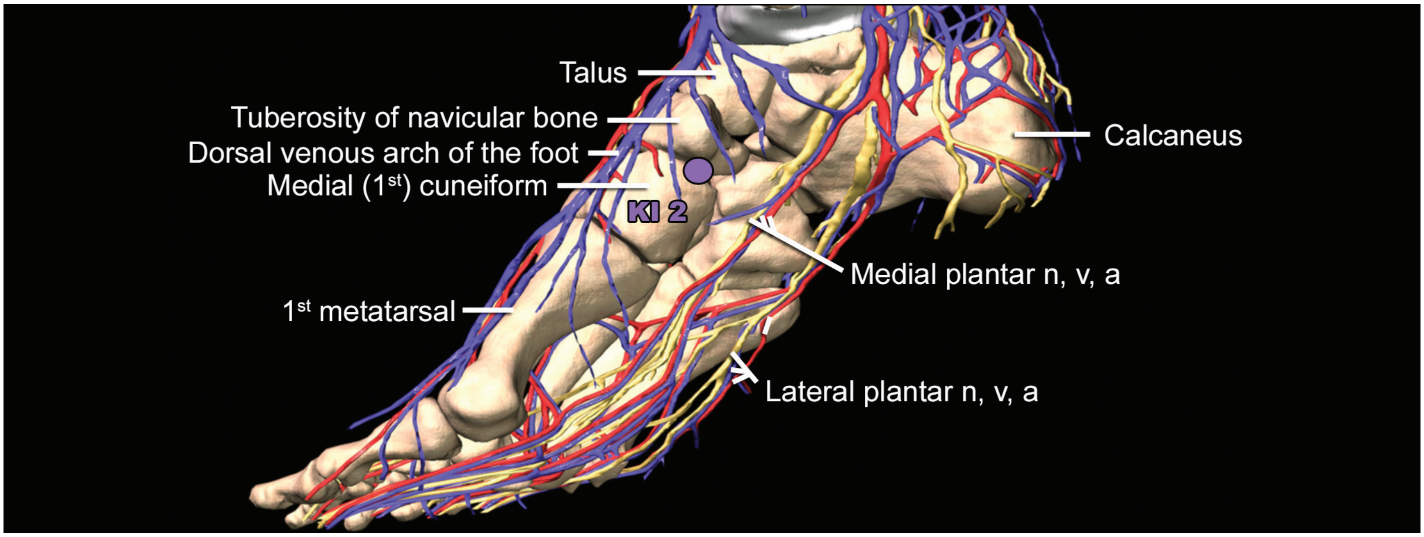


Figure 8-6. While the "blazing" in "Blazing Valley" may refer to the foot pain experienced when an examiner presses a trigger point at KI 2, "valley" indicates the the depression distal and plantar to the tuberosity of the navicular bone.

in plantar metatarsal arteries.[6] This raises consideration of neuromodulation through acupuncture, laser therapy, and massage to exogenously improve circulation through similarly compromised vessels.

Reflux in foot veins is associated with venous toe and forefoot ulceration.[7] Although ulceration typically affects the dorsum of the toes and forefoot, pressure changes secondary to forces affecting the arch as well as contraction of the triceps surae muscles (i.e., gastrocnemius and soleus muscles) contribute to venous drainage of the foot and ankle. Neuromodulation and circulatory balance provided by acupuncture, massage, and laser therapy should improve venous drainage and tissue maintenance.

Compartment syndrome of the medial foot may result in increased venous and capillary pressures due to venous outflow obstruction.[8] Arterial blood has difficulty entering the fixed space, causing ischemia that compromises the integrity of capillary walls. As permeability of the walls increase, edema, hypoxia, and acidosis take hold. Complications such as nerve and muscle dysfunction ensue after three hours of ischemia. Damage to nerves may become irreversible after 12-24 hours, about the time that muscle contracture begins. While awaiting or considering urgent fasciotomy, treatment with laser therapy may aid tissue health. However, given the urgency required for surgical treatment, practitioner should not delay proper diagnosis or treatment of compartment syndrome in order to wait and see if physical medicine treatments help over the course of several days.

Pseudoaneurysm of the medial plantar artery may follow trauma, iatrogenic vascular intervention, or intravenous drug administration.[9] Although pseudoaneurysm of the lateral plantar artery more commonly occurs, it can afflict the medial vessel in cases of ankle sprain, penetrating injury, iatrogenic causes such as arthroscopy and fracture fixation, and contusion. Patients exhibit pain, swelling, and hematoma from the trauma, the pseudoaneurysm, or both. Left untreated, pseudoaneurysms may either resolve spontaneously or grow gradually and compress the local neurovascular structures. When a pseudoaneurysm falls in the vicinity of KI 2, tibial nerve compression and tarsal tunnel syndrome may result. Whether surgical or nonsurgical means are employed to address the vascular damage, acupuncture, laser, and massage can improve nerve function and circulation, allowing the patient to recover more fully.

Indications and Potential Point Combinations

- **Reproductive problems:** Pain, irregular menses, uterine prolapse, vulvar pruritus: KI 2, LR 5, CV 2.
- **Urinary disorders, including cystitis:** KI 2, SP 6, CV 3, BL 28, BL 32.
- **Foot pain, medial aspect:** Palpate for trigger points, select KI 2 plus local points for dysfunctional abductor hallucis muscle.
- **Tarsal tunnel syndrome:** KI 3, KI 5, KI 6, KI 2, SP 6, local trigger points. Laser therapy, massage to entire ankle to free surrounding fascia.

References

1. Sinikumpu J-J, Lepojarvi S, Serlo W, et al. Atraumatic compartment syndrome of the foot in a 15-year-old female. *The Journal of Foot and Ankle Surgery*. 2013;52(1):72-75.
2. Lam SK, McAlister J, Oliver N, et al. Bilateral medial foot compartment syndrome after an aerobics class: a case report. *The Journal of Foot & Ankle Surgery*. 2012;51:652-655.
3. Thoma A and Levis C. Compression neuropathies of the lower extremity. *Clin Plastic Surg*. 2003;30:189-201.
4. Gondring WH, Tarun PK, and Trepman E. Touch pressure and sensory density after tarsal tunnel release in diabetic neuropathy. *Foot and Ankle Surgery*. 2012;18:241-246.
5. Dayton P and Haulard JP. Hallux varus as complication of foot compartment syndrome. *The Journal of Foot & Ankle Surgery*. 2011;50:504-506.
6. Johansen NJ, Tripovic D, and Brock JA. Streptozotocin-induced diabetes differentially affects sympathetic innervation and control of plantar metatarsal and mesenteric arteries in the rat. *Am J Physiol Heart Circ Physiol*. 2013;304(2):H215-H228.
7. Van Bemmelen PS, Spivack D, and Kelly P. Reflux in foot veins is associated with venous toe and forefoot ulceration. *J Vasc Surg*. 2011;53:394-398.
8. Lam SK, McAlister J, Oliver N, et al. Bilateral medial foot compartment syndrome after an aerobics class: a case report. *The Journal of Foot & Ankle Surgery*. 2012;51:652-655.
9. Park S-E, Kim J-C, Ji J-H, et al. Post-traumatic pseudoaneurysm of the medial plantar artery combined with tarsal tunnel syndrome: two case reports. *Arch Orthop Trauma Surg*. 2012; Oct 8. DOI 10.1007/s00402-012-1672-7.

KI 3

Tai Xi "Supreme Stream", "Great Torrent", or "Great Ravine"

On the medial ankle region, midway between the most prominent aspect of the medial malleolus and the caudal border of the Achilles tendon, immediately caudal to the pulsation of the posterior tibial artery. Lands between the tendons of the flexor hallucis longus (caudal to KI 3) and the flexor digitorum longus (cranial to KI 3), shown in Figure 8-8.

Muscles and Tendons

- **Flexor digitorum longus tendon:** Flexes the lateral four pedal digits. Supports the longitudinal pedal arch and plantarflexes the ankle.
- **Flexor hallucis longus muscle and tendon:** Flexes all joints of the great toe.

Supports medial longitudinal pedal arches. Weakly plantarflexes the ankle. The flexor hallucis longus tendon passes through a sheath created by the flexor retinaculum at the caudal talus and a fibro-osseous tunnel formed along the medial calcaneus and distal sustentaculum tali. The tendon changes direction at a number of sites, including the caudal talar tubercles, sustentaculum tali, the Master Knot of Henry, and the 1st metatarsophalangeal-sesamoid joint complex. These anatomic pulley sites can coincide with areas of tendon injury and pathology.[14] Cysts, exostoses, muscle hypertrophy, the presence of accessory muscles, and more further impact the tendon and predispose it to problems. Also, the flexor hallucis longus tendon is vulnerable to traumatic injury along its entire route.[15]

- **Plantaris tendon:** Assists the gastrocnemius muscle in knee flexion and ankle plantarflexion.
- **Posterior tibialis tendon:** The posterior tibialis inverts the foot and provides ankle plantarflexion.

Clinical Relevance: Trigger point pathology in the flexor digitorum muscle at about the level of BL 56 travels down the tendon, coursing through KI 3 and KI 7, expanding to the sole of the foot. Trigger points in the calf at about BL 56 and BL 57, refer pain strongly to BL 57 and even more strongly to the calcaneal tendon before reaching the sole of the foot. Sustained trigger point dysfunction and myofascial restriction shorten myofibrils and place added tension on tendons, impacting biomechanics and subjecting loci crossing bony prominences to extra wear and tear.

Repetitive tendon injuries that become chronic state lead to pain and disability. Chronic tendon disorders fall into two general categories: stenosing tenosynovitis and tendinosis.[16] Stenosing tenosynovitis manifests as adhesions that interfere with tendon glide. Tendinosis, on the other hand, involves degeneration of the connective tissue exhibited as tears with nodule production, tendon thickening, mucoid degeneration, and/or lengthening of the tendon. Tendon lengthening contributes to hypermobile joints and other biomechanical dysfunction. Stenosing tenosynovitis frequently affects the flexor hallucis longus tendon of ballet dancers due to the en pointe position they employ, placing large

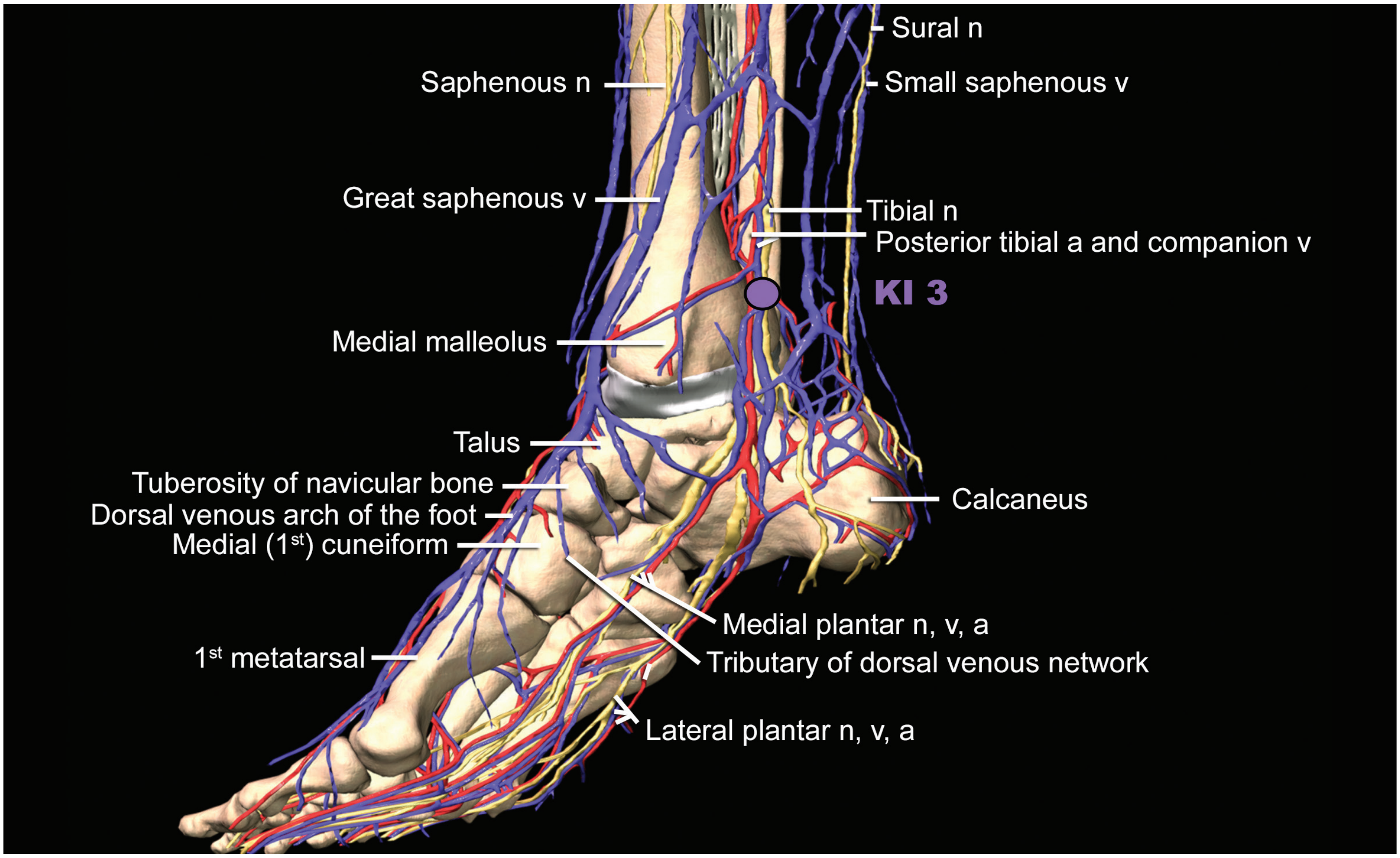


Figure 8-7A. The "Gushing Spring" (KI 1) where the KI line began becomes a "Great Torrent" at KI 3. The deeper structures shown here illustrate the neurovascular continuity between the bottom of the foot where KI 1 resides and KI 3.

supraphysiologic loads on the tendon; hence, the term "dancer's tendonitis". However, patients involved in equestrian activities, long distance running, sports requiring jumping, and tennis have also exhibited this condition. Running on the forefoot predisposes patients to developing tendonitis.[17] Tendinosis, in contrast, targets the tibialis posterior, calcaneal, and fibularis (peroneal) tendons.

The diagnosis of flexor hallucis longus stenosing tenosynovitis can be challenging, as patients simultaneously exhibit signs of not only tendon pathology, but also plantar fasciitis and tarsal tunnel syndrome. Many patients with this problem have already undergone conservative and/or surgical protocols for one or more of these conditions by the time they present for acupuncture or surgery; they continue to complain of pain and disability because the correct diagnosis has remained elusive. Myofascial palpation of the calf, ankle, and foot should aid in revealing the sources of trigger point pathology and soft tissue abnormalities.

Patients with flexor hallucis longus stenosing tenosynovitis may initially experience pain and tenderness at the caudomedial malleolar region (near KI 3). They then report that the pain radiates toward and along the medial arch of the foot.

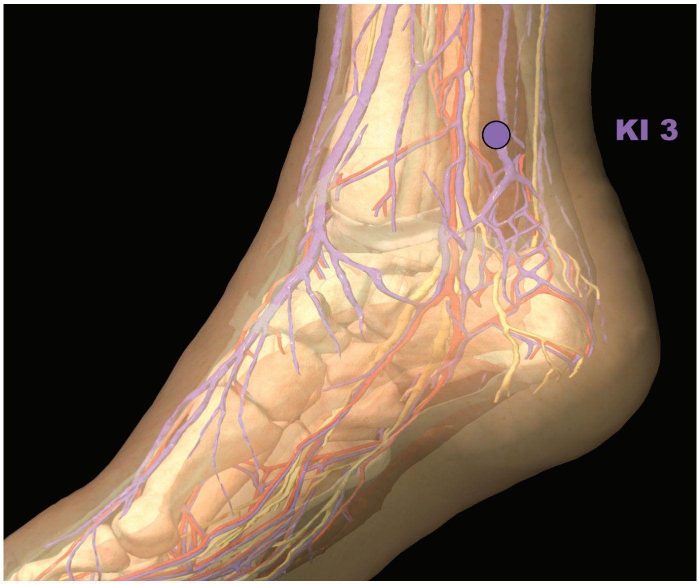


Figure 8-7B. The ravine containing the "raging torrent" of arterial blood flow beneath KI 3 consists of the groove formed between the tibia and the calcaneal tendon. One isolates KI 3 in the deep hole at the base of the ravine.

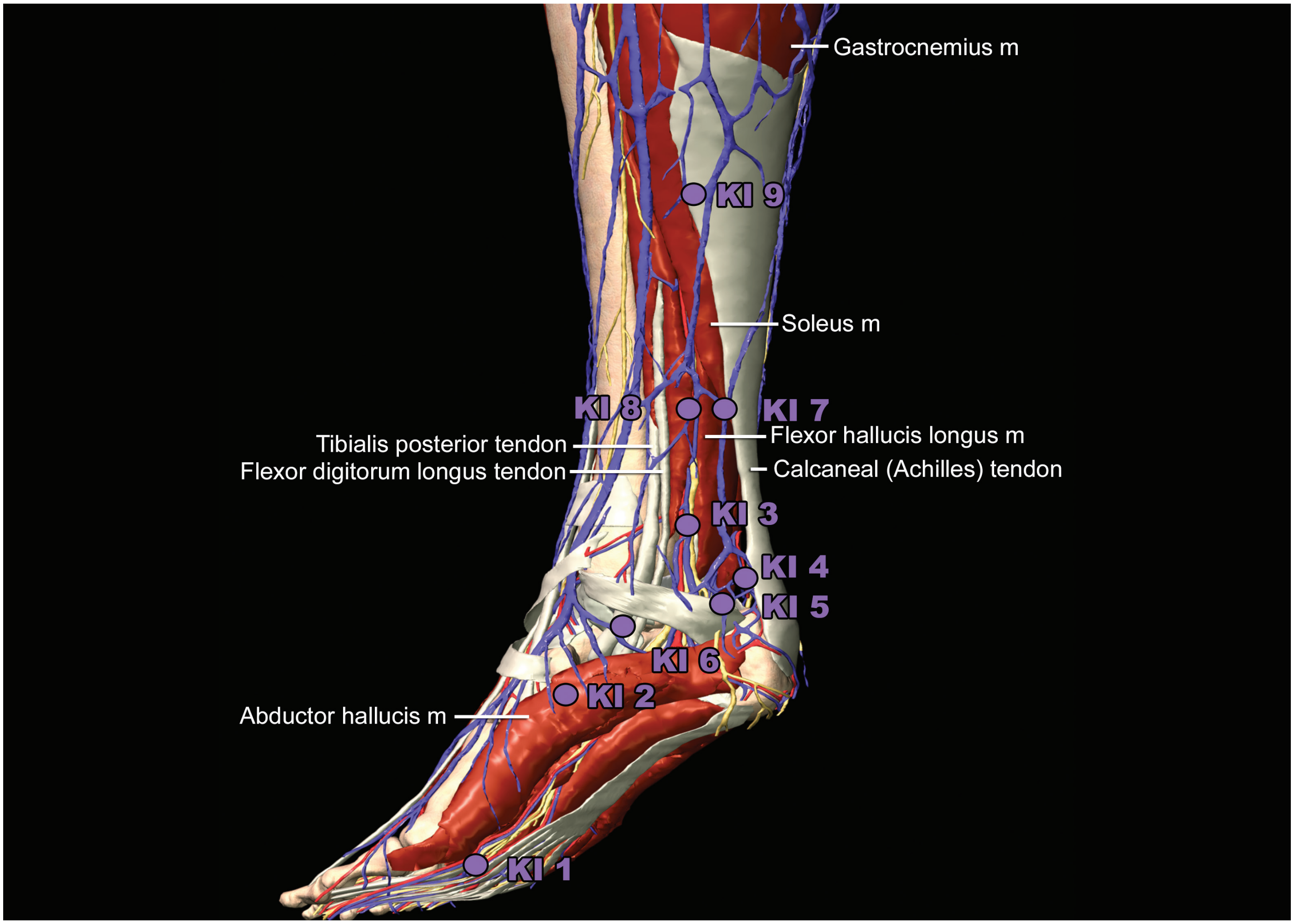


Figure 8-8. Two tendons, the flexor digitorum longus and flexor hallucis longus, create a groove that coddles KI 3 and its neural partner, the tibial nerve. Myofascial release of the tissue involving these two myotendinous structures from KI 3 to KI 7 and KI 8 will help relieve pressure on the nerve. Pain in the foot from tibial nerve compression at the ankle (a.k.a., tarsal tunnel syndrome) leads to pain that may be confused with plantar fasciitis. However, symptoms of plantar fasciitis improve with stretching and activity and worsen in the morning after first arising, whereas those associated with tarsal tunnel syndrome worsen with running and at the end of the day.[28]

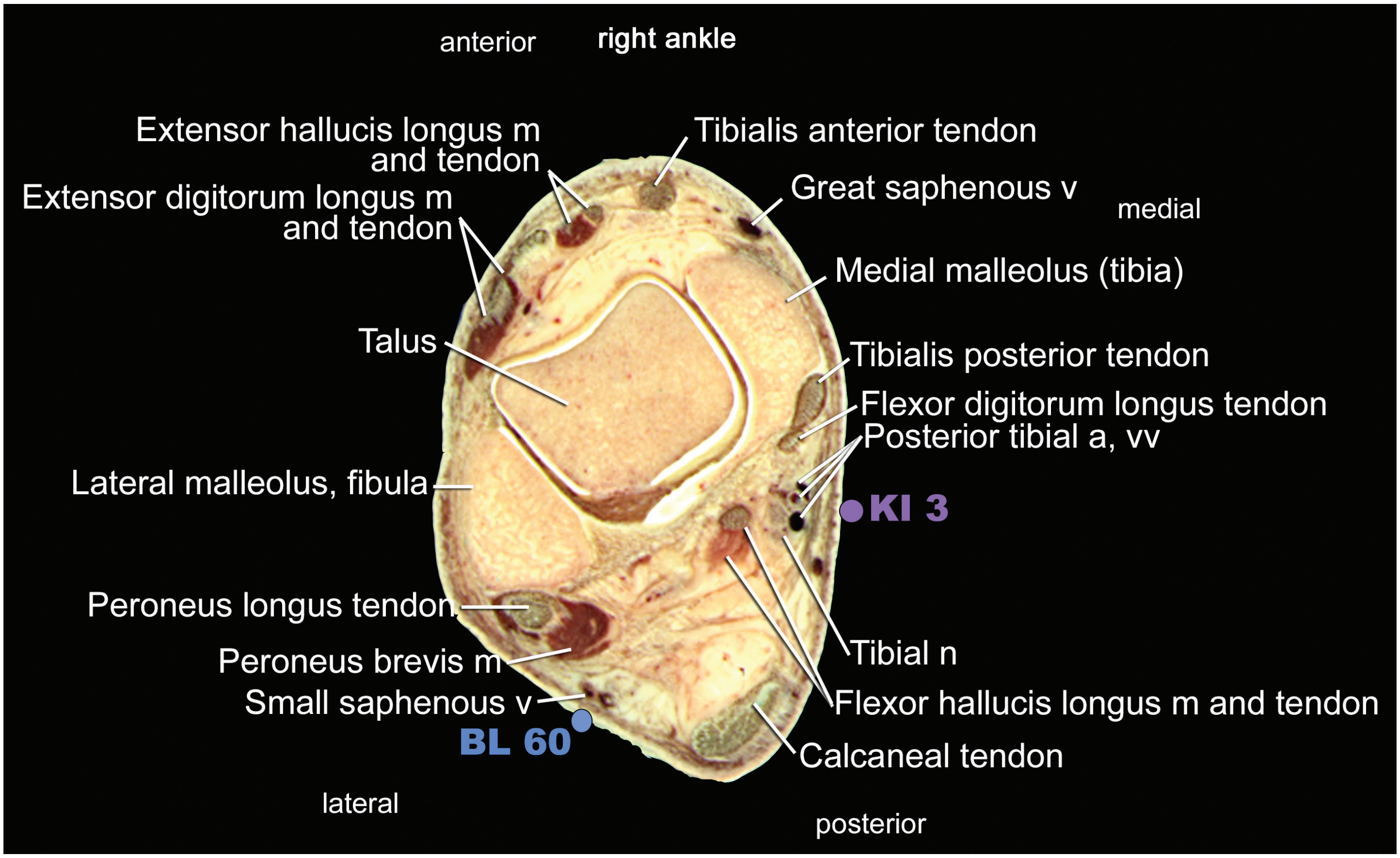

anterior
right ankle
Extensor hallucis longus m and tendon
Tibialis anterior tendon
Extensor digitorum longus m and tendon
Great saphenous v
medial
Medial malleolus (tibia)
Talus
Tibialis posterior tendon
Flexor digitorum longus tendon
Posterior tibial a, vv
Lateral malleolus, fibula
KI 3
Peroneus longus tendon
Peroneus brevis m
Tibial n
Small saphenous v
Flexor hallucis longus m and tendon
BL 60
Calcaneal tendon
lateral
posterior

Figure 8-9. In this image, KI 3 locates the tibial nerve caudal to the medial malleolus, opposite its counterpart, BL 60, on the lateral aspect of the ankle. Nestled in the nook with KI 3 reside the contents of the nearby tarsal tunnel, i.e., the tibial nerve, the posterior tibial vessels, and the posterior tibialis, flexor digitorum longus, and flexor hallucis longus tendons.

Shortening of the muscle restricts the movement of the hallux through its range of motion; crepitus or malfunction of the joint may occur. Bearing weight and performing athletic activity accentuate the pain. Triggering of the great toe, also called "hallux saltans", results when stenosing tenosynovitis afflicts the flexor hallucis longus at the fibro-osseous tunnel below the sustentaculum tali. As aforementioned, this condition occurs in dancers and athletes.

The tendinous contents of the tarsal tunnel, i.e., the tibialis posterior, flexor digitorum longus, and the flexor hallucis longus, may swell and compress the tibial nerve and posterior tibial vessels, shown in Figure 8-9. "Tarsal tunnel syndrome" involves tibial nerve compression at the ankle.[18] The tarsal tunnel extends from KI 3 to KI 6 or KI 2. It is located between the medial retinaculum of the ankle joint and the medial aspect of the calcaneus.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee. Distal to the medial malleolus and KI 3, the tibial nerve divides into the lateral and medial plantar nerves. Other nerve branches include the nerve for the abductor digiti minimi muscle and its branch to the quadratus plantae muscle, and the medial calcaneal nerve branch.[19] Any of these nerve branches may experience compression by connective tissue or vascular sources.

Clinical Relevance: In addition to the saphenous nerve, the sural and tibial nerves contribute cutaneous sensory branches to the medial ankle.[20] Branches from the saphenous nerve sometimes pierce the belly of the abductor hallucis muscle, leading to a connection with the medial plantar nerve by means of a small cutaneous branch. Iatrogenic injury to any of these nerves as in the case of tarsal tunnel release can lead to loss of sensation in the area of KI 3.

The tibial nerve and its distal branches may become entrapped at the medial ankle, producing a condition known as "tarsal tunnel syndrome" that leads to pain in the foot. It may cause neuropathic changes in tibial nerve branches coursing beneath KI 4 to KI 2. Compression of the tibial nerve most commonly takes place at the level of the tarsal tunnel, especially in athletes.[21] Inflammation and/or space-occupying lesions affecting structures comprising the tunnel readily impact the tibial nerve due to the inelastic nature of this fibro-osseous canal. Surgical incisions designed to decompress the tarsal tunnel extend roughly from KI 7 to KI 6; those patients who fail to respond to conservative treatment may require acupuncture, laser therapy, and/or massage to assist with healing not only the skin but also nerve function. Treatment would focus on "lining the scar" with needles inserted a small distance from the site of incision as well as releasing the connective tissue deep to the skin.

Treatment at KI 3 and nearby KI points helps release pressure on the nerve. Neuromodulation of structures at KI 3, proximal to the tunnel, influences the nerve prior to the compression.

Stimulation of KI 3 for neuromodulation of the tibial nerve influences micturition and defecation by reflexing through the sacral spinal cord segments that supply the pelvic floor, bladder, urinary sphincter, and anal sphincter.[22]

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.

Clinical Relevance: Primary venous aneurysms resulting from focal loss of normal connective tissue components in the venous wall potentially produce entrapment neuropathies. Such compressions typically occur in narrow anatomical sites comprising canals incorporating fibrous tissue from aponeuroses or septa.[23] The reversibility of symptoms associated with nerve compression corresponds to the chronicity and severity of the entrapment. Prolonged pressure on a nerve wall compromised its health by reducing blood flow through the vasa nervorum to the inner nerve fibers. The ischemia these fibers experience reduces nerve conduction velocity. The cross-section presented in Figure 8-9 reveals the proximity of the posterior tibial artery and venae concomitants to the tibial nerve, visually reinforcing the concept of how vascular enlargements may place pressure on nerves.

The posterior tibial vein covers the nerve for the abductor digiti minimi muscle. The posterior tibial artery and lateral plantar artery also cross the nerve to the abductor digiti minimi.[24] Vascular pressure on this nerve can produce pain and myofascial dysfunction in the abductor digiti minimi muscle.

Indications and Potential Point Combinations

- Like its lateral malleolar counterpart, BL 60, KI 3 provides a distal endnote option for many needling protocols, especially those benefiting by tibial nerve stimulation such as voiding dysfunction.
- **Urinary disorders (especially incontinence), voiding dysfunction:** Urinary frequency, enuresis, voiding dysfunction: K I3, SP 6, BL 32, BL 28, CV 3.
- **Reproductive problems:** Menstrual dysfunction, erectile dysfunction, sexual dysfunction, infertility: KI 3, PC 6, SP 4, BL 25, BL 23, GV 4.
- **Low back pain**: KI 3, BL 60, BL 23, trigger points in painful muscles, paraspinal (BL) points cranial and caudal to facilitated (sensitized) spinal cord segments.
- **Edema of the lower extremities:** KI 3, KI 16, SP 6, SP 9, CV 6.
- **Arthritic and degenerative diseases**: KI 3, BL 23, LI 4, ST 36, local painful points.
- **Tibial nerve injury following ankle arthroscopy through posteromedial portal:**[25] Acupuncture stimulation of KI 3, KI 7, KI 2; add laser therapy and massage for further recovery of surrounding soft tissue.

Evidence-Based Applications

- Case report of improvement with acupuncture at LR 3, KI 3, SP 6, and ST 36 for **sweating associated with malignancy,** unresponsive to other measures.[1]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[2]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis in women.**[3]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[4]
- Acupuncture at BL 23, BL 31, BL 32, BL 33, SP 6, KI 3, and LI 11 significantly improved **urge- and mixed-type incontinence** after acupuncture treatment among elderly women – a pilot study.[5]
- Acupuncture-based neuromodulation at KI 3, CV 3, CV 6, GV 4, BL 23, BL 32, LI 4, and ST 36 impacted recto-anal function and significantly improved **anal continence** in patients with fecal incontinence.[6]
- Electroacupuncture at CV 4, GV 20, SP 6, KI 3, and HT 7 may have afforded a modulating positive effect on psychogenic and non-psychogenic **erectile dysfunction.** It improved the quality of erection and restored sexual activity in 39% of patients.[7]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6 plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[8]
- Neuroanatomically, acupuncture at KI 3 may support **sexual performance** by sending signals to the sacral cord segments and inferior hypogastric plexus, via the tibial nerve.[9]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in improvement in **sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[10]
- A case report indicated that acupuncture at ST 36, KI 3, and LR 3 produced dramatic improvement in **chronic venous ulceration.**[11]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[12]
- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis,** using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[13]
- Needling at KI 3, BL 60, LR 4, and LR 3 reduced **acute postoperative pain in hospitalized children.**[26]
- Electroacupuncture at HT 7, ST 36, ST 40, and KI 3 activated brain areas thought impaired by **Alzheimer's Disease.** [27]

References

1. Hallam C and Whale C. Acupuncture for the treatment of sweating associated with malignancy. *Acupuncture in Medicine.* 2003;21(4):155-156.

2. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.

3. Alraek T and Baerheim A. "An empty and happy feeling in the bladder…": health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine.* 2001;9(4):219-223.

4. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrentlower urinary tract infection in adult women. *Scand J Prim Health Care.* 1998;16:37-39.

5. Bergström K, Carlsson CPO, Lindholm C, and Widengren R. Improvement of urge- and mixed-type incontinence after acupuncture treatment among elderly women – a pilot study. *Journal of the Autonomic Nervous System.* 2000;79:173-180.

6. Scaglia M, Delaini GG, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Autonomic Neuroscience: Basic and Clinical:* 209;145:89-92.

7. Kho HG, Sweep CGJ, Chen X, Rabsztyn PRI, and Meuleman EJH. The use of acupuncture in the treatment of erectile dysfunction. *International Journal of Impotence Research.* 1999;11:41-46.

8. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.

9. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05

10. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility.* 2005;84(1):141-147.

11. Mears T. Acupuncture for chronic venous ulceration. *Acupuncture in Medicine.* 2003;21(4):150-152.

12. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.

13. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology.* 1999;38:346-354.

14. Oloff LM and Schulhofer SD. Flexor hallucis longus dysfunction. *The Journal of Foot & Ankle Surgery.* 1998;37(2):101-109.

15. Noda D, Yoshimura I, Kanazawa K, et al. Subcutaneous rupture of the flexor hallucis longus tendon: a case report. *The Journal of Foot & Ankle Surgery.* 2012;51:234-236.

16. Oloff LM and Schulhofer SD. Flexor hallucis longus dysfunction. *The Journal of Foot & Ankle Surgery.* 1998;37(2):101-109.

17. Purushothaman R, Karuppal R, and Valsalan R. Hallux saltans due to flexor hallucis longus entrapment at a previously unreported sites in an unskilled manual laborer: a case report. *The Journal of Foot & Ankle Surgery.* 2012;51:334-336.

18. Stull PA and Hunter RE. Posterior tibial nerve entrapment at the ankle. *Operative Techniques in Sports Medicine.* 1996;4(1):54-60.

19. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.

20. Aszmann OC, Ebmer MJ, and Dellon AL. Cutaneous innervation of the medial ankle: an anatomic study of the saphenous, sural, and tibial nerves and their clinical significance. *Foot & Ankle International.* 1998;19(11):753-756.

21. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.

22. Moossdorff-Steinhauser HFA and Berghmans B. Effects of percutaneous tibial nerve stimulation on adult patients with overactive bladder syndrome: a systematic review. *Neurourology and Urodynamics.* 2013;32(3):206-214.

23. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *British Journal of Neurosurgery.* 2012;26(3):386-391.

24. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.

25. Ferkel RD, Heath DD, and Guhl JF. Neurological complications of ankle arthroscopy. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 1996;12(2):200-208.

26. Wu S, Sapru A, Stewart MA, et al. Using acupuncture for acute pain in hospitalized children. *Pediatr Crit Care Med.* 2009;10:291-296.

27. Zhou Y and Jia J. Effect of acupuncture given at HT 7, ST 36, ST 40, and KI 3 acupoints on various parts of the brains of Alzheimer's disease patients. *Acupuncture & Electro-therapeutics Res., Int J.* 2008; 33:9-17.

28. Stull PA and Hunter RE. Posterior tibial nerve entrapment at the ankle. *Operative Techniques in Sports Medicine.* 1996;4(1):54-60.

KI 4

Da Zhong "Large Goblet", "Big Bell"

On the medial ankle region, inferior and posterior to KI 3, in a depression just anterior to the attachment site of the Achilles tendon onto the calcaneus, between the tendon and the bone.

Tendons

- **Calcaneal (Achilles) tendon:** Includes the tendons of the triceps surae muscle (i.e., the two-headed gastrocnemius and soleus muscles). This is also the strongest and thickest tendon in humans as well as the mostly commonly ruptured.[1] Figure 8-10 illustrates the way in which vessels supply the insertion, or osteotendinous junction. The middle third receives blood from the peroneal (fibular) artery while the proximal and distal attachments connect to the posterior tibial artery. Innervation arises from the sural and tibial nerves.

Clinical Relevance: The site of insertion of the calcaneal tendon at KI 4 and near BL 61 exhibits special characteristics that allow for the dissipation of stress from the tendon to the calcaneal bone.

Prolonged, low-intensity activity as well as highly vigorous activity can cause tendon injury, degeneration, and possibly rupture.[2] Calcaneal tendon ruptures heal slowly, requiring weeks to months due to the limited blood supply reaching the tendon. Acupuncture and related techniques, especially laser therapy, increase blood flow and accelerate repair. Laser therapy also reduces the stiffness and elongation that may follow tendon injury and repair. It benefits the process by promoting fibroblast proliferation, collagen synthesis, and circulation.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee. Posterior and inferior to the medial malleolus, the tibial nerve divides into the lateral and medial plantar nerves. Other nerve branches include the nerve for the abductor digiti minimi muscle and its branch to the quadratus plantae muscle, and the medial calcaneal nerve branch, which supplies the skin over the medial heel.[3] Any of these nerve branches may experience compression by connective tissue or vascular sources.

Clinical Relevance: The saphenous, sural and tibial nerves contribute cutaneous sensory branches to the medial ankle.[4] Branches from the saphenous nerve sometimes pierce the belly of the abductor hallucis muscle, leading to a connection with the medial plantar nerve by means of a small cutaneous branch. Iatrogenic injury to any of these nerves as in the case of tarsal tunnel release can lead to loss of sensation in the area of KI 4.

The tibial nerve and its distal branches may become entrapped at the medial ankle, producing a condition known as "tarsal tunnel syndrome" that leads to pain in the foot. It may cause neuropathic changes in tibial nerve branches coursing beneath KI 4 to KI 2. Compression of the tibial nerve most commonly takes place at the level of the tarsal tunnel, especially in athletes.[5] Inflammation and/or space-occupying lesions affecting structures comprising the tunnel readily impact the tibial nerve due to the inelastic nature of this fibro-osseous canal. Surgical

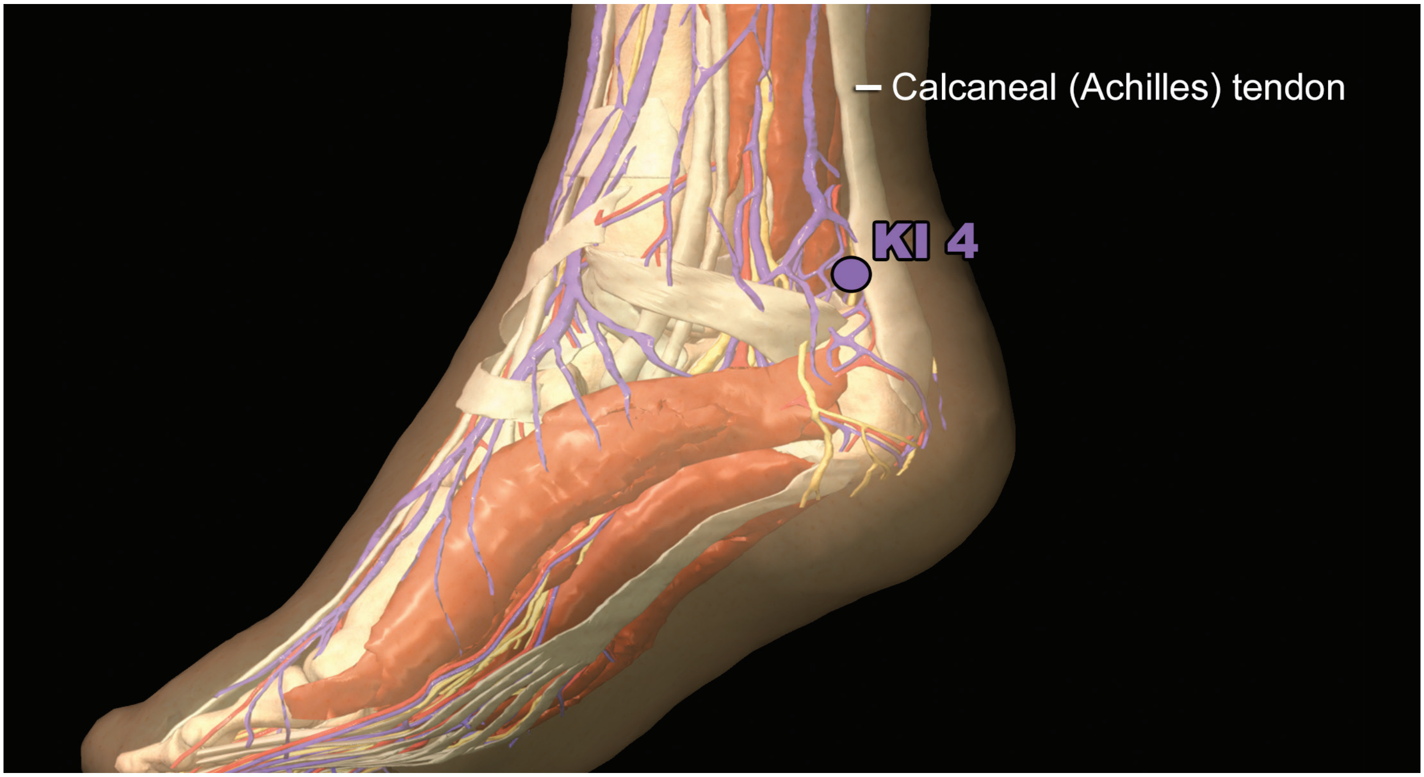


Figure 8-10. KI 4 identifies the site where the calcaneal tendon inserts onto the calcaneus. Pain at KI 4 and KI 5 may originate from a trigger point in the soleus muscle near KI 7; the pain extends to the plantar and lateral heel and KI 1. Note how the calcaneal tendon acquires a crescent shape as it inserts onto the calcaneus. This image also depicts the way in which the vessels and nerve fibers supply the calcaneal tendon at the osteotendinous junction.

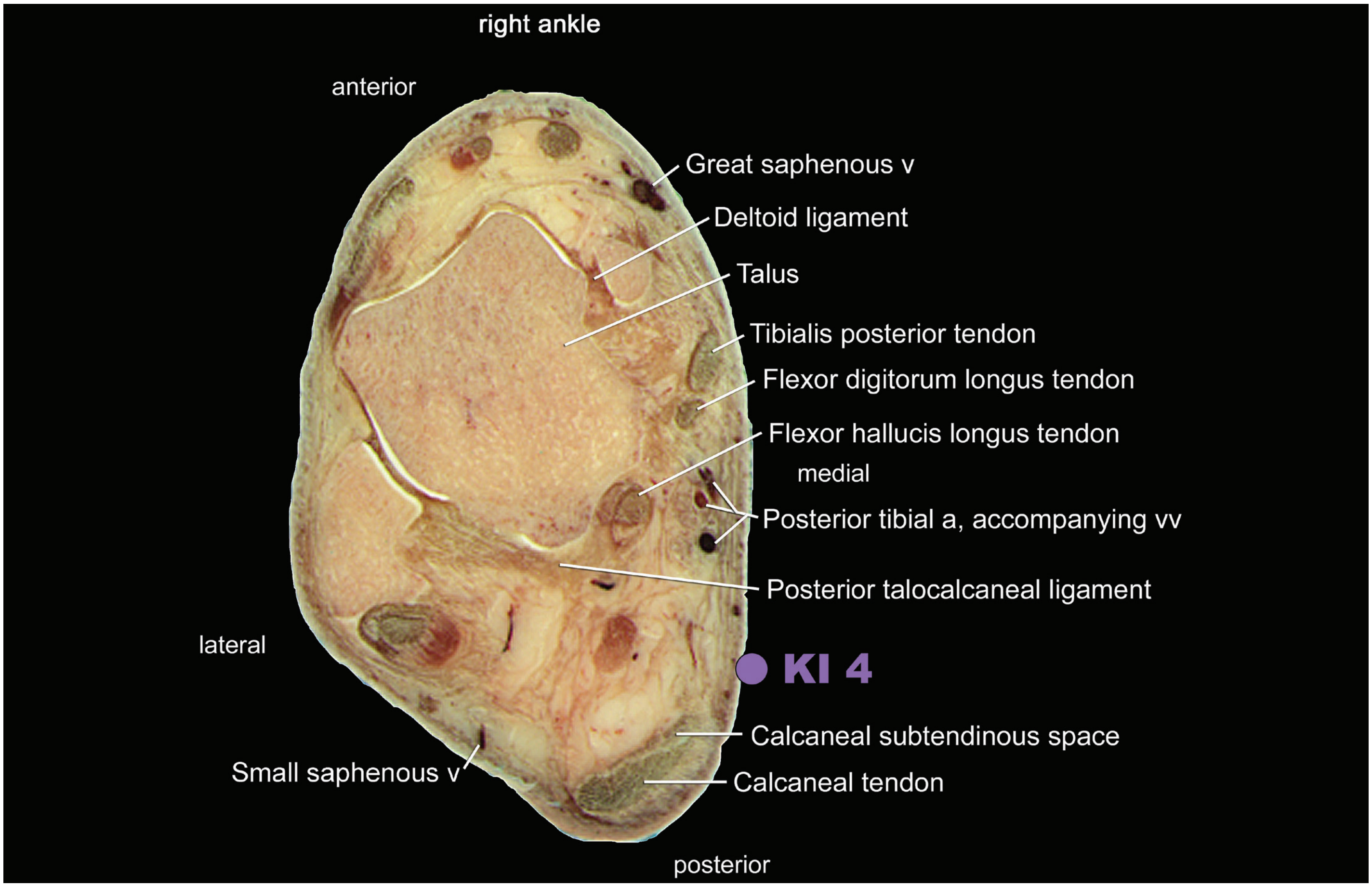

right ankle
anterior
Great saphenous v
Deltoid ligament
Talus
Tibialis posterior tendon
Flexor digitorum longus tendon
Flexor hallucis longus tendon
medial
Posterior tibial a, accompanying vv
Posterior talocalcaneal ligament
lateral
KI 4
Calcaneal subtendinous space
Small saphenous v
Calcaneal tendon
posterior

Figure 8-11. The descriptive name for KI 4, i.e., "Large Goblet" or "Big Bell",,refers to the calcaneus, which widens and then tapers at the bottom. This cross-section exposes the close relationship of KI 4 to the calcaneal tendon and nearby vessels.

incisions designed to decompress the tarsal tunnel extend roughly from KI 7 to KI 6; those patients who fail to respond to conservative treatment may require acupuncture, laser therapy, and/or massage to assist with healing not only the skin but also nerve function. Treatment would focus on "lining the scar" with needles inserted a small distance from the site of incision as well as releasing the connective tissue deep to the skin.

Treatment at KI 4 and nearby KI points helps release pressure on the nerve. In addition to acupuncture, massage and laser therapy play important roles in alleviating pain, tension, and neuropathy of the ankle and foot.

Vessels

- **Medial calcaneal artery:** Arises from the posterior tibial artery to supply the medial calcaneal area.

Clinical Relevance: Acupuncture, laser therapy, and other physical medicine measures improve circulation to the calcaneal tendon by local and systemic means in the event of tendon injury.[6,7,8]

Indications and Potential Point Combinations

- **Heel pain:** KI 4; check for trigger points in the soleus ("jogger's heel") at KI 7, the tibialis posterior ("runner's nemesis") near BL 55, and the gastrocnemius ("calf cramp muscle") near LR 7.
- **Achilles tendinopathy:** KI 4, KI 3, BL 61, BL 60, plus trigger points in the muscular contributors to the calcaneal tendon: the gastrocnemius, the soleus, and the plantaris (BL 40). Add laser therapy and massage to support tissue health and repair.
- **Iatrogenic injury of the posterior neurovascular bundle during arthroscopy:** KI 3, KI 4, KI 6, BL 60, add laser therapy and massage to support recovery.

References

1. Doral MN, Alam M, Bozkurt M, et al. Functional anatomy of the Achilles tendon. *Knee Surg Sports Traumatol Arthrosc.* 2010;18:638-643.
2. Da Re Guerra F, Vieira CP, Almeida MS, et al. LLLT improves tendon healing through increase of MMP activity and collagen synthesis. *Lasers Med Sci.* 2013; 28(5):1281-1288.
3. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.
4. Aszmann OC, Ebmer MJ, and Dellon AL. Cutaneous innervation of the medial ankle: an anatomic study of the saphenous, sural, and tibial nerves and their clinical significance. *Foot & Ankle International.* 1998;19(11):753-756.
5. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
6. Kubo K, Yajima H, Takayama M, et al. Changes in blood circulation of the contralateral Achilles tendon during and after acupuncture and heating. *Int J Sports Med.* 2011;32(10):807-813.
7. Kraemer R, Vogt PM, and Knobloch K. Microcirculatory effects of acupuncture and hyperthermia on Achilles tendon microcirculation. *Eur J Appl Physiol.* 2010;109(5):1007-1008.
8. Papa JA. Conservative management of Achilles tendinopathy: a case report. *J Can Chiropr Assoc.* 2012;56(3):216-224.

KI 5

Shui Quan "Water Spring"

On the medial side of the ankle, 1 cun below KI 3, in a depression proximal to the medial tubercle of the calcaneal tuberosity.

(Alternate location: in a depression midway between the tip of the medial malleolus and KI 4.)

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee. Posterior and inferior to the medial malleolus, the tibial nerve divides into the lateral and medial plantar nerves. Other nerve branches include the nerve for the abductor digiti minimi muscle and its branch to the quadratus plantae muscle, and the medial calcaneal nerve branch, which supplies the skin over the medial heel.[3] Any of these nerve branches may experience compression by connective tissue or vascular sources. A heel spur at KI 5 may entrap the nerve to the abductor digiti quinti (minimi) muscle.[4] Tension of the medial plantar fascia and deep fascia of the abductor hallucis muscle may also compress the nerve branch that supplies the quadratus plantae muscle.
- **Medial calcaneal nerve (from tibial nerve):** Supplies the skin over the medial calcaneal region.

Clinical Relevance: The saphenous, sural and tibial nerves contribute cutaneous sensory branches to the medial ankle.[5] Branches from the saphenous nerve sometimes pierce the belly of the abductor hallucis muscle, leading to a connection with the medial plantar nerve by means of a small cutaneous branch. Iatrogenic injury to any of these nerves as in the case of tarsal tunnel release can lead to loss of sensation in the area of KI 5.

The tibial nerve and its distal branches may become entrapped at the medial ankle, producing a condition known as "tarsal tunnel syndrome" that leads to pain in the foot. It may cause neuropathic changes in tibial nerve branches coursing beneath KI 4 to KI 2, including the site of KI 5. Compression of the tibial nerve most commonly takes place at the level of the tarsal tunnel, especially in athletes.[6] Inflammation and/or space-occupying lesions affecting structures comprising the tunnel readily impact the tibial nerve due to the inelastic nature of this fibro-osseous canal. Surgical incisions designed to decompress the tarsal tunnel extend roughly from KI 7 to KI 6 (which includes KI 5); those patients who fail to respond to conservative treatment may require acupuncture, laser therapy, and/or massage to assist with healing not only the skin but also nerve function. Treatment would focus on "lining the scar" with needles inserted a small distance from the site of incision as well as releasing the connective tissue deep to the skin.

Treatment at KI 5 and nearby KI points helps release pressure on the nerve. In addition to acupuncture, massage and laser therapy play important roles in alleviating pain, tension, and neuropathy of the ankle and foot.

Vessels

- **Medial calcaneal artery:** Arises from the posterior tibial artery to supply the medial calcaneal area.

Clinical Relevance: Acupuncture, laser therapy, and other physical medicine measures improve circulation to the medial ankle by local and systemic means in the event of iatrogenic or other injury.[7,8,9]

Indications and Potential Point Combinations

- **Genitourinary problems (nephritis, nephrolithiasis, renal colic, kidney failure, difficult urination, menstrual pain or irregularities):** KI 5, KI 3, SP 6, SP 10, BL 23, BL 28, BL 32, BL 33, CV 3, CV 4,CV 6, GV 20.
- **Pelvic limb edema:** KI 5, KI 3, SP 6, SP 9, KI 16, SP 20.
- **Heel pain:** KI 5; check for trigger points in the soleus ("jogger's heel") at KI 7, the tibialis posterior ("runner's nemesis") near BL 55, and the gastrocnemius ("calf cramp muscle") near LR 7.
- **Achilles tendinopathy:** KI 4, KI 3, KI 5, BL 61, BL 60, plus trigger points in the muscular contributors to the calcaneal tendon: the gastrocnemius, the soleus, and the plantaris (BL 40). Add laser therapy and massage to support tissue health and repair.

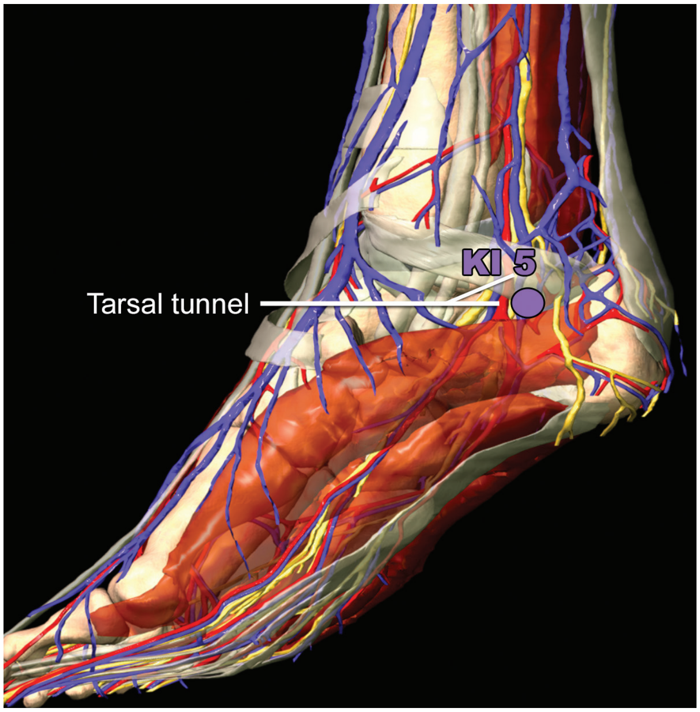


Figure 8-12. KI 5, "Water Spring", continues the water metaphor of previous points, including "Gushing Spring" (KI 1) and "Great Torrent" (KI 3). This image reveals the way in which needling KI 5 may address trigger points in the myotendinous junction of the abductor hallucis muscle. Trigger points here can produce intense medial heel pain that refer to KI 2 along the medial aspect of the foot. Too, compression of the tibial nerve (cranial to KI 5) beneath the flexor retinaculum causes tarsal tunnel syndrome. Patients with tarsal tunnel syndrome complain of paresthesia and burning dysesthesia along the medial foot, worse with walking and standing.[10]

- **Iatrogenic injury of the posterior neurovascular bundle during arthroscopy:** KI 5, KI 4, KI 6, BL 60, add laser therapy and massage to support recovery.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of enuresis.[1]
- Acupuncture and electroacupuncture at ST 4, ST 7, LI 4, HT 7, SP 6, KI 5, and ST 36 induced an increase in the local blood flow in the skin over the parotid gland in patients with Sjögren's syndrome.[2]

References

1. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
2. Blom M, Lundeberg T, Dawidson I, and Angmar-Mansson. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjögren's Syndrome. *Journal of Oral Rehabilitation.* 1993;20:541-548.
3. Del Sol M, Olave E, Gabrielli C, et al. Innervation of the abductor digiti minimi muscle of the human foot: anatomical basis of the entrapment of the abductor digiti minimi nerve. *Surg Radiol Anat.* 2002;24:18-22.
4. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
5. Aszmann OC, Ebmer MJ, and Dellon AL. Cutaneous innervation of the medial ankle: an anatomic study of the saphenous, sural, and tibial nerves and their clinical significance. *Foot & Ankle International.* 1998;19(11):753-756.
6. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
7. Kubo K, Yajima H, Takayama M, et al. Changes in blood circulation of the contralateral Achilles tendon during and after acupuncture and heating. *Int J Sports Med.* 2011;32(10):807-813.
8. Kraemer R, Vogt PM, and Knobloch K. Microcirculatory effects of acupuncture and hyperthermia on Achilles tendon microcirculation. *Eur J Appl Physiol.* 2010;109(5):1007-1008.
9. Papa JA. Conservative management of Achilles tendinopathy: a case report. *J Can Chiropr Assoc.* 2012;56(3):216-224.
10. Antoniadis G and Scheglmann. Posterior tarsal tunnel syndrome. *Dtsch Arztebl Int.* 2008;105(45):776-781.)

KI 6

Zhao Hai "Shining Sea"

On the medial ankle, 1 cun below the tip of the medial malleolus.

Between the tibialis posterior tendon (anteriorly) and the flexor digitorum longus tendon (posteriorly).

Alternate location (KI 6'): Directly distal to the medial malleolus at the dorsal/plantar skin junction.

Tendons

- **Posterior tibialis tendon:** The posterior tibialis inverts the foot and provides ankle plantarflexion. The primary stabilizer of the medial longitudinal arch, the posterior tibialis muscle lefts the arch during plantarflexion. Other active stabilizers of the arch include the flexor hallucis longus and brevis muscles along with the abductor hallucis.[5] Passive support structures include the ligaments and fascia, including the plantar fascia, long and short plantar ligaments, and the spring ligament.
- **Flexor digitorum longus tendon:** The flexor digitorum longus flexes the lateral four pedal digits and plantarflexes the ankle. It helps support the longitudinal arch of the foot.
- **Abductor hallucis muscle:** Abducts the great toe.

Clinical Relevance: Dysfunction of the caudomedial soft tissues, including the posterior tibial tendon and flexor digitorum longus tendon, can lead to flattening of the medial arch of the foot, or pes planus.[6] Posterior tibial tendon dysfunction also leads to a shift of the center of gravity toward the heel and medial aspect of the foot. Tension and trigger point pathology of the medial foot frequently results in medial foot pain involving the abductor hallucis muscle. Trigger points in the abductor hallucis muscle in the vicinity of KI 6 refer pain strongly to the caudal calcaneus and extend to the medial foot at SP 3.

Whereas myofascial dysfunction of the abductor hallucis muscle responds quickly and dramatically to physical medicine maneuvers, compartment syndrome can constitute a surgical emergency. Compartment syndrome of the medial foot affecting the abductor hallucis muscle and neurovascular contents can follow surgery, fracture, crush injury, vascular insult, or even minor or unrecognized injury, especially in children.[7] Patients with compartment syndrome complain of the "7 P's", namely: pain, paresthesias, pulselessness, paralysis, pressure, pain with passive stretch, and induration with palpation.[8] Pain, out of proportion with the stimulus, may be the most sensitive clinical symptom.

Figure 8-13 compares the location of KI 6 and KI 6'. KI 6 lands between the flexor digitorum longus and tibialis posterior tendons; KI 6' relates more closely to the medial plantar nerve and vessels.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior

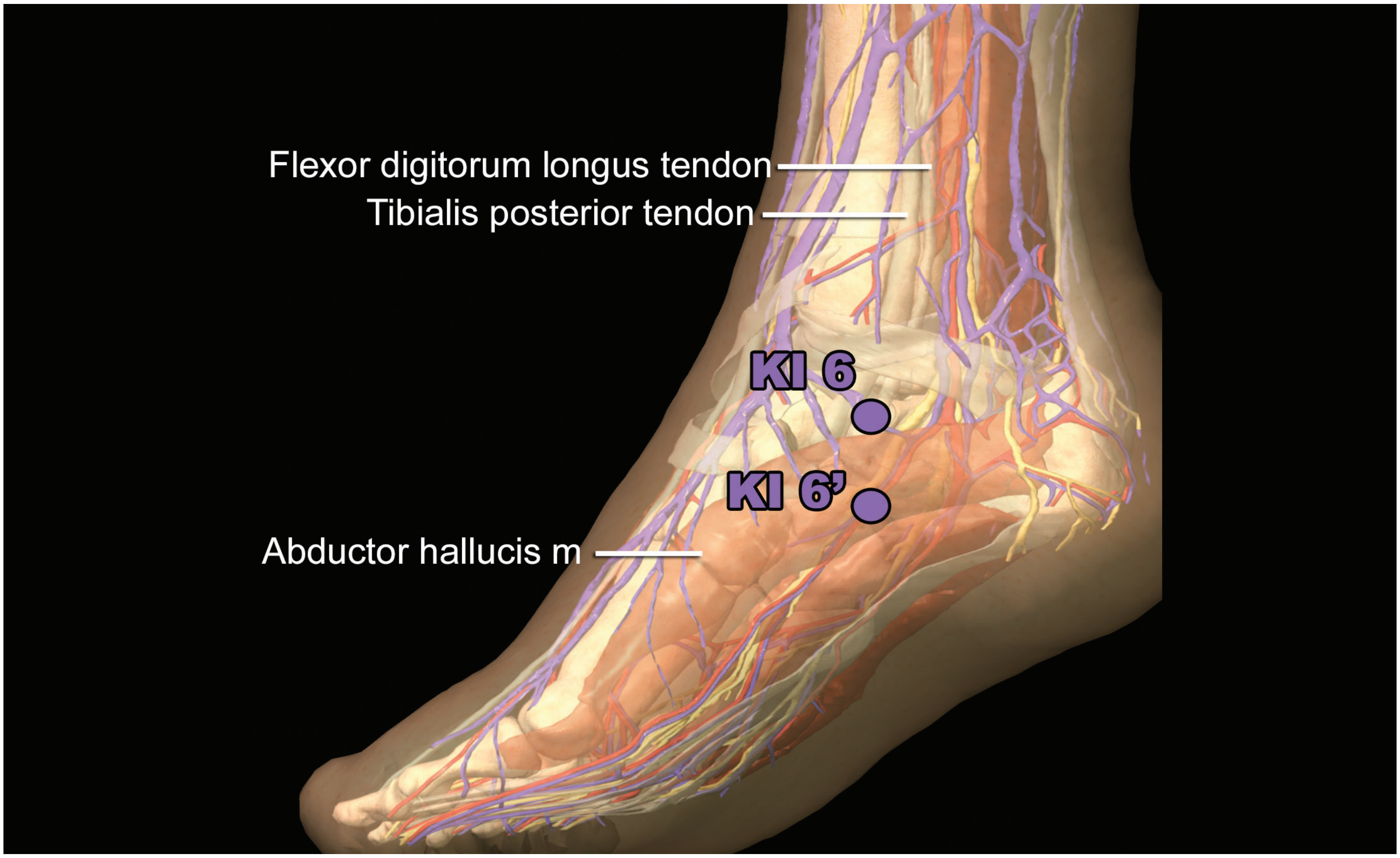


Figure 8-13. KI 6 associates with tendinous elements while KI 6' impacts the abductor hallucis muscle and the medial plantar vessels and nerve. Like Gushing Spring (KI 1), Water Spring (KI 5), and Great Ravine (KI 3), "Shining Sea" for KI 6 refers to the rich vascular supply of the medial foot and ankle.

aspect of the leg and knee. Posterior and inferior to the medial malleolus, the tibial nerve divides into the lateral and medial plantar nerves.

- **Medial plantar nerve (larger terminal branch of tibial nerve):** The medial plantar nerve supplies the skin on the medial aspect of the sole of the foot, as well as the sides of pedal digits I through III. The medial plantar nerve supplies the following muscles: abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical muscle.

Clinical Relevance: Figure 8-6 depicts and compares the courses of the medial and lateral plantar nerves and vessels; these neurovascular components appear again in Figure 8-13, unlabeled. Tension and contracture of the abductor hallucis muscle can compress the nerve, causing numbness, tingling, cramping, and burning pain on the plantar foot at the metatarsal heads and possibly the heel.[9] Symptoms of tarsal tunnel syndrome, which this condition is called, worsen with weight bearing and pressure applied to the tunnel. They improve with both rest and elevation of the foot. On neurologic examination, sensory examination may reveal reduction in two-point discrimination and vibratory perception of the great toe. Some patients report a history of surgical release for plantar fasciitis with insufficient relief; these individuals may have been experiencing plantar nerve compression misdiagnosed as plantar fasciitis. While surgical release of the tarsal tunnel serves as one option, many patients would prefer conservative approaches to reduce myofascial restriction if given the option.

Tibial nerve compression in the tarsal tunnel causes neuropathy that, in diabetic patients, can increase risk of pedal ulceration, pain, and sensory loss.[10] This may affect nerves coursing through KI 6.

Branches of the tibial nerve, including the medial plantar nerve, can also experience compression during compartment syndrome in the foot. Crush injury of the foot commonly increases pressure in the foot compartments. Compression of the structures coursing through the calcaneal compartment predisposes patients to claw toes secondary to contracture of the quadratus plantae muscle.[11] Entrapment of the medial plantar nerve as it courses through the calcaneal tunnel may follow, perhaps leading to hallux varus as a complication.

Vessels

- **Medial plantar artery:** This small artery mainly supplies the muscles of the great toe, but most of the plantar digital arteries arise from the medial plantar artery. Its superficial branch provides circulation to the skin on the medial aspect of the sole. This branch gives off digital branches which accompany the medial plantar nerve's digital nerve branches.
- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.

Clinical Relevance: Diabetes mellitus decreases the density of perivascular nerve fibers and the reactivity of vascular muscles in plantar metatarsal arteries.[12] This raises consideration of neuromodulation through acupuncture, laser therapy, and massage to exogenously improve circulation through similarly compromised vessels.

Reflux in foot veins is associated with venous toe and forefoot ulceration.[13] Although ulceration typically affects the dorsum of the toes and forefoot, pressure changes secondary to forces affecting the arch as well as contraction of the triceps surae muscles (i.e., gastrocnemius and soleus muscles) contribute to venous drainage of the foot and ankle. Neuromodulation and circulatory balance provided by acupuncture, massage, and laser therapy should improve venous drainage and tissue maintenance.

Compartment syndrome of the medial foot may result in increased venous and capillary pressures due to venous outflow obstruction.[14] Arterial blood has difficulty entering the fixed space, causing ischemia that compromises the integrity of capillary walls. As permeability of the walls increase, edema, hypoxia, and acidosis take hold. Complications such as nerve and muscle dysfunction ensue after three hours of ischemia. Damage to nerves may become irreversible after 12-24 hours, about the time that muscle contracture begins. While awaiting or considering urgent fasciotomy, treatment with laser therapy may aid tissue health. However, given the urgency required for surgical treatment, practitioner should not delay proper diagnosis or treatment of compartment syndrome in order to wait and see if physical medicine treatments help over the course of several days.

Pseudoaneurysm of the medial plantar artery may follow trauma, iatrogenic vascular intervention, or intravenous drug administration.[15] Although pseudoaneurysm of the lateral plantar artery more commonly occurs, it can afflict the medial vessel in cases of ankle sprain, penetrating injury, iatrogenic causes such as arthroscopy and fracture fixation, and contusion. Patients exhibit pain, swelling, and hematoma from the trauma, the pseudoaneurysm, or both. Left untreated, pseudoaneurysms may either resolve spontaneously or grow gradually and compress the local neurovascular structures. When a pseudoaneurysm falls in the vicinity of KI 6, tibial nerve compression and tarsal tunnel syndrome may result. Whether surgical or nonsurgical means are employed to address the vascular damage, acupuncture, laser, and massage can improve nerve function and circulation, allowing the patient to recover more fully.

Indications and Potential Point Combinations

- **Local pain or dysfunction:** KI 6 for medial ankle pain; KI 6' for medial foot pain. Search for additional trigger points related to the referred pain distribution.
- **Dysphonia:** KI 6, ST 9, LU 7, SI 3, BL 60.

Evidence-Based Applications

- Case report indicated KI 6 was useful for the treatment of **chronic laryngitis, pharyngitis, nocturnal epilepsy, costochondritis, and upper palpebral ptosis.**[1]
- Acupuncture at KI 6, ST 9, LU 7, BL 60, and SI 3 offered an effective alternative treatment for **hyperfunctional dysphonia,**

bolstering findings that acupuncture can serve as an effective adjunctive support for the treatment of **voice disorders** without the invasiveness or concomitant adverse effects of surgical or medical management.[2]

- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **keratoconjunctivitis sicca (KCS).**[3]
- Of the following group of points, 12 were chosen according to the Chinese medical assessment of men with **poor quality sperm.** Following a series of acupuncture treatments, their fertility index increased significantly, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. The acupuncture points from which the 12 were selected included: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[4]

References

1. Fan L. Experience in the clinical application of acupoint Zhaohai (K6). *Journal of Traditional Chinese Medicine.* 1995;15(2):118-121.
2. Yiu E, Xu JJ, Murry T, et al. A randomized treatment-placebo study of the effectiveness of acupuncture for benign vocal pathologies. *Journal of Voice.* 2006;20(1):144-156.
3. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2.* New York: Plenum Press, 1998. pp. 1011-1016.
4. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
5. Kamiya T, Uchiyama E, Watanabe K, et al. Dynamic effect of the tibialis posterior muscle on the arch of the foot during cyclic axial loading. C*linical Biomechanics.* 2012;27:962-966.
6. Bek N, Simsek IE, Erel S, et al. Home-based general versus center-based selective rehabilitation in patients with posterior tibial tendon dysfunction. *Acta Orthop Traumatol Turc.* 2012;46(4):286-292.
7. Sinikumpu J-J, Lepojarvi S, Serlo W, et al. Atraumatic compartment syndrome of the foot in a 15-year-old female. *The Journal of Foot and Ankle Surgery.* 2013;52(1):72-75.
8. Lam SK, McAlister J, Oliver N, et al. Bilateral medial foot compartment syndrome after an aerobics class: a case report. *The Journal of Foot & Ankle Surgery.* 2012;51:652-655.
9. Thoma A and Levis C. Compression neuropathies of the lower extremity. *Clin Plastic Surg.* 2003;30:189-201.
10. Gondring WH, Tarun PK, and Trepman E. Touch pressure and sensory density after tarsal tunnel release in diabetic neuropathy. *Foot and Ankle Surgery.* 2012;18:241-246.
11. Dayton P and Haulard JP. Hallux varus as complication of foot compartment syndrome. *The Journal of Foot & Ankle Surgery.* 2011;50:504-506.
12. Johansen NJ, Tripovic D, and Brock JA. Streptozotocin-induced diabetes differentially affects sympathetic innervation and control of plantar metatarsal and mesenteric arteries in the rat. *Am J Physiol Heart Circ Physiol.* 2013;304(2):H215-H218.
13. Van Bemmelen PS, Spivack D, and Kelly P. Reflux in foot veins is associated with venous toe and forefoot ulceration. *J Vasc Surg.* 2011;53:394-398.
14. Lam SK, McAlister J, Oliver N, et al. Bilateral medial foot compartment syndrome after an aerobics class: a case report. *The Journal of Foot & Ankle Surgery.* 2012;51:652-655.
15. Park S-E, Kim J-C, Ji J-H, et al. Post-traumatic pseudoaneurysm of the medial plantar artery combined with tarsal tunnel syndrome: two case reports. *Arch Orthop Trauma Surg.* 2012; Oct 8. DOI 10.1007/s00402-012-1672-7.

KI 7

Fu Liu "Returning Current" or "Recover Flow"

2 cun proximal to KI 3, in the first depression along the cranial border of the calcaneal tendon appreciated when palpating from KI 3 proximad.

Figure 8-14 contrasts the locations of KI 3, KI 7, and KI 8.

Muscles and Tendons

- **Flexor hallucis longus muscle:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It assists ankle plantarflexion.
- **Plantaris tendon:** Weakly assists the gastrocnemius muscle in plantarflexing the ankle and in flexing the knee. The plantaris muscle contains an exceptionally high density of proprioceptive endings that confer the ability to relay feedback about position of the foot to the central nervous system. As such, it may act more as an adjunct stabilizer for the foot and ankle. The plantaris tendon, supplied by the tibial nerve, attaches blends with the calcaneal tendon or inserts separately to the medial aspect of the calcaneus.
- **Calcaneal (Achilles) tendon:** The common tendon of the "triceps surae" muscle, which includes the two-headed gastrocnemius muscle and the soleus muscle. May incorporate the plantaris tendon.

Clinical Relevance: Pain in the great (big) toe and 1st metatarsal may arise from trigger point pathology in the vicinity of KI 7. Note the prominence of the flexor hallucis longus in the cross-section of Figure 8-17. Palpate firmly and deeply in this region to fully examine the distal crus for the presence of myofascial dysfunction requiring treatment to fix foot and calf problems.

The plantaris muscle or tendon can be impacted by excessive traction applied to the site as in over-vigorous stretching, jumping, or running. It may suffer collateral damage in a calcaneal tendon rupture. Also, while the plantaris tendon may contribute to "tennis leg", a calf injury identified by a "snapping" in the mid-calf during strenuous exercise, it appears that tennis leg may more commonly arise from a rupture of the medical head of the gastrocnemius muscle at its tendinomuscular junction.[2] Surgical procedures that remove the plantaris tendon for reconstruction elsewhere or because direct trauma, pain, and swelling have injured the tendon, remove the ability of the plantaris to assist in foot placement and ankle stability by dint of its proprioceptive function. As such, acupuncture and related techniques that address pain and swelling in an injured plantaris tendon or directly treat joints elsewhere making its removal

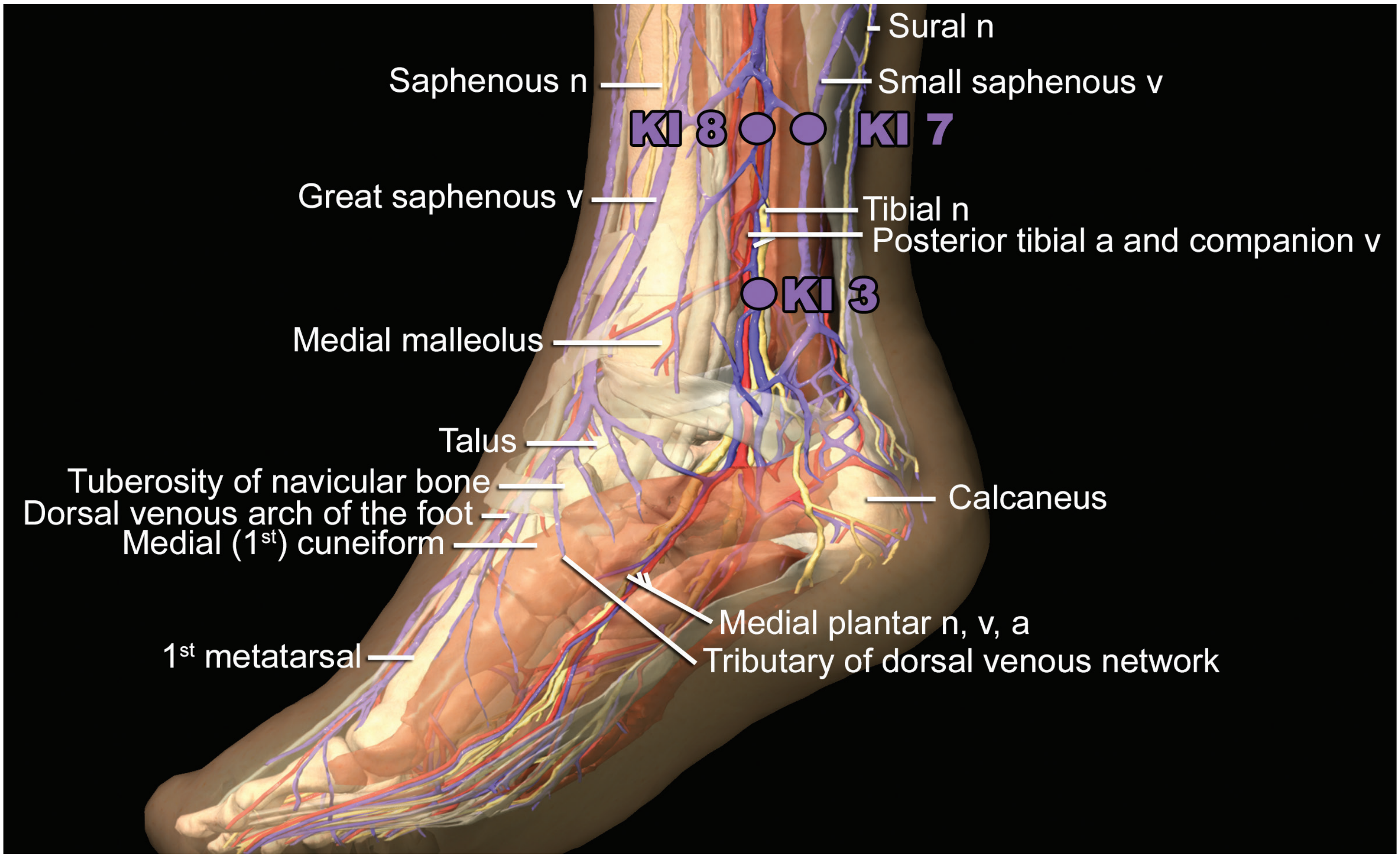


Figure 8-14. This image elucidates the basis of the name "Recover Flow" or "Returning Current" for KI 7. First, the sural nerve that related to the BL channel on its lateral aspect is now touching the KI channel. Thus, the channel "flow" returns to meet the sural nerve, having migrated from BL to KI. In addition, KI 7 represents the first point along the KI channel to associate with predominantly venous territory, rather than coupled arteries and veins. Thus, the blood referenced by "flow" and "current" pertains to venous blood returning to the heart. Indications for KI 7 associated with alleviating edema and encouraging fluid movement arise from both the small saphenous venous network deep to KI 7 and the autonomic nerve fibers accessible in this area.

for reconstruction unnecessary can help patients maintain the structural integrity of their original design.

Calcaneal tendon rupture can become a recurring problem because the tendinous tissue has a high degree of disorganization. Pulsed low level laser therapy remodels tissue and improves tendon healing by increasing matrix metalloproteinase activity and collagen synthesis.[3] Quinolones may also injure the calcaneal tendon, perhaps through ischemic processes, oxidative damage, and direct collagen toxicity.[4] Patients with calcaneal tendinopathy exhibit pain, swelling, and possibly crepitus at the tendon.[5] Points associated with the calcaneal tendon include KI 4, KI 3, KI 7, BL 59, BL 60, and BL 61. Acupuncture improves blood circulation and healing to the tendon through systemic/generalized effects.[6] Laser therapy also facilitates tendon recovery through circulatory support and anti-inflammatory means.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (L5-S2 and sometimes S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, Plantaris, and the posterior tibialis muscle, as well as the other muscles in the caudal aspect of the leg and knee.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). Considering their sacral innervation and higher sympathetic nerve density, distal points may confer greater impact on genitourinary complaints than those at the proximal calf and knee.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.

Clinical Relevance: After calcaneal tendon injury, acupuncture and hyperthermia may improve microcirculation in local vessels supplying the tendon whose blood flow promotes repair and recovery of function.[7,8] Laser therapy and massage also provide improved blood flow to tendons.

Indications and Potential Point Combinations

- **Urinary problems, including cystitis, pain:** KI 7, KI 3, SP 6, BL 28, BL 32, CV 2, CV 3.
- **Reproductive problems, including orchitis, infertility, erectile dysfunction, menstrual irregularity:** KI 7, SP 6, SP 10, ST 30, BL 23, GV 3, CV 4.
- **Low back pain:** KI 7, BL 40, BL 60, BL 23, local trigger points on the back.
- **Edematous ankles:** KI 7, SP 6, SP 9, SP 10, SP 12, CV 6. Add massage and laser therapy to promote resolution of edema.

Evidence-Based Applications

- Of the following group of points, 12 were chosen according to the Chinese medical assessment of men with **poor quality sperm.** Following a series of acupuncture treatments, their fertility index increased significantly, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. The acupuncture points from which the 12 were selected included: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[1]

References

1. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Effect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
2. Delgado GJ, Chung CB, Lektrakul N, et al. Tennis leg: clinical US study of 141 patients and anatomic investigation of four cadavers with MR imaging and US. *Radiology.* 2002;224:112-119.
3. Da Re Guerra F, Vieira CP, Almeida MS, et al. LLLT improves tendon healing through increase of MMP activity and collagen synthesis. *Lasers Med Sci.*
4. Takeda S-I, Imai T, Chaki Y, et al. Four consecutive cases of Achilles tendon disorders associated with levofloxacin treatment in hemodialysis patients. *Clin Exp Nephrol.* 2012; 16(6):977-978.
5. Simpson MR and Howard TM. Tendinopathies of the foot and ankle. *Am Fam Physician.* 2009;80(10):1107-1114,
6. Kubo K, Yajima H, Takayama M, et al. Changes in blood circulation of the contralateral Achilles tendon during and after acupuncture and heating. *Int J Sports Med.* 2011;32(10):807-813.
7. Kraemer R, Vogt PM, and Knobloch K. Microcirculatory effects of acupuncture and hyperthermia on Achilles tendon microcirculation. *Eur J Appl Physiol.* 2010;109:1007-1008.
8. Kubo K, Yajima H, Takayama M, et al. Effects of acupuncture and heating on blood volume and oxygen saturation of human Achilles tendon in vivo. *Eur J Appl Physiol.* 2010;109(3):545-550.

KI 8

Jiao Xin "Intersection Reach"

On the medial aspect of the leg, caudal to the tibia, 2 cun proximal to KI 3. Approximately 0.5 cun cranial to KI 7.

Muscles

- **Posterior tibialis muscle:** This muscle inverts the foot and provides ankle plantarflexion.
- **Flexor hallucis longus muscle:** The flexor hallucis longus muscle supports the medial longitudinal arches of the foot. It flexes the great toe at each of its joints. It assists ankle plantarflexion.
- **Flexor digitorum longus muscle:** The flexor digitorum longus flexes the lateral four pedal digits and plantarflexes the ankle. It helps support the longitudinal arch of the foot.

Clinical Relevance: Called the "runner's nemesis", the posterior tibialis muscle triggers pain in the sole of the foot and calcaneal tendon; it worsens when running on uneven surfaces. Pain may also extend to the midcalf and heel.

The flexor digitorum longus and flexor hallucis longus muscles, i.e., long flexors of the toes, earn the name "clawtoe muscles" because contracture of these muscles lead to hammer toe and clawtoe.

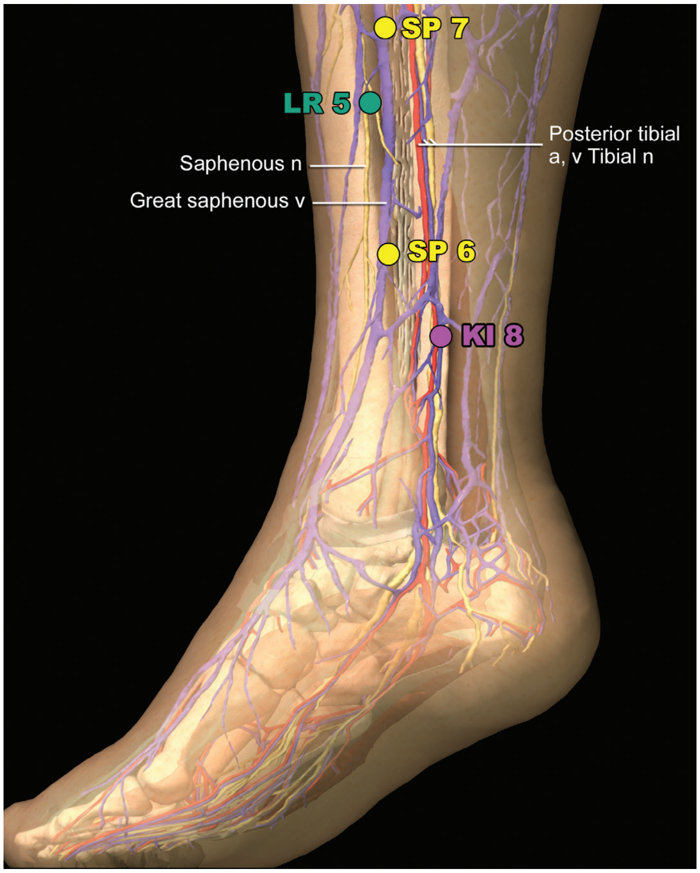


Figure 8-15. KI 8, the "Intersection Reach" follows the posterior tibial artery and vein as well as the tibial nerve, similar to KI 3. In contrast, the nearby great saphenous vein accompanies the SP line.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee. At about KI 8 and SP 6, the tibial nerve occupies the location known as the "high tarsal tunnel".[1] Nerve compression can result from myofascial restriction involving the flexor digitorum longus and flexor hallucis longus, the soleus, and tibialis posterior.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Women treated with percutaneous tibial nerve stimulation for overactive bladder syndrome may experience a transient sensory deficit in the region of great toe and 1st metatarsophalangeal joint. Acupuncture along the SP and KI lines may aid in the recovery of sensory nerve function in the tibia.[2] In addition, acupuncture noninvasively stimulates the tibial nerve without causing sensory dysfunction afterward in most cases.

The fact that sacral spinal segments contribute significantly to the fiber composition of the tibial nerve helps explain why distal tibial nerve points may be more successful at neuromodulating pelvic organ function than medial thigh or knee locations, and why these points appears so often in needling protocols for genitourinary concerns and voiding dysfunction. In particular, segments supplying the tibial nerve as it innervates the flexor hallucis longus and flexor digitorum longus arise from S2 and S3, the most caudal segments associated with the tibial nerve. Thus, stimulation of KI 8 for voiding dysfunction should be considered, along with SP 6 and KI 3.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins by the union of the dorsal vein of the great toe and the pedal dorsal venous arch. It anastomoses with the small saphenous vein and empties into the femoral vein.
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin off of the superficial veins. When they do so, they travel at an oblique angle so that muscular contraction and pressure within the compartment compresses the perforating veins. This phenomenon assists in encouraging unidirectional blood flow from superficial to deep veins and enables muscular contraction to assist in returning venous blood toward the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable

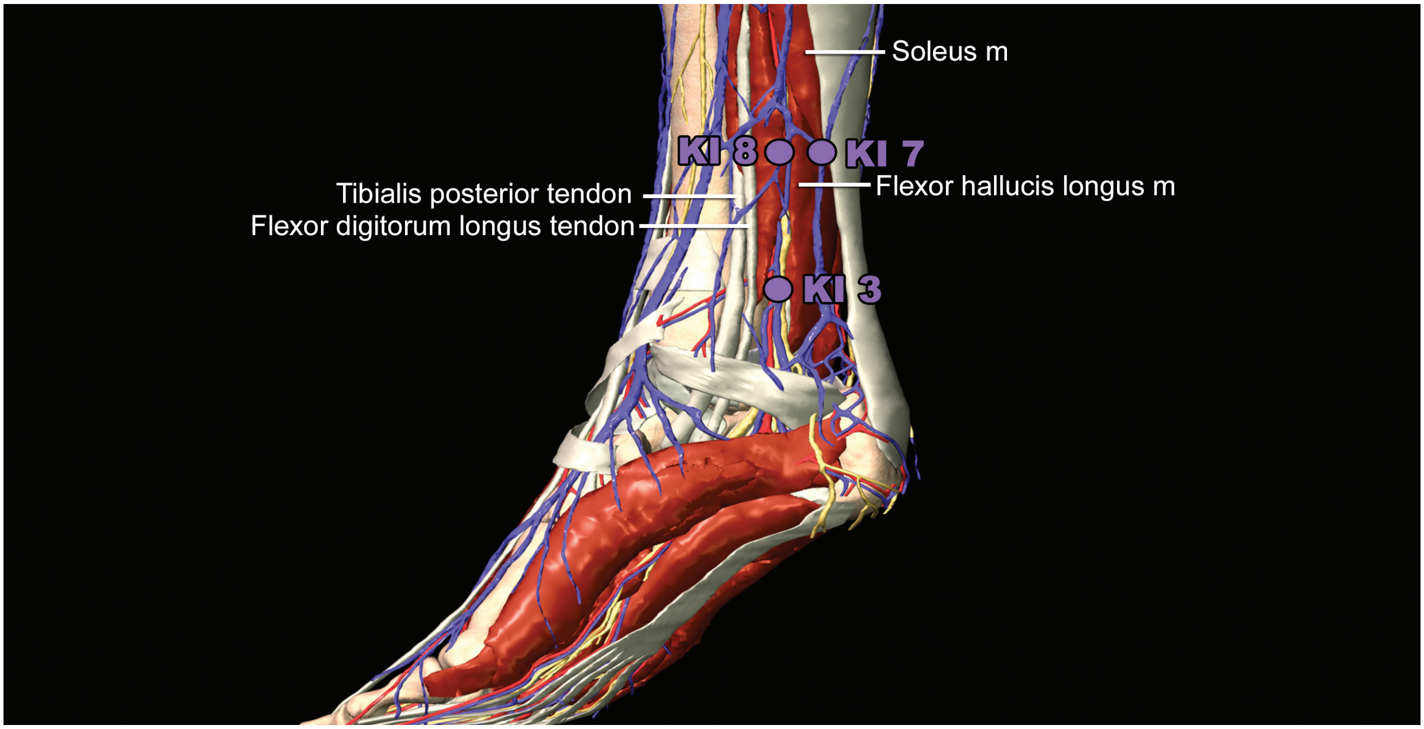

Soleus m
KI 8
KI 7
Tibialis posterior tendon
Flexor hallucis longus m
Flexor digitorum longus tendon
KI 3

Figure 8-16. After the brief detour to the venous system with KI 7, KI 8 resumes the KI line's association with the tibial nerve and posterior tibial arterial, putting the channel "back on track".

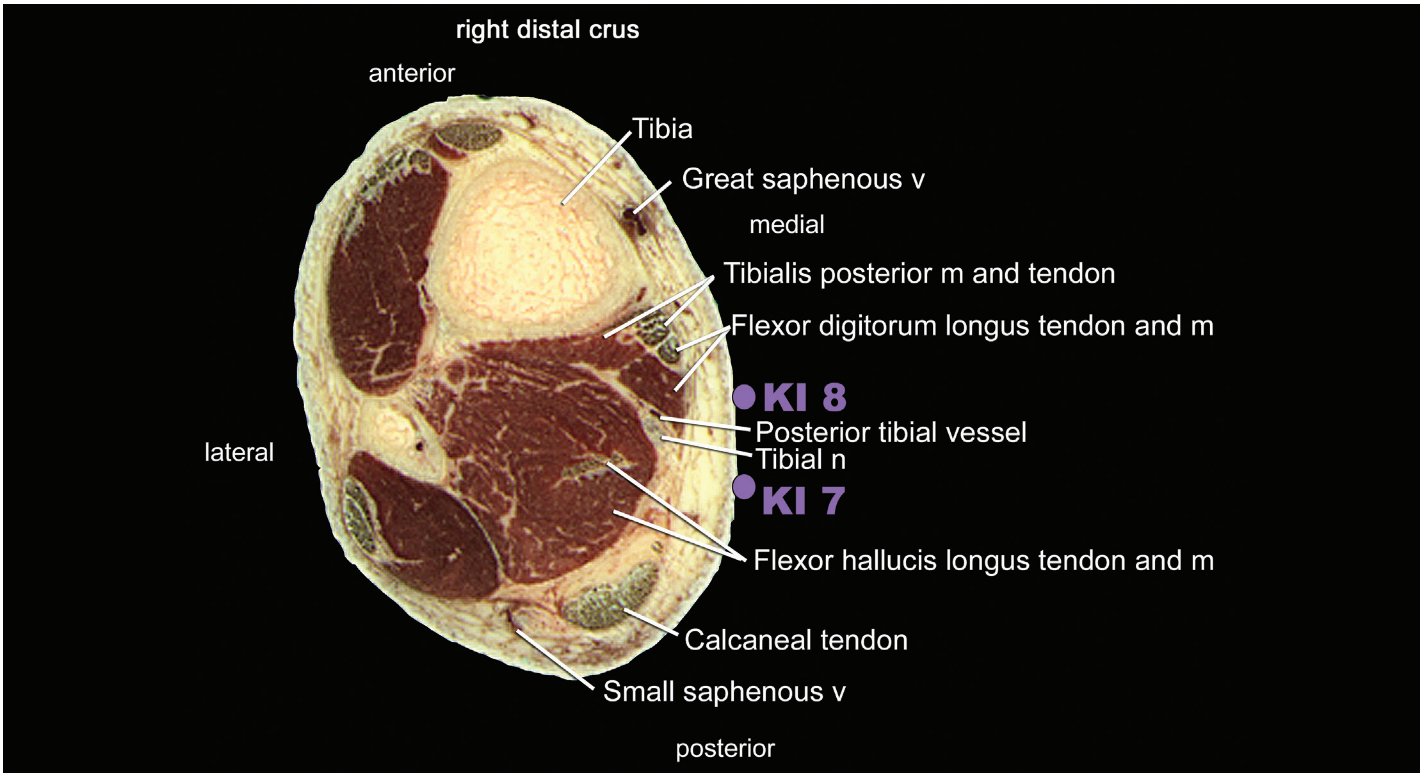

right distal crus
anterior
Tibia
Great saphenous v
medial
Tibialis posterior m and tendon
Flexor digitorum longus tendon and m
KI 8
lateral
Posterior tibial vessel
Tibial n
KI 7
Flexor hallucis longus tendon and m
Calcaneal tendon
Small saphenous v
posterior

Figure 8-17. KI 8, like KI 3, KI 5, KI 6′, and KI 1, closely relates to the tibial nerve, as shown in this cross-section. This means, then, that many of the systemic indications of these points overlap. Myofascial pain problems, on the other hand, require identification and treatment of specific of trigger points. KI 8 needling would more likely target the flexor hallucis longus trigger point than the typical location for trigger points in the flexor digitorum longus, typically located in the proximal calf.

relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[3]

From a therapeutic perspective needling points along the caudal tibia may activate nervi vasorum of local vasculature, conferring autonomic neuromodulatory benefits affecting genitourinary organ function and circulation.

Indications and Potential Point Combinations

- **Regulates blood supply to the pelvic limb, especially to the foot:** KI 8, SP 6, LR 3.
- **Irregular menstruation, amenorrhea, menorrhagia, metrorrhagia, uterine prolapse:** KI 8, KI 3, SP 6, CV 2.
- **Urinary hesitancy or retention, voiding dysfunction:** KI 3, KI 8, SP 6, BL 39, BL 33, BL 32, BL 28, CV 3.

Evidence-Based Applications

- **Effects on the brain:** Acupuncture at KI 8 affect brain areas involved with pain modulation as well as the hippocampus and insula.[4] This supports an indication for analgesia.[5] Acupuncture at KI 8 also inspires a stronger interplay between the default mode network (DMN), the hippocampus, and the insula. The DMN consists of cortical midline structures and lateral parietal regions involved in analgesia. Improved communication between the DMN, involved in self-projective thinking, and the periaqueductal gray (analgesia), the anterior cingulate cortex and amygdala (affective processing), and the hippocampus (memory) fosters integration between “neural dimensions of inner life” and “psychophysical pain homeostasis”.[6] In addition, stimulation of KI 8 also activated the visual cortex spatial domain but in an opposite direction from GB 37 in the resting state after acupuncture.[7]

References

1. Baxter DE. Functional nerve disorders in the athlete’s foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.

2. Yoong W, Shah P, Dadswell R, et al. Sustained effectiveness of percutaneous tibial nerve stimulation for overactive bladder syndrome: 2-year follow-up of positive responders. *Int Urogynecol J.* DOI 10.1007/s00192-012-1936-3.

3. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology.* 2011;26(3):114-118.

4. Liu P, Qin Wei, Zhang Y, et al. Combining spatial and temporal information to explore function-guide action of acupuncture using fMRI. *J Magn Reson Imaging.* 2009;30:41-46.

5. Liu P, Zhou G, Yang X, et al. Power estimation predicts specific function action of acupuncture: an fMRI study. *Magnetic Resonance Imaging.* 2011;29:1059-1064.

6. Otti A and Noll-Hussong M. Acupuncture-induced pain relief and the human brain’s default mode network – an extended viow of central effects of acupuncture analgesia. *Forsch Komplementmed.* 2012;9:197-201.

7. Zhang Y, Liang J, Qin W, et al. Comparison of visual cortical activations induced by electro-acupuncture at vision and nonvision-related acupoints. *Neuroscience Letters.* 2009;458:6-10.

KI 9

Zhu Bin "Expel Attack"

On the medial aspect of the leg, in a depression approximately 5 cun proximal to KI 3, on the line adjoining KI 3 and KI 10. About 1 cun caudal to the tibial border and approximately level with LR 5.

Muscles

- **Gastrocnemius tendon:** The gastrocnemius muscle raises the heel during ambulation. It flexes the leg at the knee, and plantarflexes the ankle if the knee is extended.
- **Soleus muscle:** Steadies the leg on the foot and plantarflexes the ankle, regardless of the position of the knee.

Clinical Relevance: KI 9 coincides with the soleus trigger point that refers pain proximal to the caudomedial calf and strongly along the medial calcaneal tendon, the entire heel, and the plantar aspect of the foot toward KI 1. Gastrocnemius trigger points typically occur further proximal, but echo the referred pain distribution of the soleus muscle.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Tibial nerve (S1, S2):** This branch of the sciatic nerve supplies the soleus, gastrocnemius, plantaris, and popliteus muscles.

Clinical Relevance: At about KI 9, the tibial nerve occupies the location known as the "high tarsal tunnel".[1] Nerve compression can result from myofascial restriction involving the flexor digitorum longus and flexor hallucis longus, the soleus, and tibialis posterior, as illustrated by the cross-section of Figure 8-19. Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and fibular (peroneal) veins.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins by the union of the dorsal vein of the great toe and the pedal dorsal venous arch. It anastomoses with the small saphenous vein and empties into the femoral vein.
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin off of the superficial veins. When they do so, they travel at an oblique angle so that muscular contraction and pressure within the compartment compresses the perforating veins. This phenomenon assists in encouraging unidirectional blood flow from superficial to deep veins and enables muscular contraction to assist in returning venous blood toward the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[2]

From a therapeutic perspective needling points along the caudal tibia may activate nervi vasorum of local vasculature, conferring autonomic neuromodulatory benefits affecting genitourinary organ function and circulation.

Treatment of KI 9 with acupuncture, laser therapy, and/or massage may bolster circulation to the myotendinous junction of the calcaneal tendon, fostering tissue repair and connective tissue regrowth.

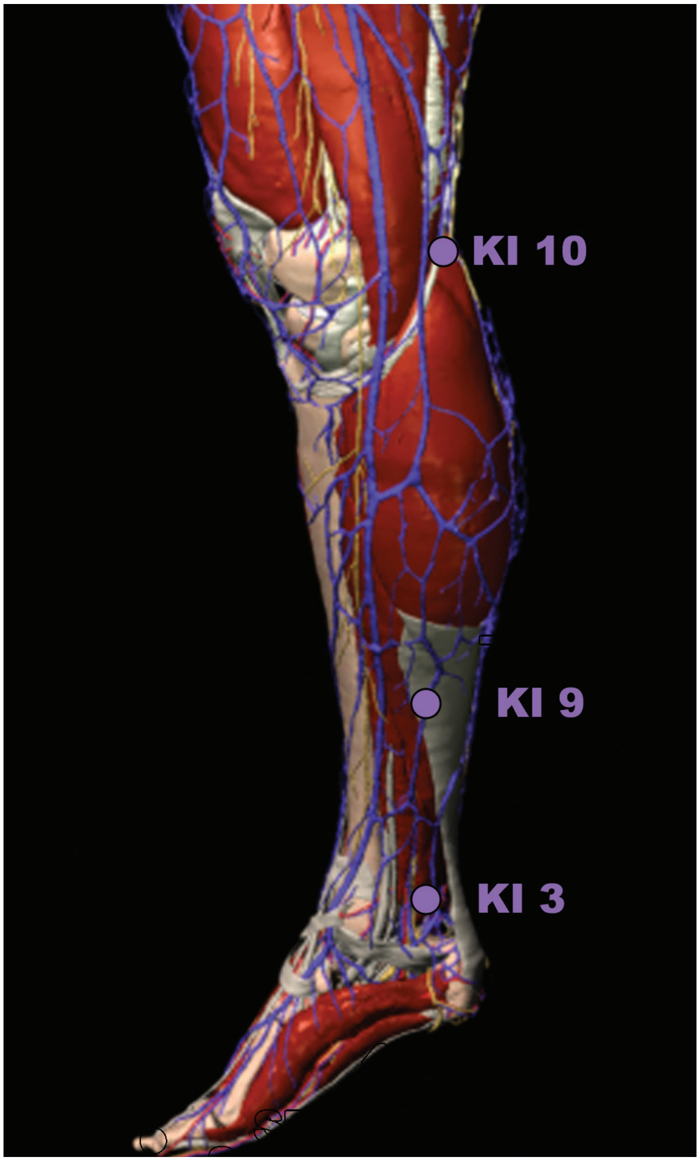


Figure 8-18. KI 9 falls along the line connecting KI 10 and KI 3. As the "Expel Attack" point, KI 9 can supposedly expel pathogenic influences. Perhaps by strengthening the power of the leg and alleviating pain in it, the leg itself becomes more capable of fending off an attack. More likely, the affliction that KI 9 repels pertains more to cramps in the calf caused by the gastrocnemius and soleus muscles.

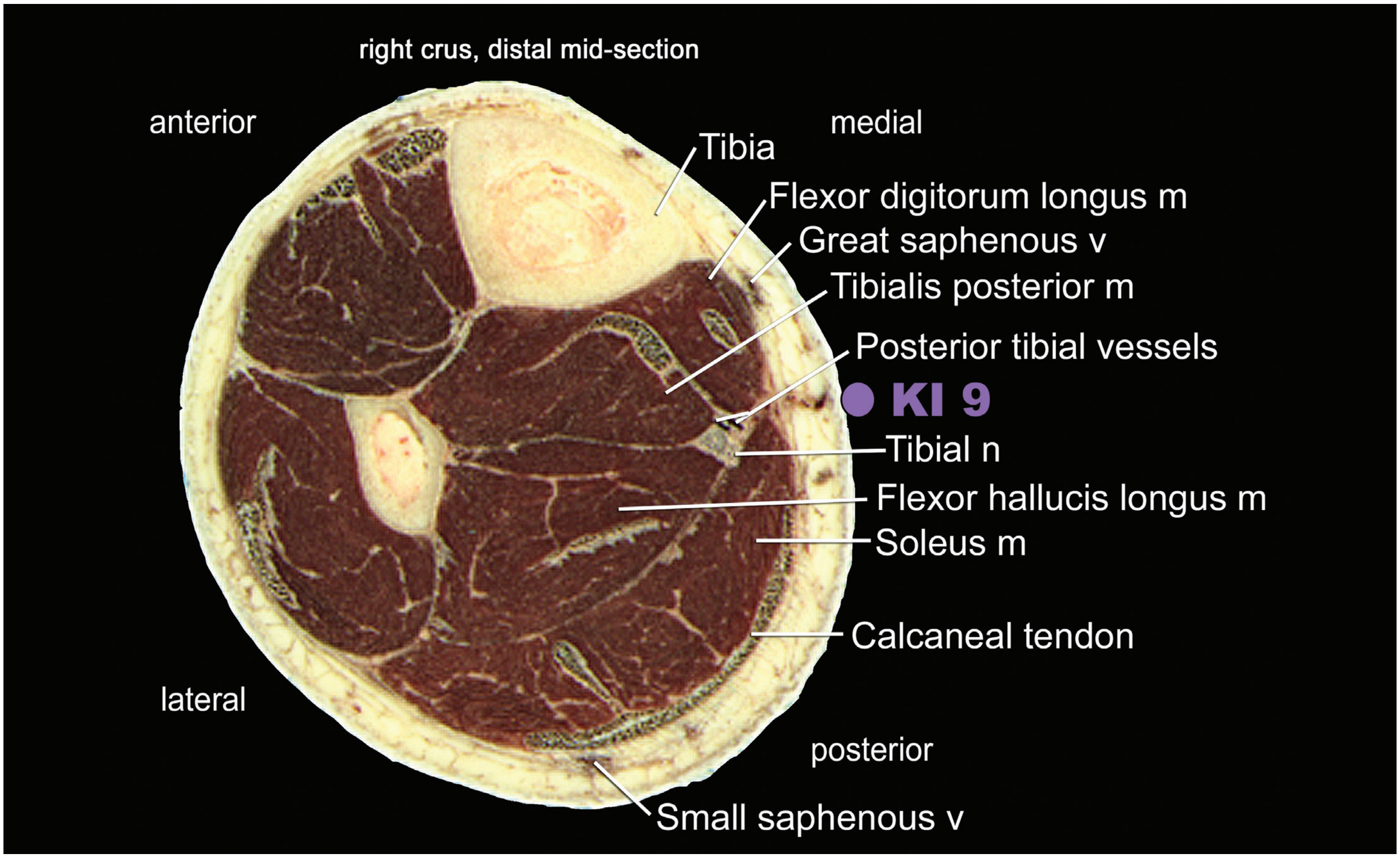

right crus, distal mid-section
anterior
medial
Tibia
Flexor digitorum longus m
Great saphenous v
Tibialis posterior m
Posterior tibial vessels
● KI 9
Tibial n
Flexor hallucis longus m
Soleus m
Calcaneal tendon
lateral
posterior
Small saphenous v

Figure 8-19. The KI channel remains faithful to the tibial nerve and posterior tibial vessels, as shown in this cross-section.

Indications and Potential Point Combinations

- Local pain and cramps: KI 9, local trigger points.

References

1. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
2. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology.* 2011;26(3):114-118.

KI 10

Yin Gu "Yin Valley"

At the medial end of the popliteal fossa, level with BL 40, between the tendons of the semitendinosus and semimembranosus muscles. Locate with the knee slightly flexed.

Tendons

- **Semimembranosus tendon:** Flexes the leg. Extends the thigh. When the knee alone is flexed, the semimembranosus muscle rotates the leg medially. When the thigh *and* leg are flexed, the semimembranosus extends the trunk. The main tendinous head inserts directly onto the caudomedial tibial plateau just caudal to the medial collateral ligament. The pars reflexa, the most cranial insertion, passes beneath the medial collateral ligament to insert on the tibia just distal to the medial joint line. Other insertions include the caudal aspect of the medial femoral condyle and the fascia of the popliteus muscle.
- **Semitendinosus tendon:** Flexes the leg. Extends the thigh. When the knee alone is flexed, the semitendinosus muscle rotates then leg medially. When the thigh *and* leg are flexed, the semitendinosus extends the trunk.

Clinical Relevance: Travell & Simons dub the hamstring muscles "chair-seat victims" due to the common finding of pain in patients who compress their hamstring muscles and sciatic nerve on the edge of a chair, thereby compromising circulation and compressing nerves. The mid-portion of the caudal thigh can harbor an abundance of trigger points in the mid-bellies of the semimembranosus, semitendinosus, and biceps femoris muscles. Pain refers from these sites either to the transverse gluteal fold or the popliteal fossa.

Semimembranosus tendinopathy, one of several potential sources of caudomedial knee pain, typically leads to a progressive ache that begins insidiously.[3] The pain may jump in intensity if the individual suddenly increases the amount of repetitive endurance activity such as running or bicycling. The pain of semimembranosus tendinopathy often localizes to the main insertion at the caudomedial knee; it may radiate proximad to the caudomedial thigh or distad to the medial calf. Pain worsens with activation of the muscle, as when walking downstairs, deeply flexing the knee, or performing the same activities that cause it to worsen, which require repetitive contractions.

Myofascial evaluation reveals tenderness to palpation of the semimembranosus tendon at its tibial insertion (SP 9) or more proximal (KI 10). Maneuvers that activate or stretch the tendon worsen the pain.

Differential diagnoses of caudomedial knee pain include tearing of the medial meniscus, osteoarthritis, pes anserine bursitis or associated tendinopathy, popliteal (Baker's) cyst, gastrocnemius strain affecting the medial head, popliteus strain, sprain of the medial collateral ligament, and more. Tendinopathy of the semimembranosus may develop in any of its insertions where the tendon experiences increased friction where it abuts or attaches to other structures. Repetitive, eccentric tendon loading can also induce degenerative changes in the tendons, the insertions, or the U-shaped bursa that surrounds the distal semimembranosus tendon and cushions it from the medial tibial plateau, the medial collateral ligament, and the semitendinosus muscle.

Conservative treatment for semimembranosus tendinopathy includes acupuncture, massage, laser therapy, hamstring stretching and strengthening exercises, shoe fit evaluation to avert over-pronation, and anti-inflammatory medications or phytomedicinals as needed.

"Snapping knee syndrome" in the caudomedial aspect of the tibia can involve dysfunction of the semitendinosus and gracilis tendons.[4]

Nerves

- **Posterior femoral cutaneous nerve (S1-S3/S4):** Supplies the skin of the posterior thigh and popliteal fossa. May receive contributions from the inferior (caudal) gluteal nerve, the common peroneal (fibular), and the sciatic/tibial nerves (with which it may communicate through nerve branching).[5] The posterior femoral cutaneous nerve gives rise to the inferior (caudal) cluneal and perineal branches that supply the caudal buttock and lateral perineal regions, the proximal medial thigh, caudolateral scrotum/labium majus, and a portion of the clitoris and penis. The posterior femoral cutaneous nerve accompanies the small saphenous vein to the mid-calf and joins with the sural nerve by means of communicating branches. Thus, in addition to the territory described by the sciatic nerve, the posterior femoral cutaneous nerve also supplies a neuroanatomic basis for the BL channel with overlap onto the KI pathway. Figure 8-21 elucidates

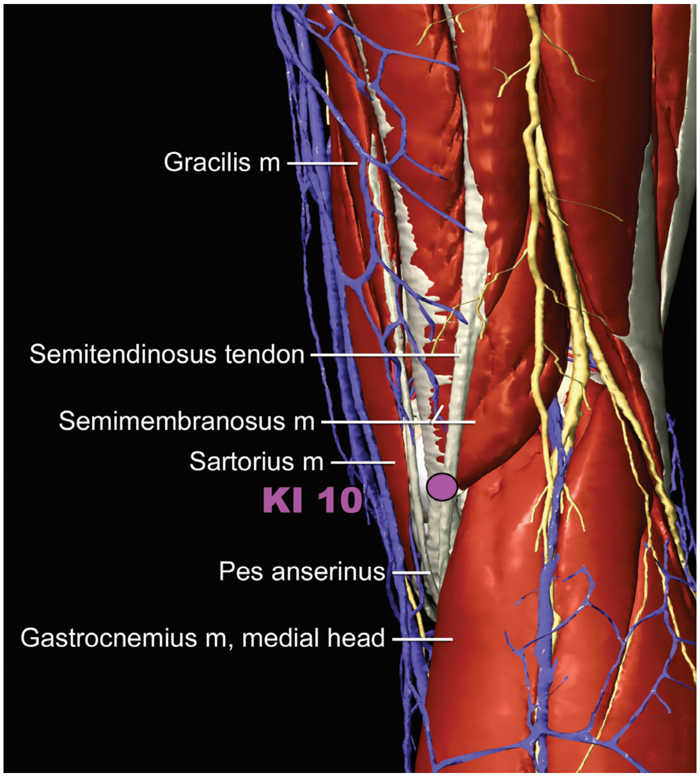


Figure 8-20. KI 10, in the "Yin Valley" at the medial aspect of the knee, forsakes the tibial nerve for the Yin, or inner, surface of the knee. Not to worry, as the BL channel partners with both branches of the sciatic nerve with BL 39 for the common peroneal and BL 40 for the tibial nerve, as shown in Figure 8-21. After all, the BL line demonstrated its commitment to the sciatic from its inception.

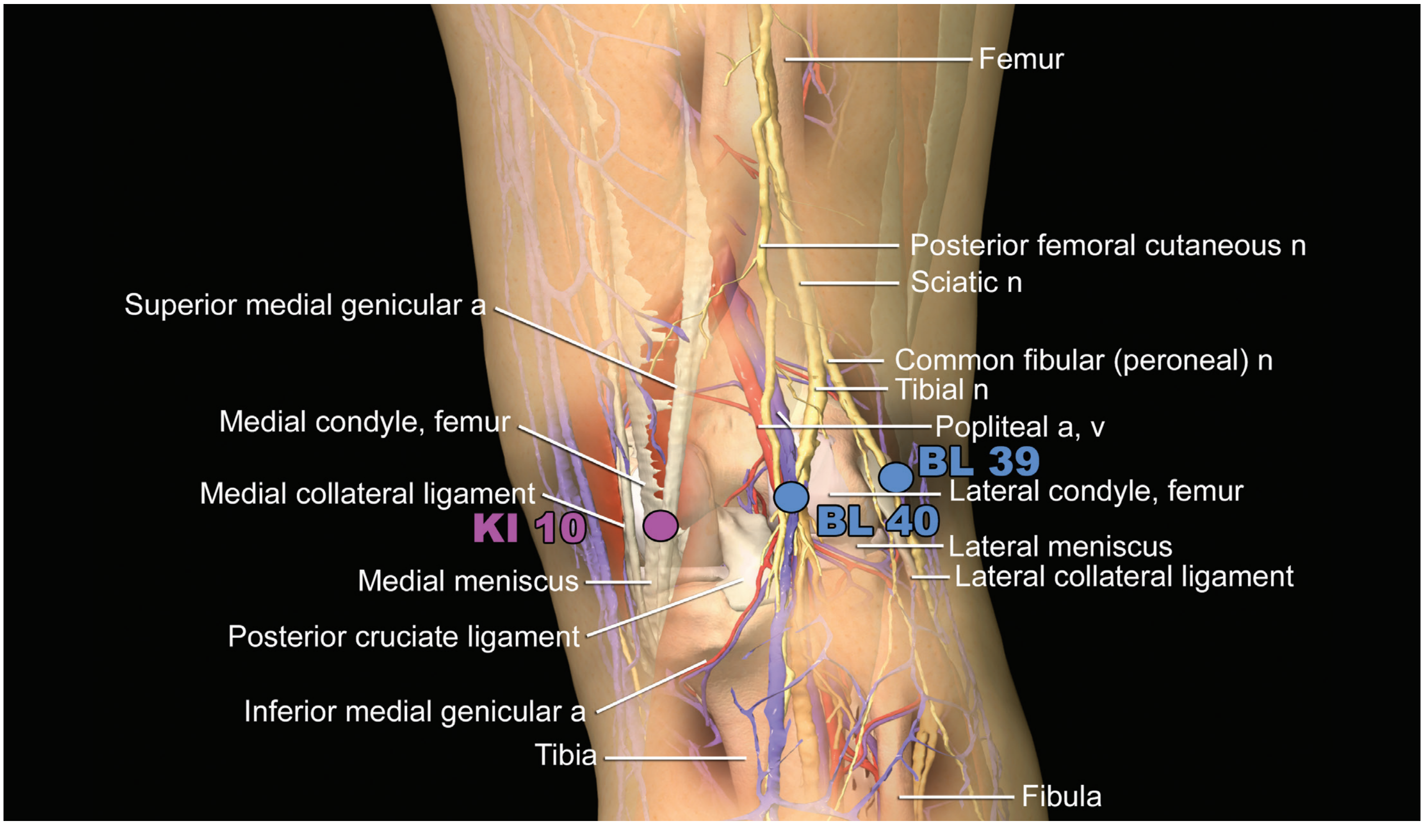

Femur
Posterior femoral cutaneous n
Sciatic n
Superior medial genicular a
Common fibular (peroneal) n
Tibial n
Medial condyle, femur
Popliteal a, v
BL 39
Medial collateral ligament
Lateral condyle, femur
KI 10
BL 40
Lateral meniscus
Medial meniscus
Lateral collateral ligament
Posterior cruciate ligament
Inferior medial genicular a
Tibia
Fibula

Figure 8-21. KI 10 ("Yin Valley"), BL 40 ("Bend Middle" or "Middle of the Crook"), and BL 39 ("Bend Yang" or "End of the Crook") line up along the popliteal crease. This image reveals significant anatomy deep to each point.

the way in which a small branch from the posterior femoral cutaneous nerve, proximal to BL 40, takes a medial detour toward KI 10.

- **Anterior branch of the medial femoral cutaneous nerve (L2-L4):** Supplies the skin on the anterior and medial thigh regions.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Sciatic nerve (L4-S3):** Supplies the hamstring muscles (i.e., the semimembranosus, semitendinosus, and long head of the biceps femoris muscles) by its tibial division (L5-S2). (The short head of the biceps femoris muscle is supplied by the common peroneal (fibular) division (L5-S2).)

Clinical Relevance: Somatic afferents from the posterior femoral cutaneous nerve participate in a somato-bladder inhibitory reflex, supporting the incorporation of neuromodulation through KI 10 (and BL 40) for the treatment of urinary incontinence.[6] Thus, three avenues of neuromodulation work in alone or in concert to aid in micturition disorders, i.e., posterior femoral cutaneous (KI 10, BL 40), pudendal (CV 1), and sacral nerve pathways (BL 27-34).

The posterior femoral cutaneous nerve can become damaged by direct trauma secondary to intragluteal injection, wherein the patient reports loss of sensation of the caudal thigh and caudomedial gluteal region by dint of the caudal medial cluneal nerve also being affected. Compressive neuropathies affecting the posterior femoral cutaneous nerve result from prolonged bicycle riding, hematoma or tumor compression of the presacral region, and falls. Because the posterior femoral cutaneous nerve follows the BL, more than the KI, channel so closely, neuromodulation would similarly follow that trajectory along the caudal thigh, adding distal points at BL 40, BL 55, and BL 60, with reinforcement by means of KI 10 and KI 3.

The saphenous nerve and the nerve to the vastus medialis provide the main sensory contributions from the femoral nerve to the knee.[7] The adductor-canal-blockade is an analgesic measure to provide pain relief following total knee arthroplasty. When performed at the mid-thigh, this block produced signs of injury to the infrapatellar branch of the saphenous nerve in 84% of patients. These individuals either displayed altered sensations to a brush stimulation, inability to discriminate between cold and warmth, and/or inability to discern between blunt and sharp stimulation to the site. As KI 10 falls within part of the territory supplied by the saphenous nerve, injury to the nerve following this or other procedures may resolve more quickly with the added interventions of acupuncture and related techniques.

Saphenous neuritis causes pain and arises when the saphenous nerve becomes irritated or compressed, usually at the adductor canal or elsewhere along its course.[8] Surgical or non-surgical trauma to the medial or cranial knee can inflame the saphenous nerve, imitating medial meniscal tear or osteoarthritis in the joint. Unrecognized, this condition complicates treatment and confuses the clinical picture. It may accompany patellofemoral pain syndrome and degenerative conditions of the knee. Palpation of the nerve and acupuncture or other physical medicine maneuvers designed to address nerve compression and irritation not only lends insight into the true cause(s) of patients' complaints, but also aids them in avoiding invasive procedures that they may not need.

Saphenous nerve entrapment involving the infrapatellar branch is a frequently overlooked and under-diagnosed source of knee pain.[9] Entrapment often involves compression by the sartorius muscle; conservative measures should be initiated before severing part of the sartorius surgically, as has been previously advised.[10]

Located at the myotendinous junction of the semimembranosus muscle, KI 10 neuromodulates Golgi tendon organs attached to the tibial portion of the sciatic nerve. Each Golgi tendon organ, interwoven in the collagen fibrils of the tendon, connects with one end to the muscle fibers and with the other end to the tendon. Supplied by a Group Ib sensory nerve fiber, the tendon organ transmits information about the degree of muscle stretch and tension. It also informs the spinal cord about how much the muscle it attaches to is contracting, by means of action potential volleys sent through the large diameter, heavily myelinated axon, the Group Ib fiber. Reflexes in the spinal cord then create autogenic inhibition; i.e., relaxation of the same muscle. In this case, needling KI 10 should promote relaxation of the semimembranosus muscle.

Vessels

- **Inferior medial genicular artery:** The inferior medial genicular artery participates in the formation of the genicular anastomoses – a network of vessels around the knee. It does so with the help of the other genicular arteries, including the lateral superior, medial superior, and lateral inferior arteries and three additional contributors: the descending genicular branch of the femoral artery, the descending branch of the lateral femoral circumflex artery, and the anterior recurrent branch of the anterior tibial artery. Genicular branches of the popliteal artery also supply the knee joint capsule and the ligaments of the knee.
- **Popliteal artery:** Muscular branches of the popliteal artery supply the hamstring and gastrocnemius muscles, as well as the soleus and plantaris muscles.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh. It begins by the union of the dorsal vein of the great toe and the pedal dorsal

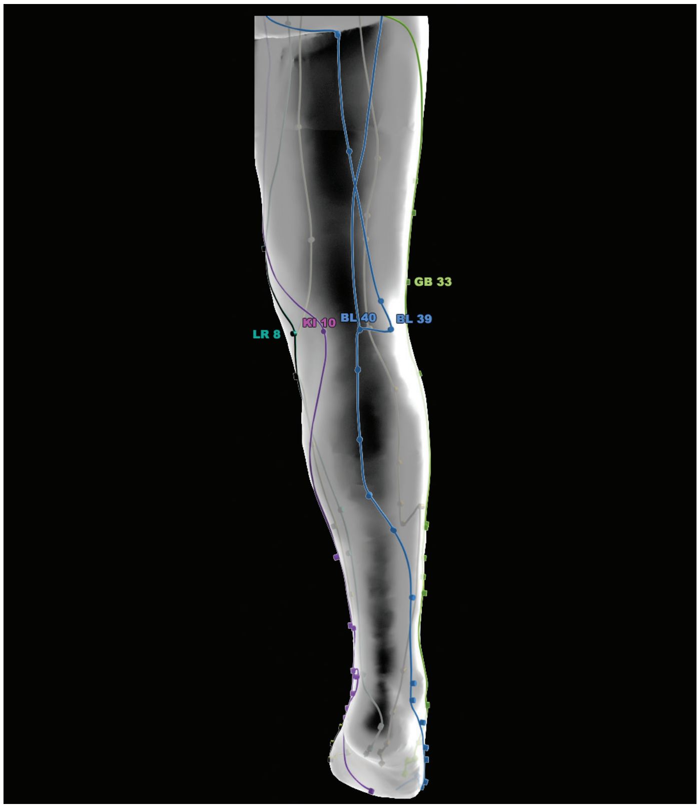

GB 33
KI 10
BL 40
BL 39
LR 8

Figure 8-22. KI and BL lines exhibit a long-lasting Yin-Yang relationship, as the other six channel pairs likewise demonstrate. As previously described, the Yin-Yang relationship translates into the way the Yin channel occupies the inner, more vulnerable aspect of a body part while the Yang partner courses over the outer, more protected surface of the same anatomy, whether limb or trunk. For KI-BL, KI remains situated on the plantar and medial surfaces of the pelvic limb while BL landed on the dorsal and lateral aspects. When KI and BL move to the trunk, KI (KI 11) will take the ventral course. BL maintains its affinity for the dorsum.

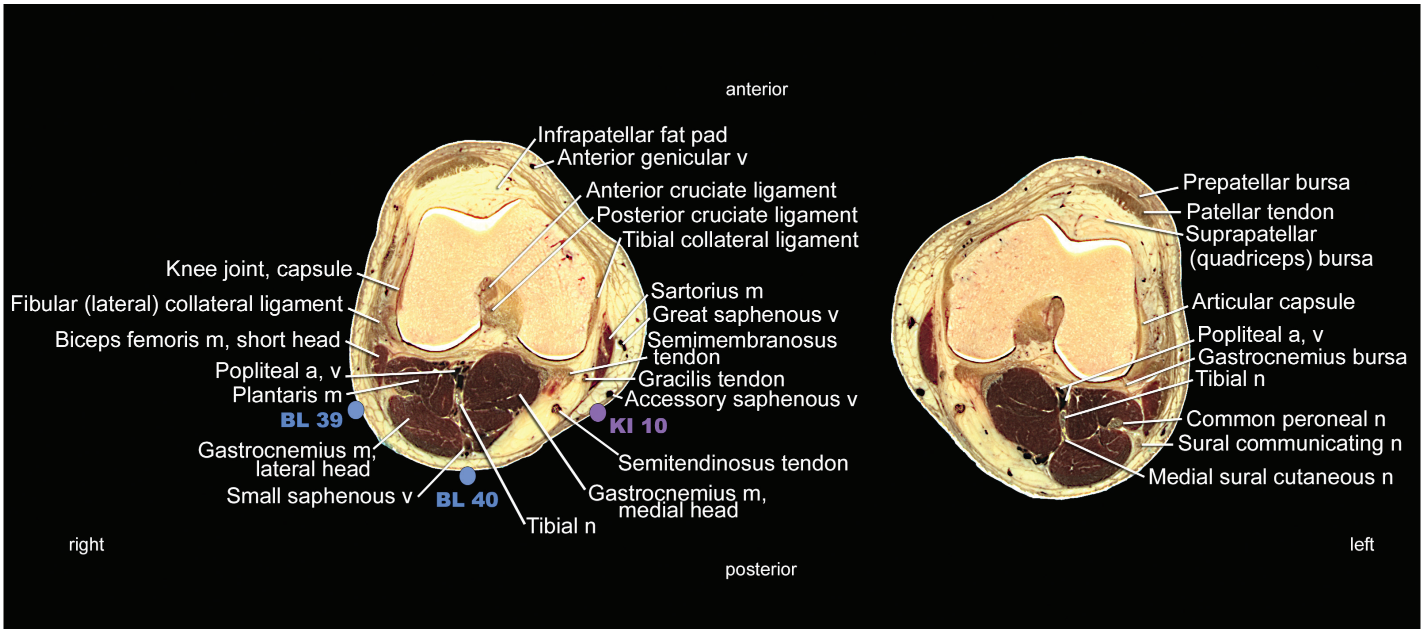

anterior
Infrapatellar fat pad
Anterior genicular v
Anterior cruciate ligament
Posterior cruciate ligament
Tibial collateral ligament
Knee joint, capsule
Fibular (lateral) collateral ligament
Biceps femoris m, short head
Sartorius m
Great saphenous v
Semimembranosus tendon
Popliteal a, v
Gracilis tendon
Plantaris m
Accessory saphenous v
BL 39
KI 10
Gastrocnemius m, lateral head
Semitendinosus tendon
Small saphenous v
BL 40
Gastrocnemius m, medial head
Tibial n
Prepatellar bursa
Patellar tendon
Suprapatellar (quadriceps) bursa
Articular capsule
Popliteal a, v
Gastrocnemius bursa
Tibial n
Common peroneal n
Sural communicating n
Medial sural cutaneous n
right
left
posterior

Figure 8-23. KI 10 relates to the tendons of the semimembranosus and semitendinosus muscles. Trigger points in these hamstrings muscles, the "chair seat victims" groups per Travell and Simons, refer strongly to the gluteal crease. The referred pain pattern extends through KI 10 to the KI 9 level.

venous arch. It anastomoses with the small saphenous vein and empties into the femoral vein.

- **Medial inferior veins of the knee:** One of several deep veins around the knee that drain into the popliteal vein.

Clinical Relevance: Pseudoaneurysms sometimes develop after orthopedic surgery. In the case of anterior cruciate ligament reconstruction, arteries affected include the medial inferior genicular artery and popliteal artery.[11] When acute, these vascular lesions can cause sudden bleeding into the joint cavity. Acute and voluminous hemarthrosis usually presents with a pulsatile mass within the first few weeks after surgery, although a pseudoaneurysm may develop after ten weeks. Their growth may compress nerves and nearby veins, potentially leading to deep vein thrombosis and occasionally amputation. Pseudoaneurysms differ from true aneurysms by not involving all layers of an artery, but they still maintain internal arterial flow. Pseudoaneurysms occur more frequently following total knee arthroplasty, but also after several other types of orthopedic interventions, including arthroscopic meniscectomy and the aforementioned anterior cruciate ligament reconstruction.

The popliteal artery is susceptible to damage during posterior cruciate ligament reconstruction, though certain approaches offer more protection to the vessels than do others.[12,13]

In such cases of vascular damage, treatment of the region at and around KI 10 and the entire popliteal fossa improve blood supply and drainage.

Indications and Potential Point Combinations

- **Renal problems, including nephritis and renal colic:** KI 10, KI 3, BL 23, BL 52, GB 25.
- **Urinary problems, including cystitis, urinary hesitancy, voiding dysfunction:** KI 10, SP 6, BL 28, BL 32.
- **Reproductive and menstrual problems, including prostatitis, erectile dysfunction, infertility, pelvic pain, urogenital infection, metrorrhagia:** KI 10, LR 5, PC 6, SP 4, CV 6, BL 23.
- **Low back pain and stiffness:** KI 10, BL 40, BL 23, local trigger points and paraspinal stimulation a few segments cranial and caudal to the painful area. Palpate gluteal and piriformis muscles for trigger points. Investigate midline GV points that may address spine-based pain.
- **Knee pain or restriction:** KI 10, BL 40. Identify nature and source of pain, and surface affected. For popliteal pain, check for hamstring (biceps femoris) and plantaris trigger points.

Anterior knee pain may require a different approach, such as SP 9, SP 10, ST 36, and ST 34, with Xiyan.

- **Anterior cruciate ligament injury:** KI 10, SP 9, SP 10, ST 34, ST 36, BL 40, BL 55, associated trigger points. Consider myofascial work and laser therapy for dynamic (active) stabilizers of the knee.[14]
- **Posterior femoral cutaneous neuropathy:** Consider KI 10, KI 3, BL 40, BL 55, BL 60, and local nerve points at BL 54, BL 35, BL 36, and BL 37. Massage and laser therapy in addition to relax myofascial restriction, further improve circulation, and promote tissue recovery.

Evidence-Based Applications

- Laser acupuncture significantly outperformed sham laser for the treatment of **mild to moderate depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[1]
- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[2]

References

1. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine.* 2005;23(3):103-111.
2. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.
3. Bylund WE and de Weber K. Semimembranosus tendinopathy: one cause of chronic posteromedial knee pain. *Sports Health.* 2010;2(5):380-384.
4. Karataglis D, Papadopoulos P, Fotiadou A, et al. Snapping knee syndrome in an athlete caused by the semitendinosus and gracilis tendons. A case report. *Knee.* 2008;15(2):151-154.
5. Tunali S, Cankara N, and Albay S. A rare case of communicating branch between the posterior femoral cutaneous and the sciatic nerves. *Rom J Morphol Embryol.* 2011;52(1):203-205.
6. Tai C, Shen B, Mally AD, et al. Inhibition of micturition reflex by activation of somatic afferents in posterior femoral cutaneous nerve. *J Physiol.* 2012;590(Pt 19):4945-4955.
7. Henningsen MH, Jaeger P, Hilsted KL, et al. Prevalence of saphenous nerve injury after adductor-canal-blockade in patients receiving total knee arthroplasty. *Acta Anaesthesiol Scand.* 2013;57:112-117.
8. Morganti CM, McFarland EG, and Cosgarea AJ. Saphenous neuritis: a poorly understood cause of medial knee pain. *J Am Acad Orthop Surg.* 2002;10(2):130-137.
9. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain. *Bull Hosp Jt Dis.* 1993;52(2):31-33.
10. House JH and Ahmed K. Entrapment neuropathy of the infrapatellar branch of the saphenous nerve. *Am J Sports Med.* 1977;5(5):217-224.
11. Mello W, de Brito WE, Migon EZ et al. Pseudoaneurysm of the medial inferior genicular artery after anterior cruciate ligament reconstruction. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 2011;27(3):442-445.
12. Miller MD, Kline AJ, Gonzales J, et al. Vascular risk associated with a posterior approach for posterior cruciate ligament reconstruction using the tibial inlay technique. *J Knee Surg.* 2002;15(3):137-140.
13. Ahn JH, Wang JH, Lee SH, et al. Increasing the distance between the posterior cruciate ligament and the popliteal neurovascular bundle by a limited posterior capsular release during arthroscopic transtibial posterior cruciate ligament reconstruction: a cadaveric angiographic study. *Am J Sports Med.* 2007;35(5):787-792.
14. Hayes GM, Granger N, Langley-Hobbs SJ, et al. Abnormal reflex activation of hamstring muscles in dogs with cranial cruciate ligament rupture. *The Veterinary Journal.* 2013;196(3):345-350..

KI 11

Heng Gu "Pubic Bone"

In the pubic region, immediately superior to the superior ramus of the pubis, 0.5 cun lateral to the anterior midline, level with CV 2.

Caution: Deep needling may penetrate a full bladder or injure the spermatic cord. See Figure 8-26 to examine structures within reach of a deeply placed acupuncture needle.

Spermatic Cord

- Contents include:
  - Testicular artery
  - Deferential artery
  - Cremasteric artery
  - Nerve to the cremaster (genital branch of the genitofemoral nerve)
  - Testicular nerves (sympathetic nerves)
  - Vas deferens (ductus deferens)
  - Pampiniform plexus
  - Lymphatic vessels
  - Tunica vaginalis
  - External spermatic fascia (an extension of the fascia that overlies the aponeurosis of the external oblique muscle)
  - Cremasteric muscle and fascia (a continuation of the internal oblique muscle and fascia)
  - Internal spermatic fascia (continuous with the transversalis fascia)

Clinical Relevance: Although one's acupuncture needle should not reach the spermatic cord, ST 29 overlies this important structure. As such, point activation with electroacupuncture, manual therapy, needle manipulation, or laser therapy may influence the function and blood supply of the cord's contents. That is, the vessels may dilate, the nerves may modulate, and myofascial elements relax. The result would likely lead to improved testicular function and reproductive capacity. See Figures 3-71 and 3-72 for two views of the anatomical relationships between ST 29 and the spermatic cord.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[1] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with a history of trauma to the abdomen. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment might allow a small, initially asymptomatic mass to enlarge and cause signs of pelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[2]

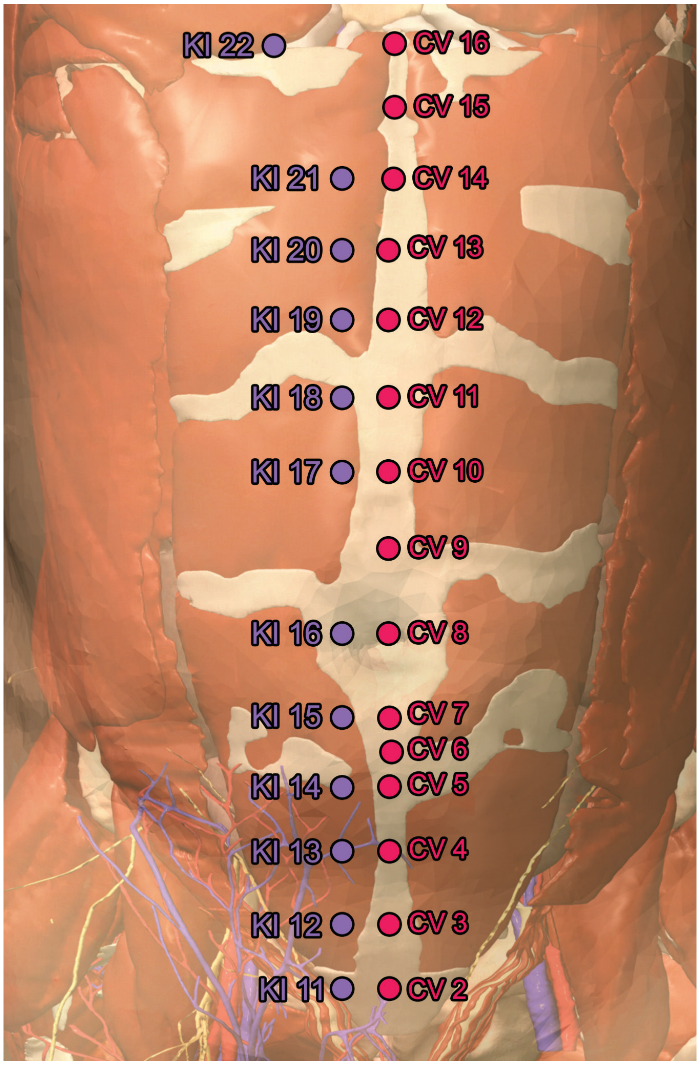


Figure 8-24. From KI 11, the "Pubic Bone" point, to KI 21, the KI channel finds a close affiliate in the CV line. Deep needling of KI and ST points in the caudal abdomen risk causing rectus sheath hematoma, a condition that may be misdiagnosed as septic shock, acute abdomen, appendicitis, and a host of other conditions.[18]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[3] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus. Transverse tendinous inscriptions or intersections further divide the muscle into segments, as illustrated through semi-transparent skin in Figure 8-24.
- **Pyramidalis muscle:** An inconstant muscle with varying incidence. Estimates of its presence in humans range from 3%[4] to 30%[5] or more. This triangular muscle resides cranial to the rectus abdominis muscle. It attaches to the pubis and the cranial pubic ligament, inserting onto the linea alba approximately halfway between the pubic symphysis and the umbilicus. It helps tense the linea alba when present.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen.

Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress. In the caudal abdomen at KI 11, trigger points can incite feelings of bladder irritation and discomfort.

The pyramidalis muscle, when present but dysfunctional, refers pain to the umbilicus.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** These nerves innervate the anterior abdominal muscles and their overlying skin, as well as the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior, or caudal, to the umbilicus. Entrapment of these nerves within the rectus abdominis muscle causes rectus abdominis syndrome, leading to lower abdominal and pelvic pain that, in female patients, simulates pain from gynecologic conditions. More details about the subcostal, iliohypogastric, and ilioinguinal nerves follow.
- **Subcostal nerve (T12):** Supplies the skin in the region.
- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[6]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region.

The iliohypogastric nerve is the first nerve of the lumbar plexus.[7] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or caudal to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.

The iliohypogastric nerve communicates extensively with the subcostal and ilioinguinal nerves. The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[8] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

- **Ilioinguinal nerve (L1, occasionally with T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus, depending on the gender of the individual. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with the genitofemoral nerve (L1,L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[9]
- **Nerve to the pyramidalis muscle (T12 – L2, variable segmental supply):** The pyramidalis receives innervation from branches

of the lumbar plexus described as "border nerves" where the abdominal wall abuts the pelvic limbs. Nerves supplying this territory include the iliohypogastric, ilioinguinal, and genitofemoral nerves. The nerve to the pyramidalis exhibits wide variation in its origin, arising potentially from any of the three nerves.[10]

- **Spermatic ganglion:** Connected to the caudal (inferior) mesenteric plexus, likely sympathetic, supplying, at least in part, the testicular artery.[11]

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[12] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from the plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively. The variability in spinal nerve origins for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by extending neuromodulation to a broader anatomic zone.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[13] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[14] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[15] Paresis of the abdominal wall may cause large swelling and mechanical complaints. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation unless the nerves were severed completely. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also be addressed with neuromodulation, in addition to adjunctive abdominal support and multimodal analgesia.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.

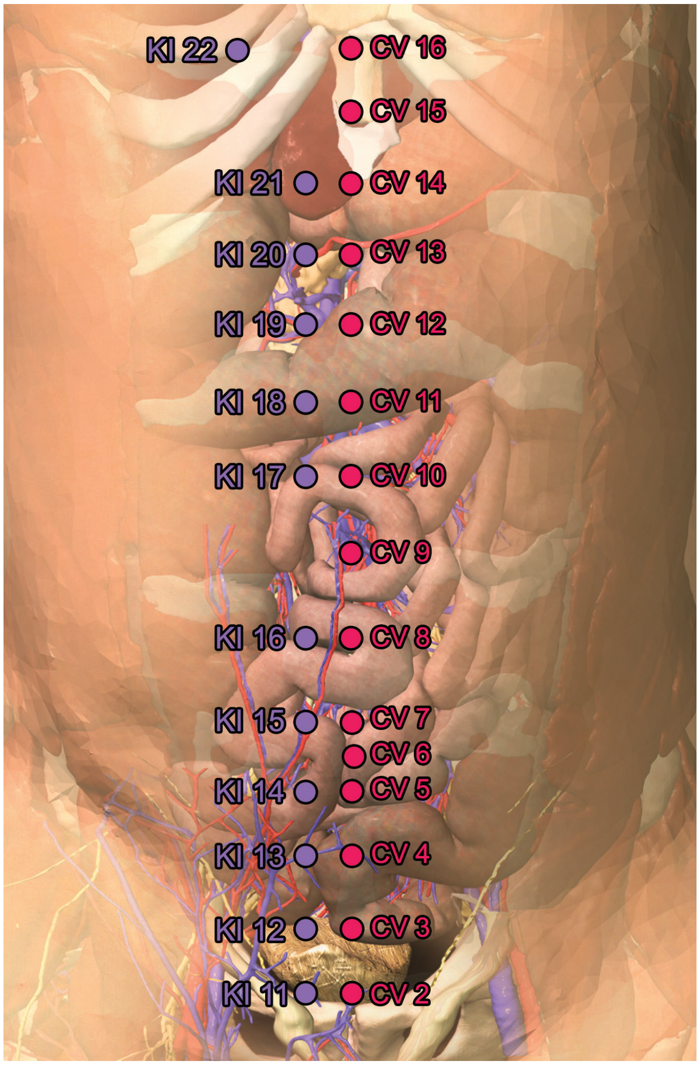


Figure 8-25. The organs beneath the KI line over the abdomen span from the pubic bone (the point's namesake) and urinary bladder at KI 11 to the pylorus at KI 21.

- **Inferior (deep) epigastric artery:** Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

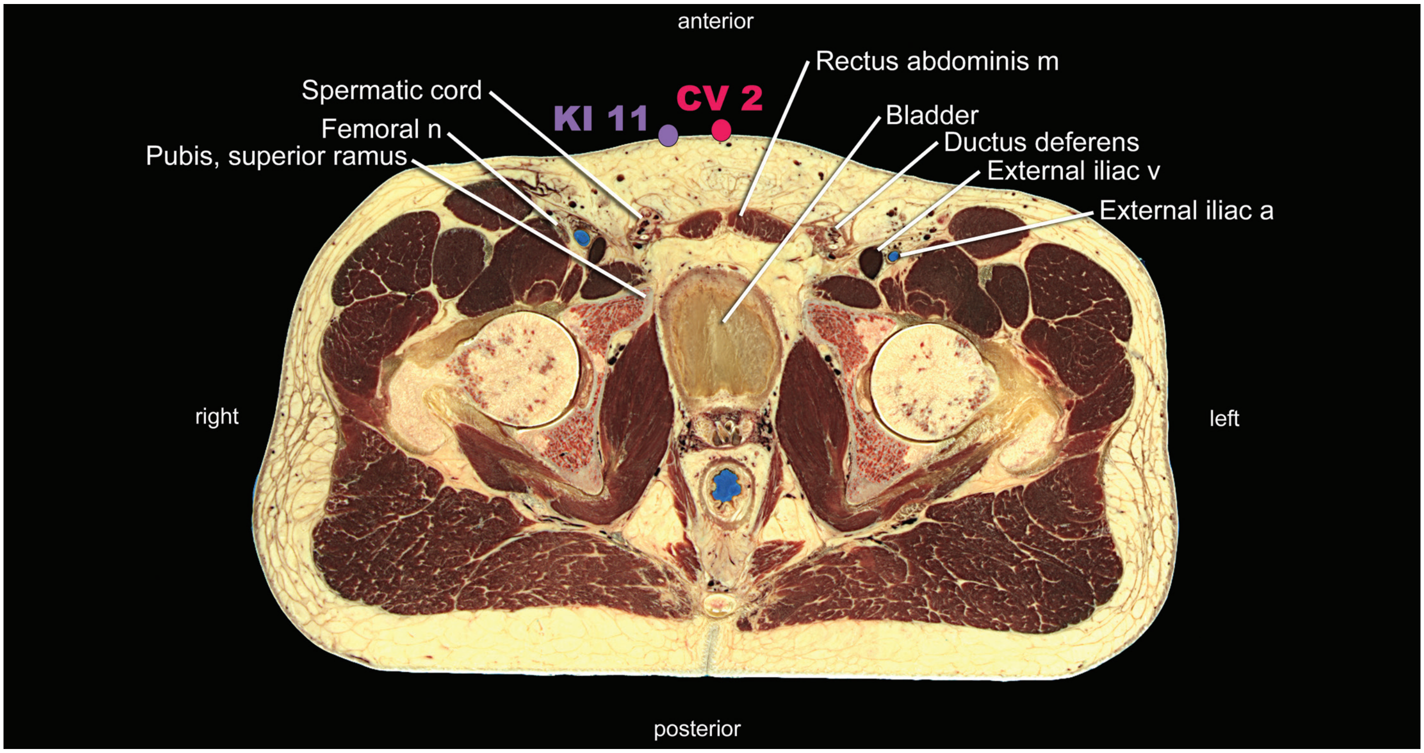


Figure 8-26. The organ targets when including KI 11 in acupuncture protocols become apparent in this cross-section. They include urinary, reproductive, and abdominal wall musculature. Although this individual did not exhibit a readily discernible pyramidalis muscle, trigger points in this or other abdominal wall musculature can cause referred pain symptoms that mimic visceral dysfunction, including diarrhea, urinary tract discomfort, and appendicitis.

- **Superficial external pudendal artery:** A branch of the femoral artery, the superficial external pudendal artery crosses the spermatic cord and supplies the skin on the lower abdomen, the penis, and scrotum. The superficial external pudendal artery anastomoses with branches of the internal pudendal artery.

The deep external pudendal artery also arises from the femoral artery, but in contrast to its superficial counterpart, passes across the pectineus and adductor longus muscles to supply the skin of the scrotum and perineum. The deep external pudendal artery anastomoses with scrotal branches of the perineal artery.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; further cranial, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[16] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.

Indications and Potential Point Combinations

- **Pelvic and reproductive problems, including oligospermia, retracted penis, priapism, pain:** KI 11, CV 2, CV 6, ST 29, SP 30, SP 12, SP 6, BL 32.
- **Urinary problems, including dysuria, enuresis, retention:** KI 11, CV 3, SP 6, BL 28, BL 32.
- **Distension, dysfunction, and/or pain of the lower abdomen:** KI 11, ST 25, ST 36. Check for trigger points in the abdominal muscles, as reciprocal somatovisceral and viscerosomatic connections between the muscles and abdominal organs may produce symptoms that closely mimic visceral or somatic dysfunction.
- **Back pain:** KI 11 as an attachment trigger point in the rectus abdominis muscle may refer pain in a band-like fashion to the sacral and cranial gluteal regions.
- **Midline post-incisional pain or continued scar irritation:** KI 11 and other points near and around scar. Direct needles toward scar but insert into normal tissue. Employ manual therapy treatment to free underlying soft and connective tissue. Consider laser therapy.

References

1. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
2. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of*

Emergency Medicine. 2005;29(1):101-102.

4. Tokita K. Anatomical significance of the nerve to the pyramidalis muscle: a morphologic study. *Anatomical Science International*. 2006;81:210-224.

5. Dickson MJ. The pyramidalis muscle. J*ournal of Obstetrics and Gynaecology*. 1999;19(3):300.

6. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy*. 2011;24:454-461.

7. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg*. 2010;76(3):253-262.

8. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves*. BC Decker, Inc.: London, England, 1997, p. 180.

9. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

10. Tokita K. Anatomical significance of the nerve to the pyramidalis muscle: a morphological study. *Anatomical Science International*. 2006;81:210-224.

11. Motoc A, Rusu MC, and Jianu AM. The spermatic ganglion in humans: an anatomical update. *Rom J Morphol Embryol*. 2010; 51(4):719-723.

12. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.

13. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.

14. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. The Permanente Journal. 2002;6(3):20-27.

15. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

16. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

17. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

18. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery*. 2009;7:150-154.

KI 12

Da He "Great Prominence", "Great Manifestation"

Just above the pubic region, 1 cun superior to the superior ramus of the pubis, 0.5 cun lateral to the ventral midline, level with CV 3.

Caution: Deep needling may penetrate a full bladder.

See Figure 8-28 to examine structures within reach of a deeply placed acupuncture needle. Note as well how the degree of adipose tissue present in the caudal abdomen changes safe needling depth.[2]

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[3] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with a history of trauma to the abdomen. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of pelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[4]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[5] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the

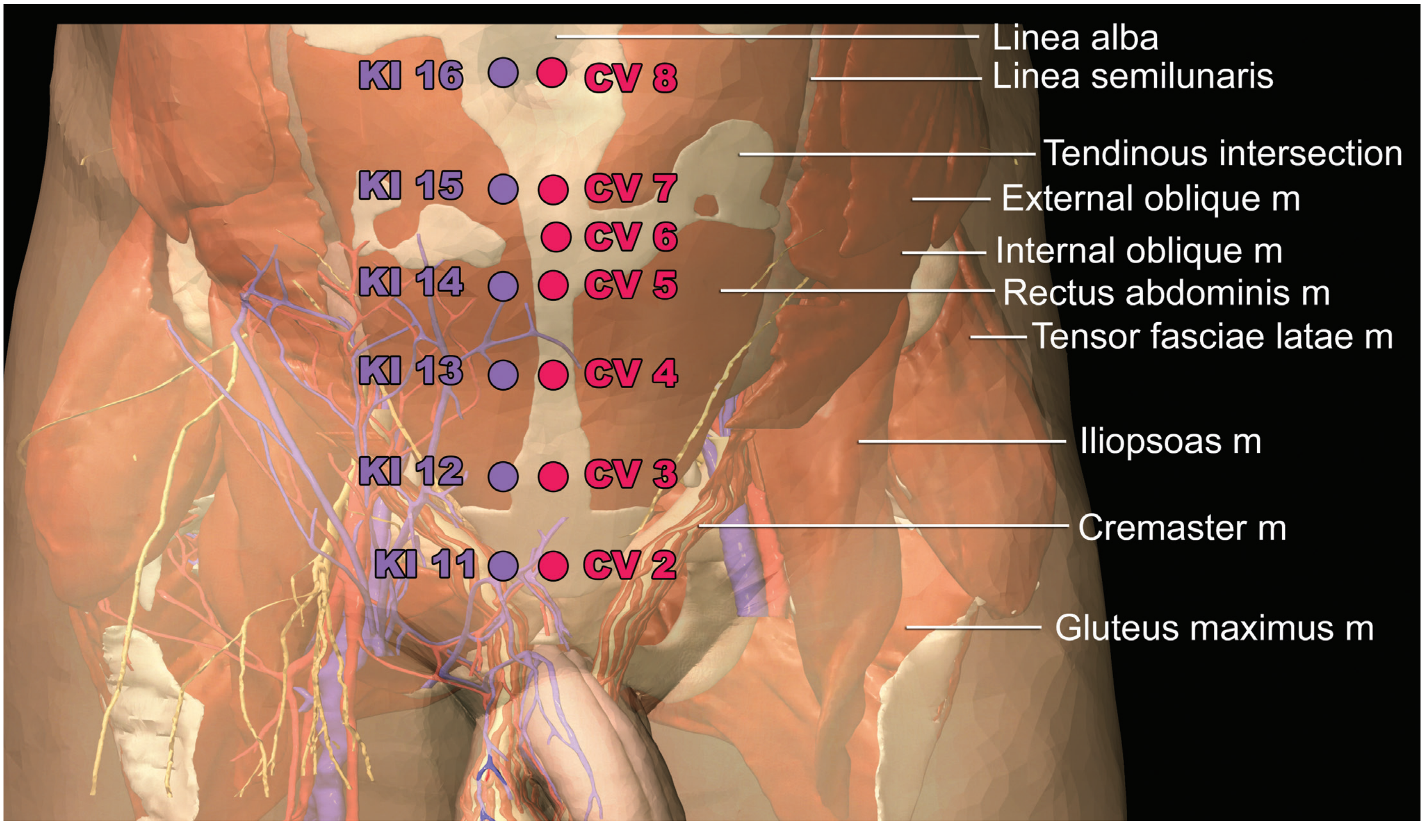


Figure 8-27. KI 12 owes its names of "Great Prominence" or "Great Manifestation" to the fact that this region in the pregnant female grows large.

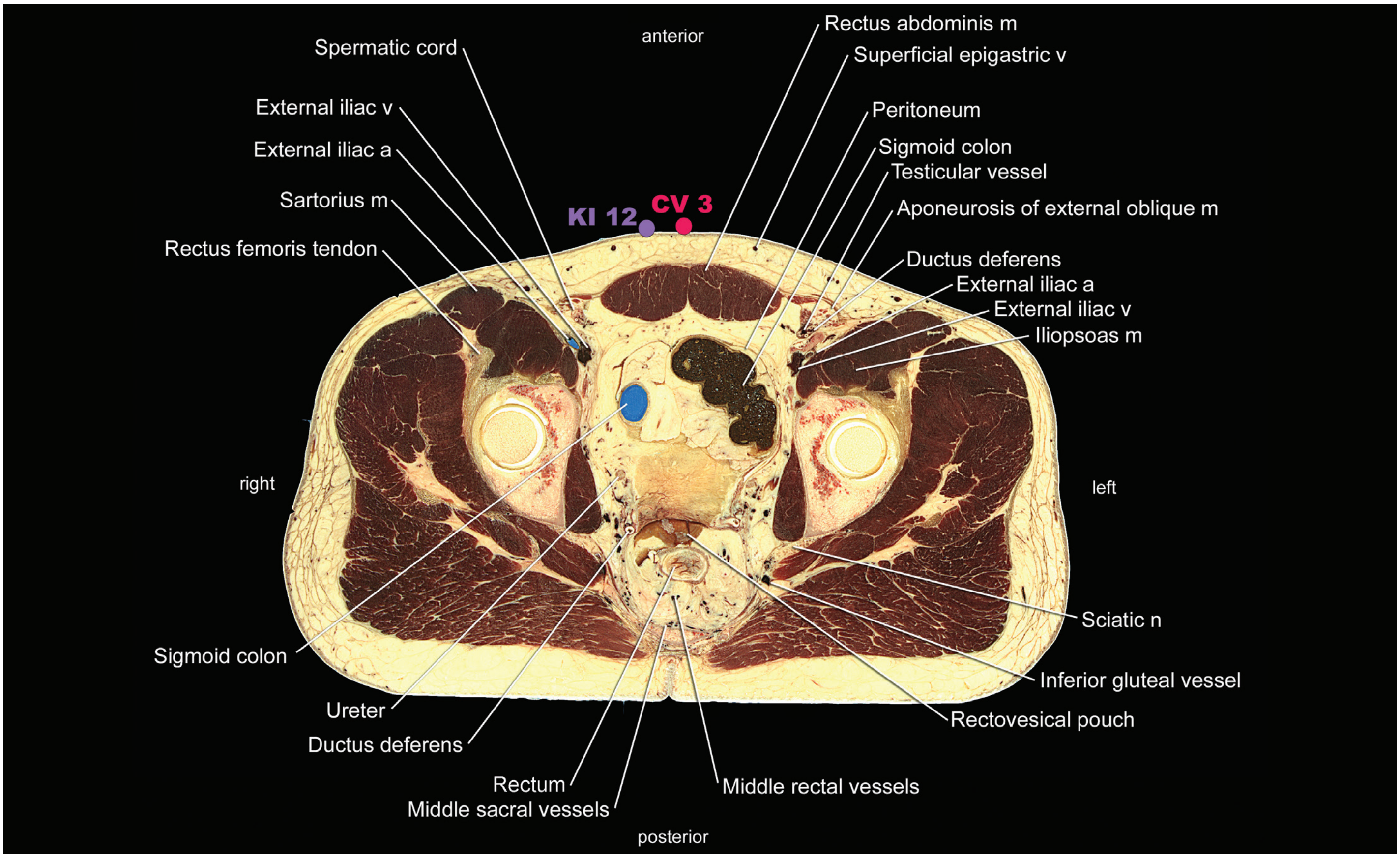

anterior
Spermatic cord
External iliac v
External iliac a
Sartorius m
Rectus femoris tendon
KI 12
CV 3
Rectus abdominis m
Superficial epigastric v
Peritoneum
Sigmoid colon
Testicular vessel
Aponeurosis of external oblique m
Ductus deferens
External iliac a
External iliac v
Iliopsoas m
right
left
Sciatic n
Sigmoid colon
Inferior gluteal vessel
Ureter
Rectovesical pouch
Ductus deferens
Rectum
Middle sacral vessels
Middle rectal vessels
posterior

Figure 8-28. KI 12 shares CV 3's indications by dint of the common neuroanatomic supply relating to abdominopelvic pain and organ dysfunction.

patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus. Transverse tendinous inscriptions or intersections further divide the muscle into segments, as illustrated through semi-transparent skin in Figures 8-24 and 8-27.
- **Pyramidalis muscle:** An inconstant muscle with varying incidence. Estimates of its presence in humans range from 3%[6] to 30%[7] or more. This triangular muscle resides cranial to the rectus abdominis muscle. It attaches to the pubis and the cranial pubic ligament, inserting onto the linea alba approximately halfway between the pubic symphysis and the umbilicus. It helps tense the linea alba when present.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen. Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress. In the caudal abdomen at KI 12, trigger points can incite feelings of bladder irritation and discomfort.

The pyramidalis muscle, when present but dysfunctional, refers pain to the umbilicus.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** These nerves innervate the anterior abdominal muscles and their overlying skin, as well as the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior, or caudal, to the umbilicus. Entrapment of these nerves within the rectus abdominis muscle causes rectus abdominis syndrome, leading to lower abdominal and pelvic pain that, in female patients, simulates pain from gynecologic conditions. More details about the subcostal, iliohypogastric, and ilioinguinal nerves follow.
- **Subcostal nerve (T12):** Supplies the skin in the region.

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[8]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region.

The iliohypogastric nerve is the first nerve of the lumbar plexus.[9] The lumbar plexus is formed from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or caudal to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.

The iliohypogastric nerve communicates extensively with the subcostal and ilioinguinal nerves. The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[10] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

- **Ilioinguinal nerve (L1, occasionally with T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus, depending on the gender of the individual. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with the genitofemoral nerve (L1,L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[11]
- **Nerve to the pyramidalis muscle (T12 – L2, variable segmental supply):** The pyramidalis receives innervation from branches of the lumbar plexus described as "border nerves" where the abdominal wall abuts the pelvic limbs. Nerves supplying this territory include the iliohypogastric, ilioinguinal, and genitofemoral nerves. The nerve to the pyramidalis exhibits wide variation in its origin, arising potentially from any of the three nerves.[12]
- **Spermatic ganglion:** Connected to the caudal (inferior) mesenteric plexus, likely sympathetic, supplying, at least in part, the testicular artery.[13]

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[14] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from the plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively. The variability in spinal nerve origins for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[15] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[16] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[17] Paresis of the abdominal wall may cause large swelling and mechanical complaints. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation unless the nerves were severed completely. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also be addressed with neuromodulation, in addition to adjunctive abdominal support and multimodal analgesia.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery:** Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins,

act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

- **Superficial external pudendal artery:** A branch of the femoral artery, the superficial external pudendal artery crosses the spermatic cord and supplies the skin on the lower abdomen, the penis, and scrotum. The superficial external pudendal artery anastomoses with branches of the internal pudendal artery. The deep external pudendal artery also arises from the femoral artery, but in contrast to its superficial counterpart, passes across the pectineus and adductor longus muscles to supply the skin of the scrotum and perineum. The deep external pudendal artery anastomoses with scrotal branches of the perineal artery.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; around the umbilicus, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep face. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[18] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[19]

Indications and Potential Point Combinations

- **Urogenital disorders and pain:** KI 12, SP 6, PC 6, BL 23, BL 25, BL 32, CV 3, GV 3.

Evidence-Based Application

- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction**.[1]

References

1. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.
2. Chen HN, Lin JG, Ying LC, et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *J Altern Complement Med.* 2009;15(9):1033-1037.
3. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
5. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
6. Tokita K. Anatomical significance of the nerve to the pyramidalis muscle: a morphologic study. *Anatomical Science International.* 2006;81:210-224.
7. Dickson MJ. The pyramidalis muscle. *Journal of Obstetrics and Gynaecology.* 1999;19(3):300.
8. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy.* 2011;24:454-461.
9. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.
10. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves.* BC Decker, Inc.: London, England, 1997, p. 180.
11. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
12. Tokita K. Anatomical significance of the nerve to the pyramidalis muscle: a morphological study. *Anatomical Science International.* 2006;81:210-224.
13. Motoc A, Rusu MC, and Jianu AM. The spermatic ganglion in humans: an anatomical update. *Rom J Morphol Embryol.* 2010; 51(4):719-723.
14. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy.* 2008;21:325-333.
15. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.
16. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
17. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
18. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
19. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

KI 13

Qi Xue "Qi Cave", "Qi Hole", or "Qi Point"

On the pubic region, 2 cun superior to the superior ramus of the pubis, or 3 cun inferior to the umbilicus, 0.5 cun lateral to the ventral midline, level with CV 4.

See Figure 8-30 to examine structures within reach of a deeply placed acupuncture needle. Note as well how the degree of adipose tissue present in the caudal abdomen changes safe needling depth.[1]

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[2] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with a history of trauma to the abdomen. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[3]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[4] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated

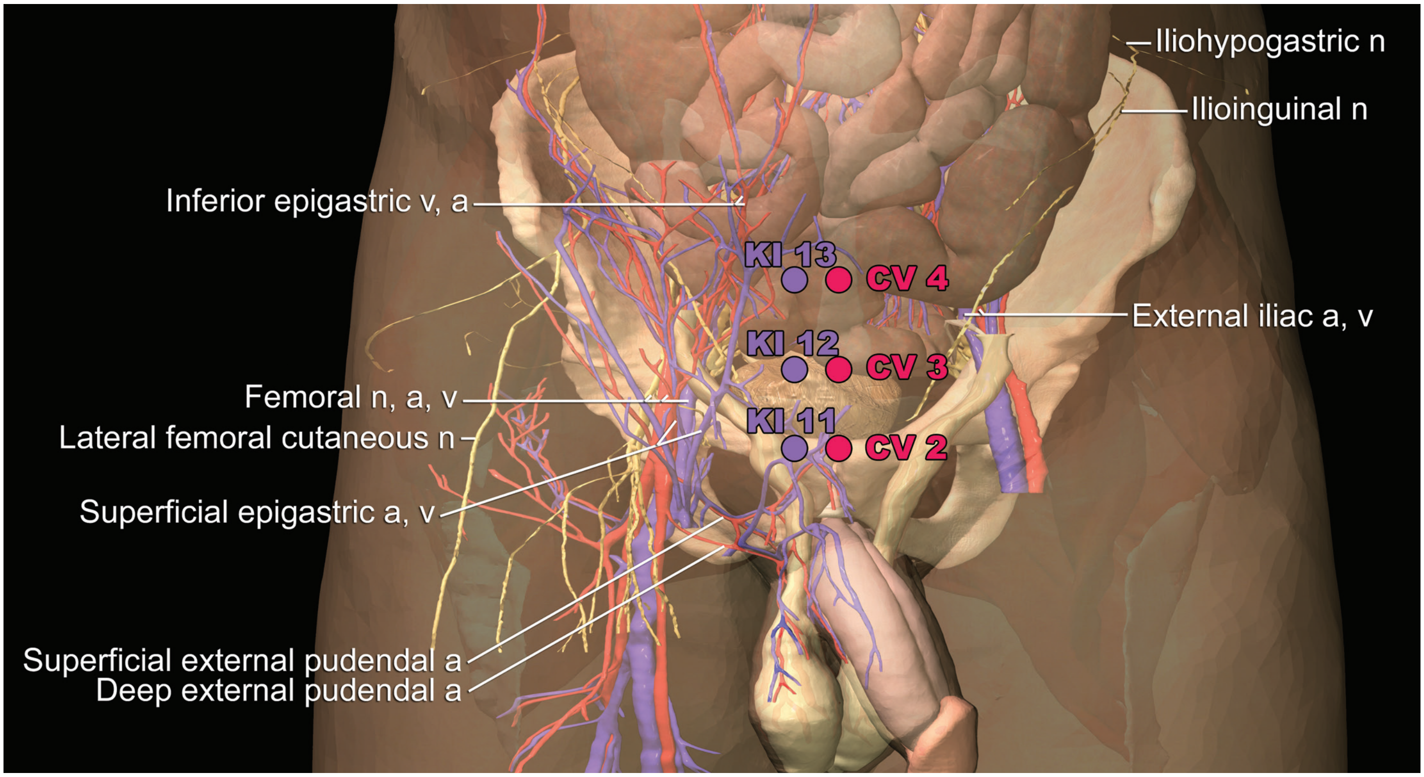


Figure 8-29. KI 13, known as the "Qi Cave" or "Qi Hole", partners with CV 4, the storage site for "original Qi". In females, CV 4 pertains to the uterus, the site of fetal origin and development. Chronic pelvic pain, exhibited by severe episodes of cyclic pain associated with dysmenorrhea and endometriosis are associated with tender regions and allodynia on the abdominal wall in the vicinity of the acupuncture points. Discomfort perceived on the abdominal surface manifests as a result of viscerosomatic reflexes. Crosstalk between neurons in the spinal cord can lead to viscerovisceral and secondary somatovisceral reflexes that cause symptoms of interstitial cystitis and irritable bower syndrome.[11]

the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as “Fothergill’s sign”.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation.
- **External oblique aponeurosis:** Flexes and rotates the trunk, as well as supports and compresses the abdominal organs.
- **Internal oblique aponeurosis:** Like the external oblique muscle, the internal oblique flexes and rotates the trunk, and supports and compresses the abdominal organs.
- **Transversus abdominis aponeurosis:** In keeping with the oblique muscles, the transversus abdominis muscle compresses and supports the abdominal organs. Like the rectus abdominis muscle, the transversus abdominis muscle acts as an antagonist of the diaphragm to facilitate exhalation.

Nerves

- **Subcostal nerve (T12):** Supplies the skin in this region.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[5] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from the plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist’s advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[6] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[7] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[8] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery:** Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; around the umbilicus, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep face. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[9] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[10]

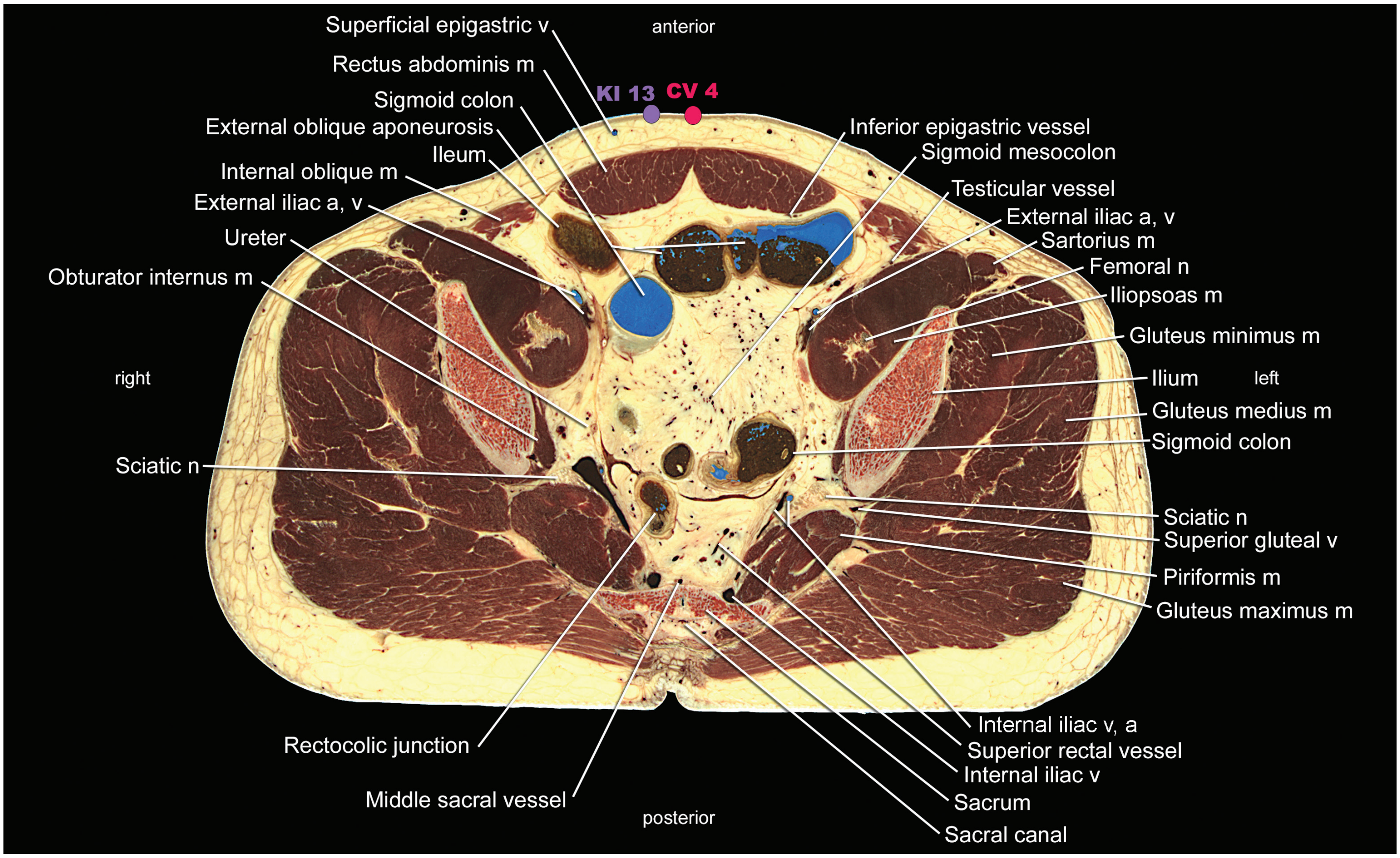

Superficial epigastric v
anterior
Rectus abdominis m
KI 13
CV 4
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
External iliac a, v
Ureter
Obturator internus m
right
Sciatic n
Inferior epigastric vessel
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
left
Gluteus medius m
Sigmoid colon
Sciatic n
Superior gluteal v
Piriformis m
Gluteus maximus m
Rectocolic junction
Middle sacral vessel
posterior
Internal iliac v, a
Superior rectal vessel
Internal iliac v
Sacrum
Sacral canal

Figure 8-30. This cross-section at the level of KI 13 examines the comparative locations of the superficial (inferior) epigastric vein and the (deep) inferior epigastric vessels, on the superficial and deep surfaces, respectively, of the rectus sheath. It illustrates how the more substantial muscle is providing protection against inadvertent organ puncture. However, patients with atrophic abdominal wall musculature and/or are taking anticoagulant therapy remain vulnerable to developing a rectus sheath hematoma following vessel wall tear.

Indications and Potential Point Combinations

- **Diarrhea:** KI 13, trigger points in the lower abdominal quadrant muscles may produce diarrhea; check for and treat local trigger points, SP 6, ST 36.
- **Pseudo-appendicitis at McBurney's point region:** KI 13, palpate rectus abdominis muscle for trigger points.
- **Dysmenorrhea, infertility, vaginal discharge, urinary retention:** KI 13, CV 4, CV 3, SP 6, BL 25, BL 27, BL 34.

References

1. Chen HN, Lin JG, Ying LC, et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *J Altern Complement Med.* 2009;15(9):1033-1037.

2. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.

3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.

4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.

5. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy.* 2008;21:325-333.

6. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.

7. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

8. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.

9. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

10. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

11. Jarrell J. Demonstration of cutaneous allodynia in association with chronic pelvic pain. J Vis Exp. 2009; Jun 23;(28). pii: 1232. doi: 10.3791/1232.

KI 14

Si Man "Fourfold Fullness"

On the lower abdomen, 2 cun inferior to the level of the umbilicus, 0.5 cun lateral to the anterior midline, level with CV 5.

Caution: Deep needling may penetrate the peritoneal cavity.

See Figure 8-32 to examine structures within reach of a deeply placed acupuncture needle. Note as well how the degree of adipose tissue present in the caudal abdomen changes safe needling depth.[1]

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[2] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[3]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[4] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

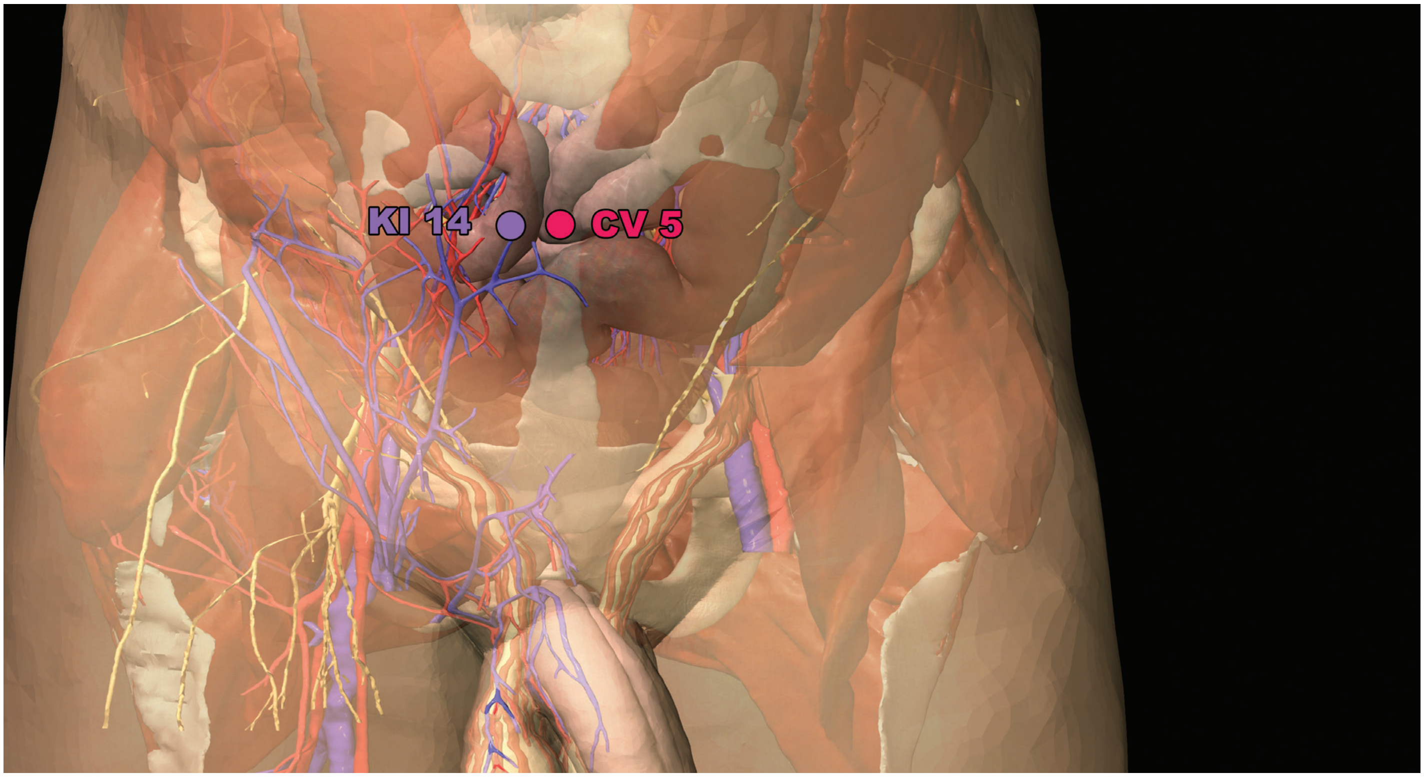


Figure 8-31. Through a window in the abdominal wall at KI 14 and CV 5, the loops of intestines and epigastric vessels become visible by means of layered anatomy. Compare this perspective with that available in the following image, Figure 8-32.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus, at about the level of KI 14. Transverse tendinous inscriptions or intersections further divide the muscle into segments.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen. Compare the cross sections of Figures 8-32 and 8-30. In the former, depicting the placement of KI 14, a tough backing to the rectus sheath better defends the intestines from a penetrating acupuncture needle than it does in Figure 8-30, deep to KI 13. Nevertheless, caution remains warranted, especially when needling the abdomen in thin or anticoagulated patients.

Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress. In the caudal abdomen at KI 14, trigger points can incite a sense of intestinal disturbance.

Nerves

- **Eleventh intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[5] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively. Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[6] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[7] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[8] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery**: Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; as they approach the umbilicus as at KI 14, they begin to anastomose with the superior epigastric vessels within the confines of the rectus sheath on its deep face. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A

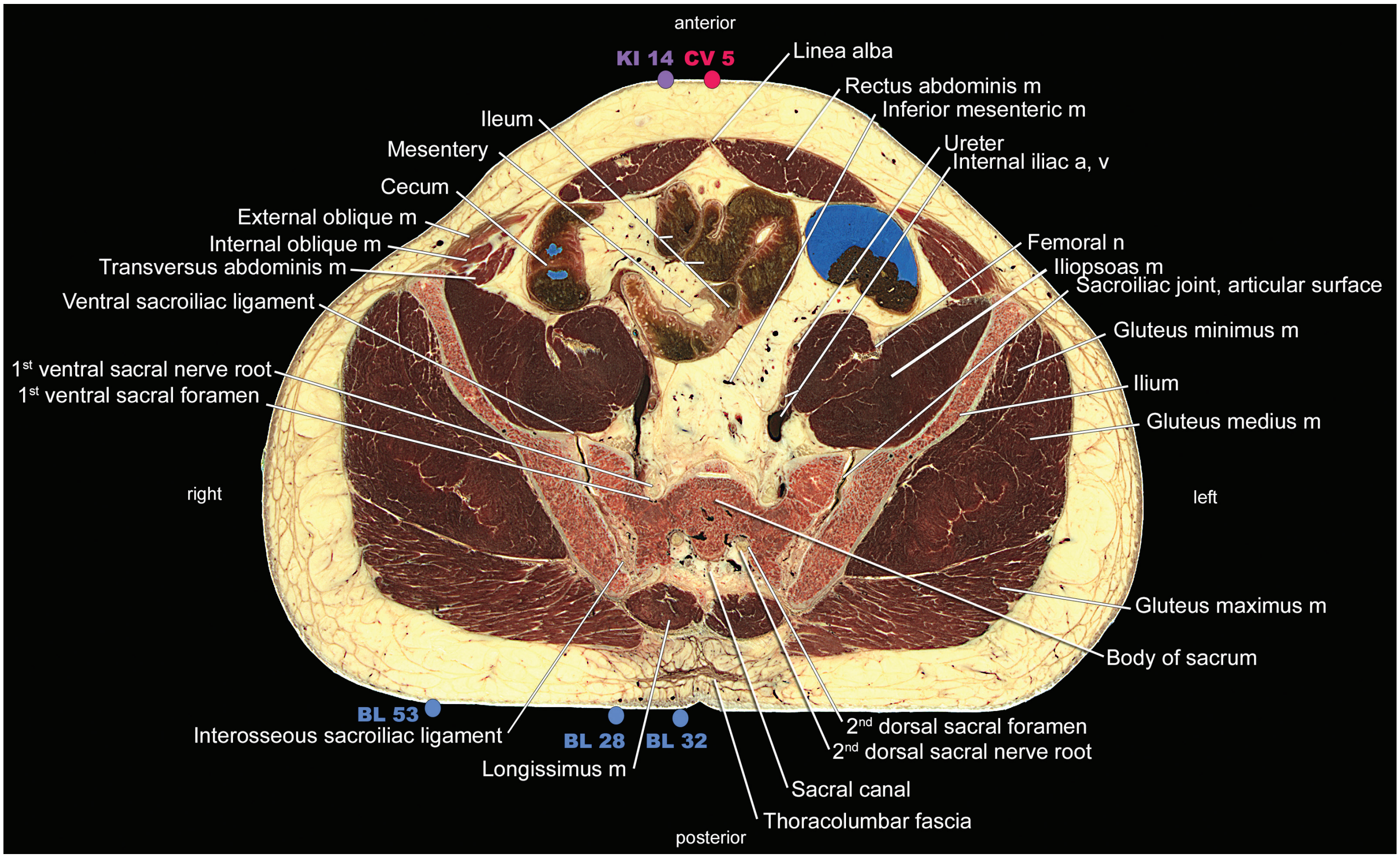

anterior
KI 14
CV 5
Linea alba
Rectus abdominis m
Inferior mesenteric m
Ileum
Mesentery
Ureter
Internal iliac a, v
Cecum
External oblique m
Internal oblique m
Transversus abdominis m
Femoral n
Iliopsoas m
Sacroiliac joint, articular surface
Ventral sacroiliac ligament
Gluteus minimus m
1st ventral sacral nerve root
1st ventral sacral foramen
Ilium
Gluteus medius m
right
left
Gluteus maximus m
Body of sacrum
BL 53
Interosseous sacroiliac ligament
BL 28
BL 32
2nd dorsal sacral foramen
2nd dorsal sacral nerve root
Longissimus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 8-32. KI 14, "Fourfold Fullness", resides next to CV 5, "Stone Gate". Both address elimination of four types of fullness, according to Chinese medicine; i.e., fullness, retention, distension, and obstruction.

predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[9] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[10]

Indications and Potential Point Combinations

- **Colic and diarrhea:** KI 14, ST 36.
- **Postpartum abdominal pain:** KI 14, CV 4, SP 6.
- **Dysmenorrhea, worsened by rectus femoris trigger points:** KI 14, ST 27, SP 6.

References

1. Chen HN, Lin JG, Ying LC, et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *J Altern Complement Med.* 2009;15(9):1033-1037.
2. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
5. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy.* 2008;21:325-333.
6. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.
7. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
8. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
9. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
10. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

KI 15

Zhong Zhu "Middle Flow"

In the periumbilical region, 1 cun inferior to the level of the umbilicus, .5 cun lateral to the midline, level with CV 7.

Caution: Deep needling may penetrate the peritoneal cavity.

View Figure 8-34 to locate structures within reach of a deeply placed acupuncture needle. Note as well how the degree of adipose tissue present in the caudal abdomen changes safe needling depth.[2]

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[3] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[4]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[5] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's

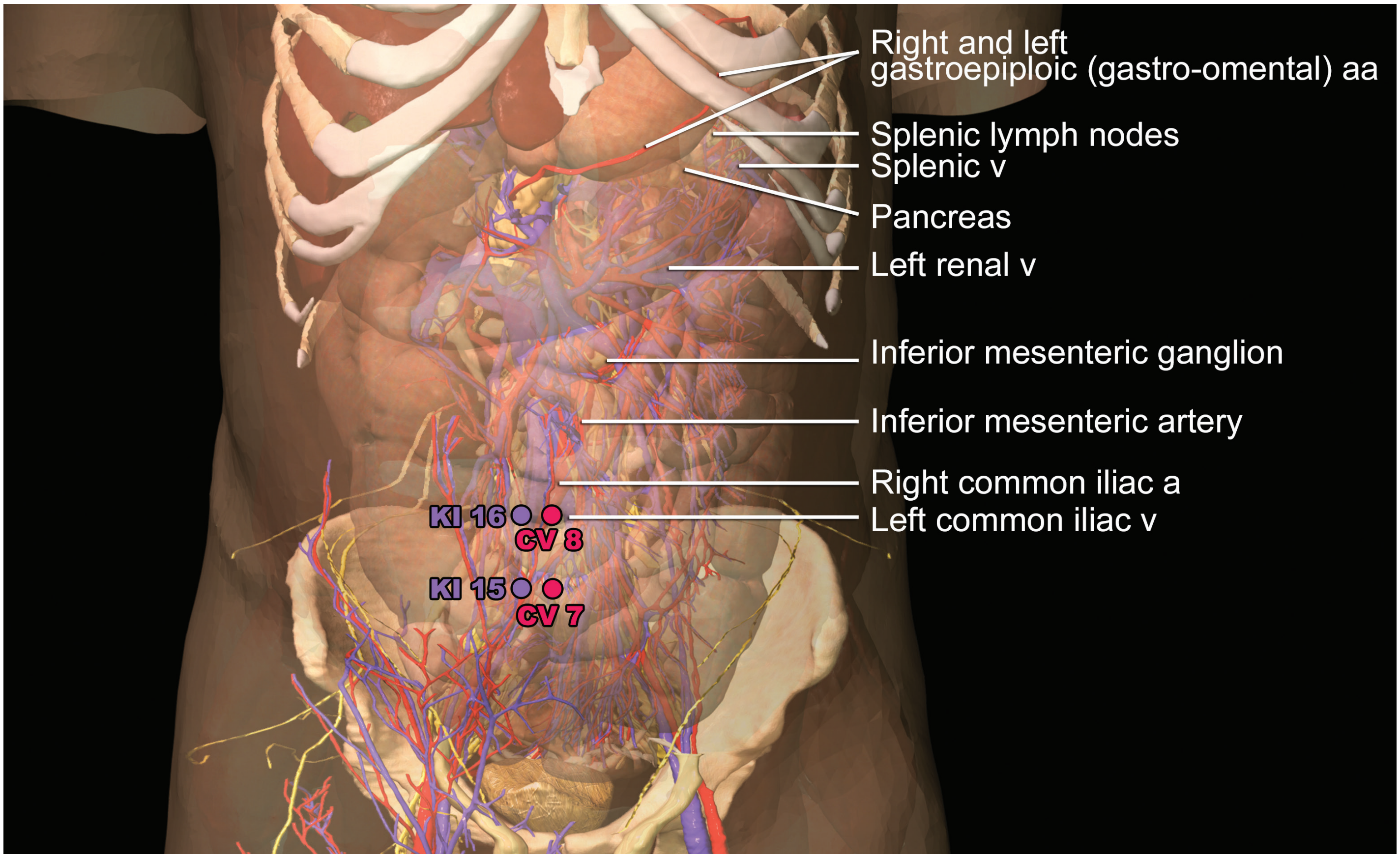


Figure 8-33. The name "Central Flow" for KI 15 connotes the movement of fluids and solids. This image depicts the vascular network feeding and draining the internal organs of the abdomen, seen through semi-transparent intestines. Overlapping the intra-abdominal fluid movement is the periumbilical anastomosis; this view reveals some of the superficial vessels as well.

test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus, at about the level of KI 14. Transverse tendinous inscriptions or intersections further divide the muscle into segments.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen. Compare the cross sections of Figures 8-34 and 8-30. In the former, depicting the placement of KI 15, a tough backing to the rectus sheath better defends the intestines from a penetrating acupuncture needle than it does in Figure 8-30, deep to KI 13. Nevertheless, caution remains warranted, especially when needling the abdomen in thin or anticoagulated patients. Clearly, based on these cross-sections, treatments with laser therapy and massage could readily reach these superficial intestinal segments, addressing inflammation and motility disorders.

Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress. In the caudal abdomen at KI 15, trigger points can incite a sense of intestinal disturbance. The significance of KI 15 as a rectus abdominis trigger point was recognized in the scientific medical literature as far back as 1975.[6]

Nerves

- **11th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[7] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[8] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[10] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery**: Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These

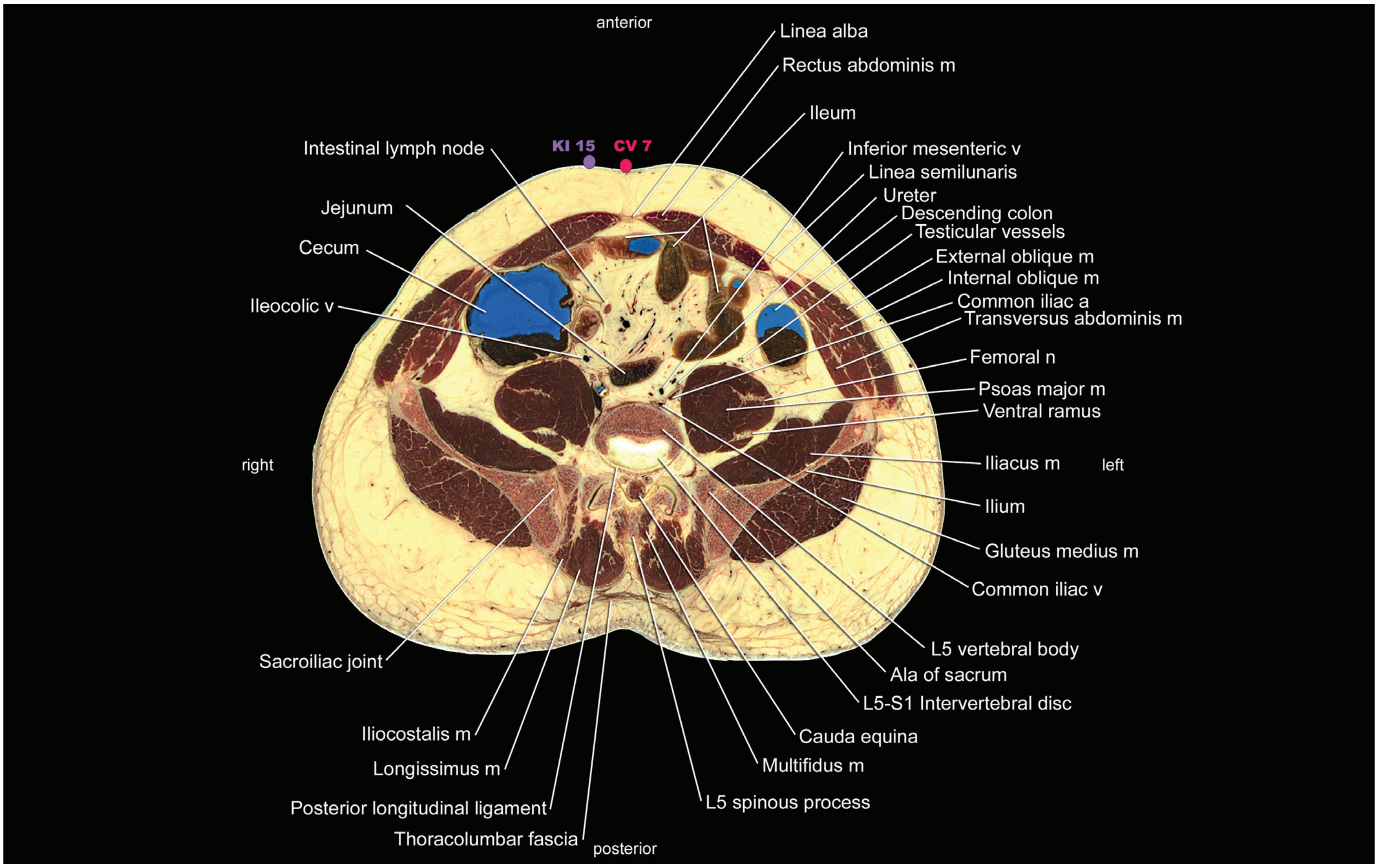

anterior
Linea alba
Rectus abdominis m
Ileum
Intestinal lymph node
KI 15
CV 7
Inferior mesenteric v
Linea semilunaris
Ureter
Jejunum
Descending colon
Testicular vessels
Cecum
External oblique m
Internal oblique m
Ileocolic v
Common iliac a
Transversus abdominis m
Femoral n
Psoas major m
Ventral ramus
right
Iliacus m
left
Ilium
Gluteus medius m
Common iliac v
L5 vertebral body
Sacroiliac joint
Ala of sacrum
L5-S1 Intervertebral disc
Iliocostalis m
Cauda equina
Longissimus m
Multifidus m
Posterior longitudinal ligament
L5 spinous process
Thoracolumbar fascia
posterior

Figure 8-34. This cross section reveals the crisp demarcation of aponeuroses along the abdominal wall, including the fascial contributions of the internal oblique and transversus abdominis muscles to the deep layer of the rectus sheath.

valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

- **Note about the periumbilical/subumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath.[1] This plexus involves a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum – a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline participate in the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; as they approach the umbilicus as at KI 15, they anastomose with the superior epigastric vessels within the confines of the rectus sheath on its deep face. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[11] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[12]

Indications and Potential Point Combinations

- **Abdominal pain or distension, diarrhea:** KI 15, ST 25, ST 36, CV 6, SP 6, BL 25.

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. Plast. Reconstr. Surg. 1998;102:761-764.

2. Chen HN, Lin JG, Ying LC, et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *J Altern Complement Med.* 2009;15(9):1033-1037.

3. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery*. 2009;7:150-154.

4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.

5. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.

6. Liu Y, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med*. 1975;3(4):347-358.

7. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.

8. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.

9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

10. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

11. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

12. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

KI 16

Huang Shu "Vitals Shu"

Level with the umbilicus and CV 8, 0.5 cun lateral to the center of the umbilicus.

Caution: Deep needling may penetrate the peritoneal cavity.

View Figure 8-35B to locate structures within reach of a deeply placed acupuncture needle. Note as well how the degree of adipose tissue present in the caudal abdomen changes safe needling depth.[2]

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[3] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[4]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[5] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's

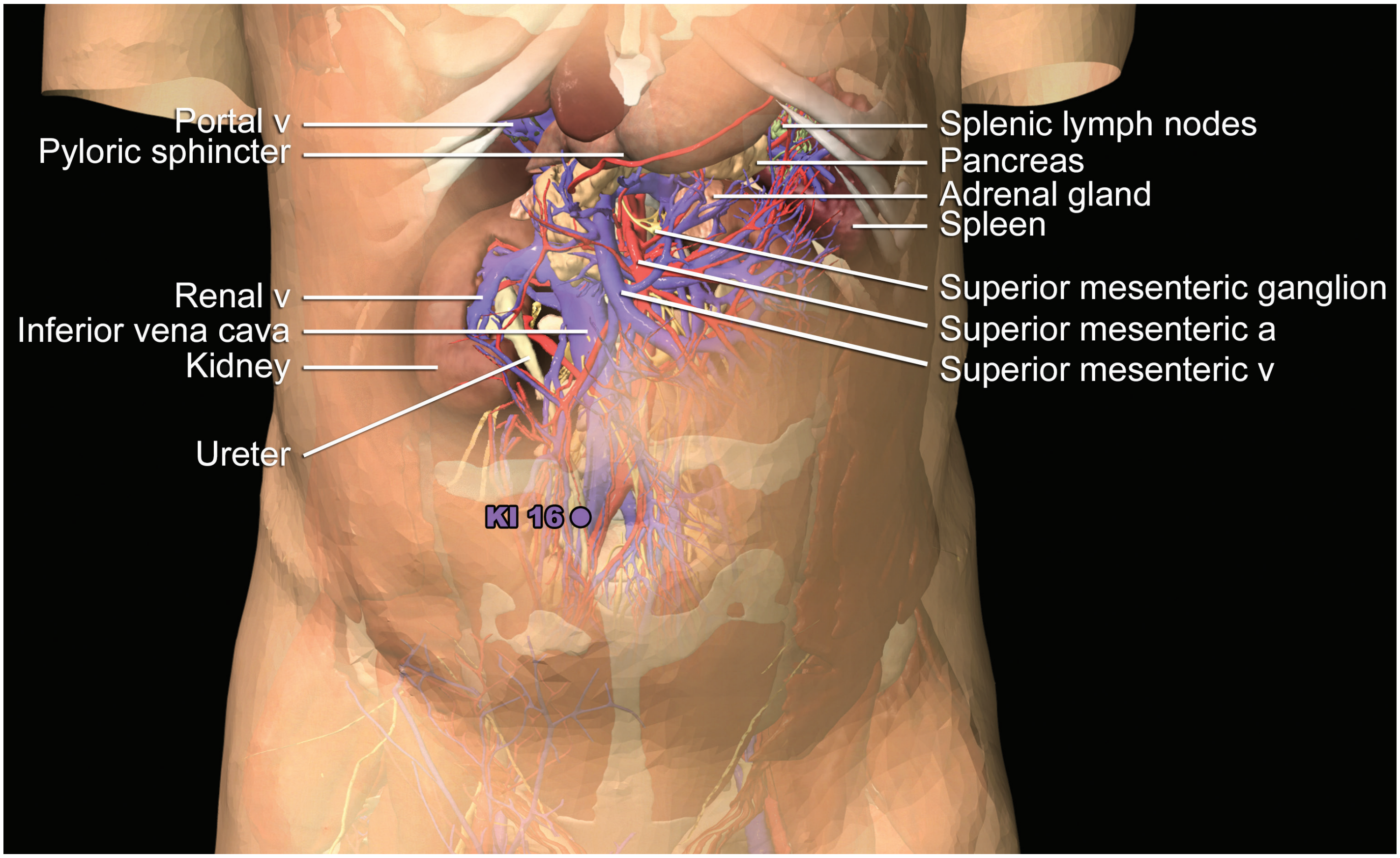


Figure 8-35A. According to Quirico's *Teaching Atlas of Acupuncture*, "From this point (KI 16) the kidney qi spreads to the peritoneum and the abdominal viscera." (P. 116.) This translucent skin image reveals the relationship between the kidneys, the ureter, and the right-hand KI 16. Thus, KI 16 earns its moniker, "Vitals Shu", by ferrying impulses from the body surface to many organs to which it communicates.

test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus, at about the level of KI 14. Transverse tendinous inscriptions or intersections further divide the muscle into segments.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen.

Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress. At the level of the mid-abdomen at KI 16, trigger points can provoke intestinal disturbance, or at least the feeling of impending upset.

Nerves

- **10th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[6] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[7] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[8] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[9] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery:** Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.
- **Note about the periumbilical/subumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath.[1] This

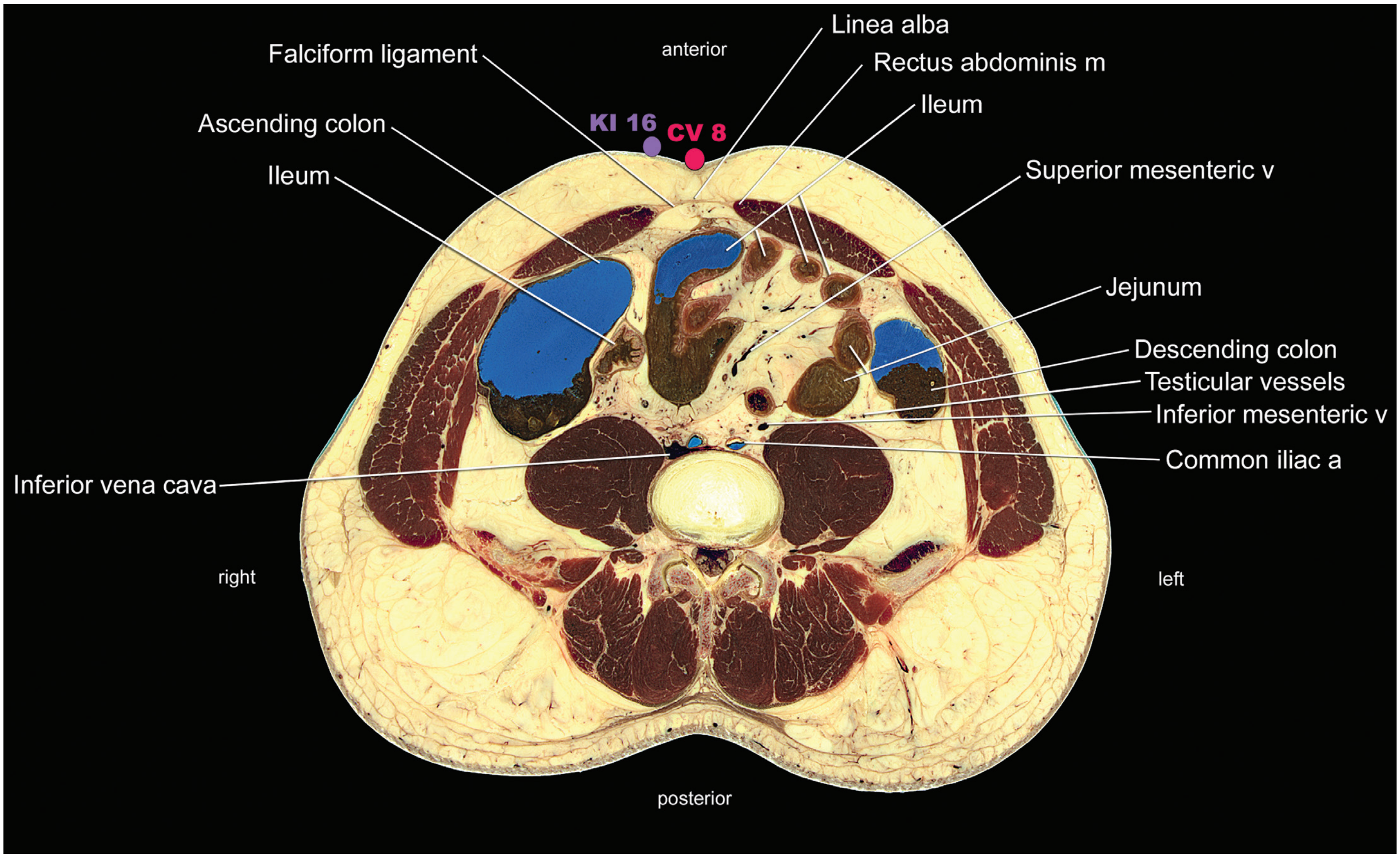


Figure 8-35B. CV 8, within the umbilicus, is considered "forbidden" for needling, whether due to the risk of entering the abdomen or the reverence bestowed on the site by dint of its connection with one's mother. The umbilicus and CV 8 ("Spirit Gate") were claimed to be the door through which the spirit enters and leaves the body and the source of life ("Supreme Unity").[13] With this proscription in mind about avoiding acupuncture at the navel, one can engender similar neuromodulatory benefits by treating territory adjacent to this delicate site, at KI 16.

plexus involves a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum – a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline participate in the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; as they reach the periumbilical region KI 16, they anastomose with the superior epigastric vessels within the confines of the rectus sheath on its deep face. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[10] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[11]

Indications and Potential Point Combinations

- **Abdominal pain, cramps, or distension:** KI 16, CV 12, ST 36.
- **Vomiting:** KI 16, PC 6.
- **Diarrhea:** KI 16, SP 6.
- **Constipation, dry stool:** KI 16, SP 6, ST 36, BL 25.
- **Retained placenta:** KI 16, SP 6.[12]

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. *Plast. Reconstr. Surg.* 1998;102:761-764.
2. Chen HN, Lin JG, Ying LC, et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *J Altern Complement Med.* 2009;15(9):1033-1037.
3. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
5. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.

6. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.

7. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.

8. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

9. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

10. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

11. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

12. Bobic MV and Habek D. Treatment of retained placenta with acupuncture. *Int J Gynaecol Obstet*. 2012;116(1):80.

13. Ellis A, Wiseman N, and Boss K. *Grasping the Wind*. Brookline: Paradigm Publications, 1989. P. 311.

KI 17

Shang Qu "Shang Bend"

Above the umbilicus and 2 cun superior, 0.5 cun lateral to the midline, level with CV 10.

Caution: Deep needling may penetrate the peritoneal cavity. Note the proximity of internal organs to the point in Figure 8-37.

Fascia

- **Rectus sheath:** The strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[2] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[3]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[4] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Falciform Ligament

- This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal

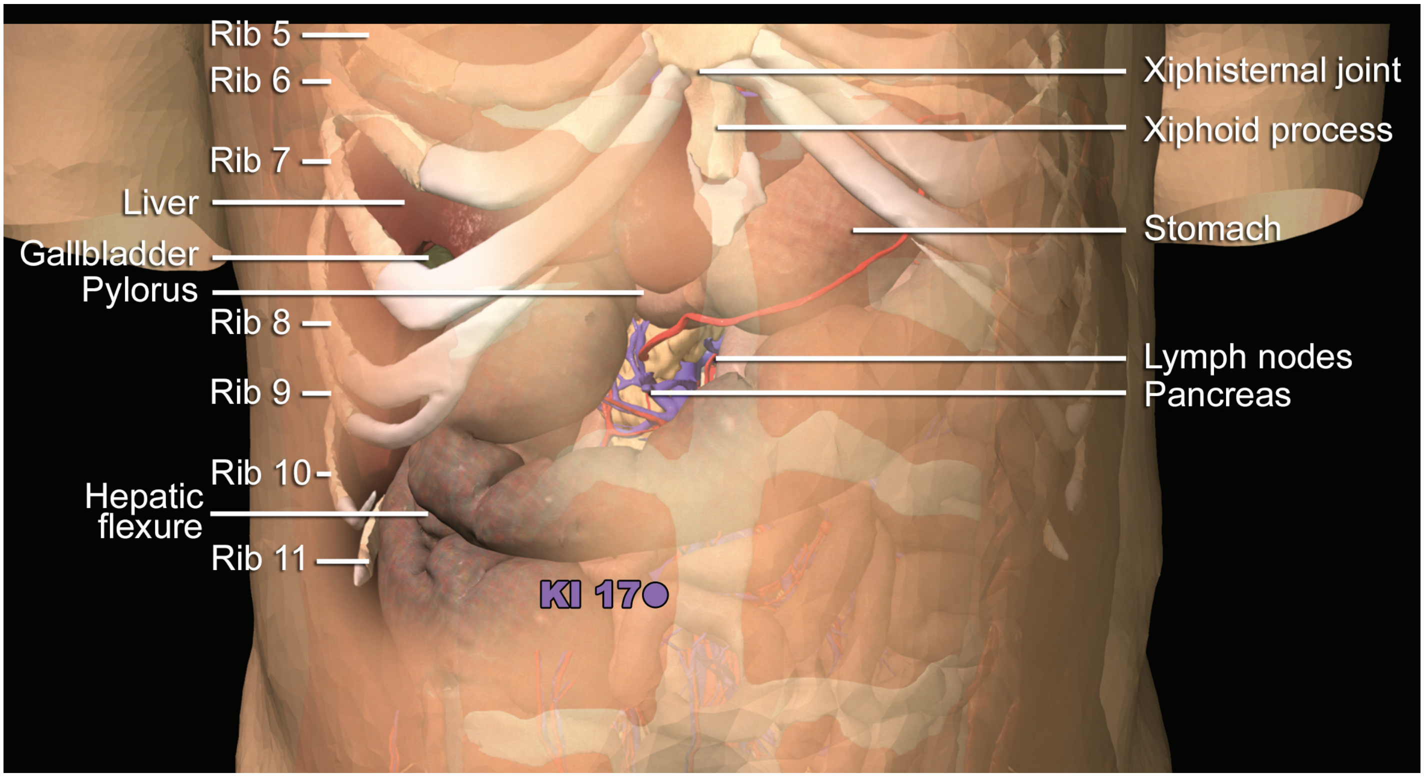


Figure 8-36. KI 17, "Shang Bend", refers to the sharp bend in the colon at the right colic, or hepatic, flexure, shown here through a window in the abdominal wall.

portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. This explains the appearance of the ligament at KI 17 but not KI 16 caudal. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[5] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[6] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[7] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[8] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[9] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI 17 and other locations in the region may offer adjunctive support but should delay appropriate diagnosis and surgical treatment if warranted. Furthermore, acupuncture at the KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the effect of needling might be able to indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation.

The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus, at about the level of KI 14. Transverse tendinous inscriptions or intersections further divide the muscle into segments.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen.

Trigger points in the more cranial rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral reflexes leading to feelings of abdominal fullness, nausea, and vomiting. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Rectus abdominis trigger points may secondarily arise as a result of internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. At the level of the mid-abdomen at KI 17, trigger points can signal or provoke intestinal disturbance, or at least raise the worry of impending upset.

Nerves

- **9th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[10] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments

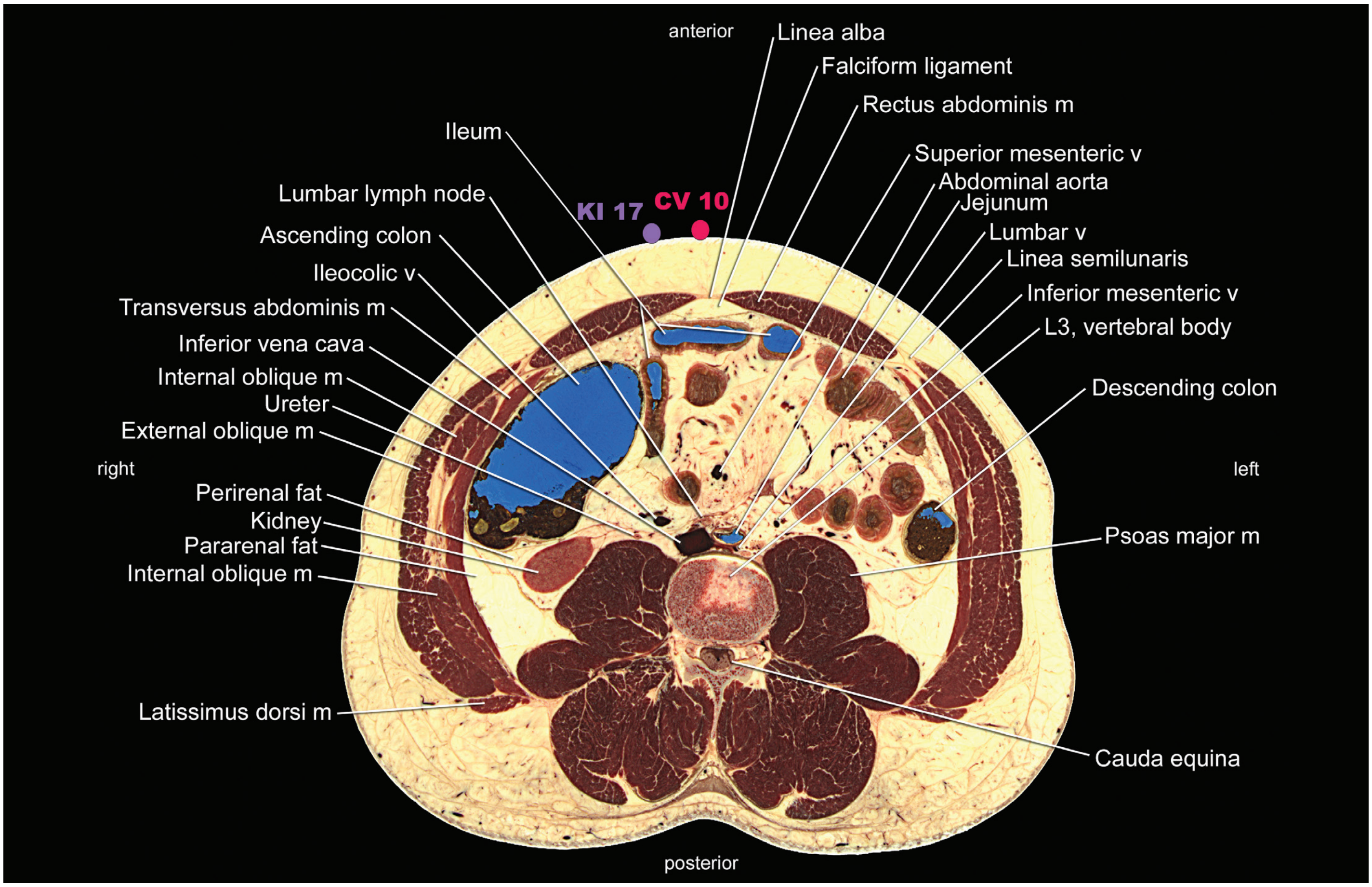

anterior
Linea alba
Falciform ligament
Rectus abdominis m
Ileum
Superior mesenteric v
Lumbar lymph node
Abdominal aorta
KI 17
CV 10
Jejunum
Ascending colon
Lumbar v
Ileocolic v
Linea semilunaris
Transversus abdominis m
Inferior mesenteric v
Inferior vena cava
L3, vertebral body
Internal oblique m
Ureter
Descending colon
External oblique m
right
left
Perirenal fat
Kidney
Psoas major m
Pararenal fat
Internal oblique m
Latissimus dorsi m
Cauda equina
posterior

Figure 8-37. Note the appearance of the falciform ligament in this cross section deep to both KI 17 and CV 10.

rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[11] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[12] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[13] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial inferior epigastric vein is a tributary of the great saphenous vein while the superior epigastric vein carries deoxygenated blood and drains into the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[14]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath.[1] This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior

epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[15] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Constipation:** KI 17, ST 25, ST 36.
- **Insomnia:** KI 17, KI 16, ST 24, ST 26, CV 4, CV 6, CV, 10, and CV 12.

Evidence-Based Application

- Acupuncture at KI 17, ST 24, Xiafengshidian, Qipang, CV 4, CV 6, CV 10, CV 12 aided in alleviating **insomnia** in women and was significantly more effective than a benzodiazepine, estazolam.[16] Qipang is located near the umbilicus, just lateral to KI 15. Xiafengshidian is found lateral and caudal to ST 26.

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. *Plast. Reconstr. Surg.* 1998;102:761-764.
2. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
4. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
5. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
6. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.
7. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.
8. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.
9. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.
10. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy.* 2008;21:325-333.
11. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.
12. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
13. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
14. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy.* 2008;21:89-98.
15. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons.* 2004;57:392-397.
16. Wang XY, Yuan SH, Yang HY, et al. Abdominal acupuncture for insomnia in women: a randomized controlled clinical trial. *Acupunct Electrother Res.* 2008;33(1-2):33-41.

KI 18

Shi Guan "Stone Pass"

On the epigastrium, 3 cun above the umbilicus, 0.5 cun lateral to the midline, level with CV 11.

Caution: Deep needling may penetrate the peritoneal cavity. Note the proximity of internal organs to the point in Figure 8-39.

Fascia

- **Rectus sheath:** The strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[1] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[2]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[3] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass

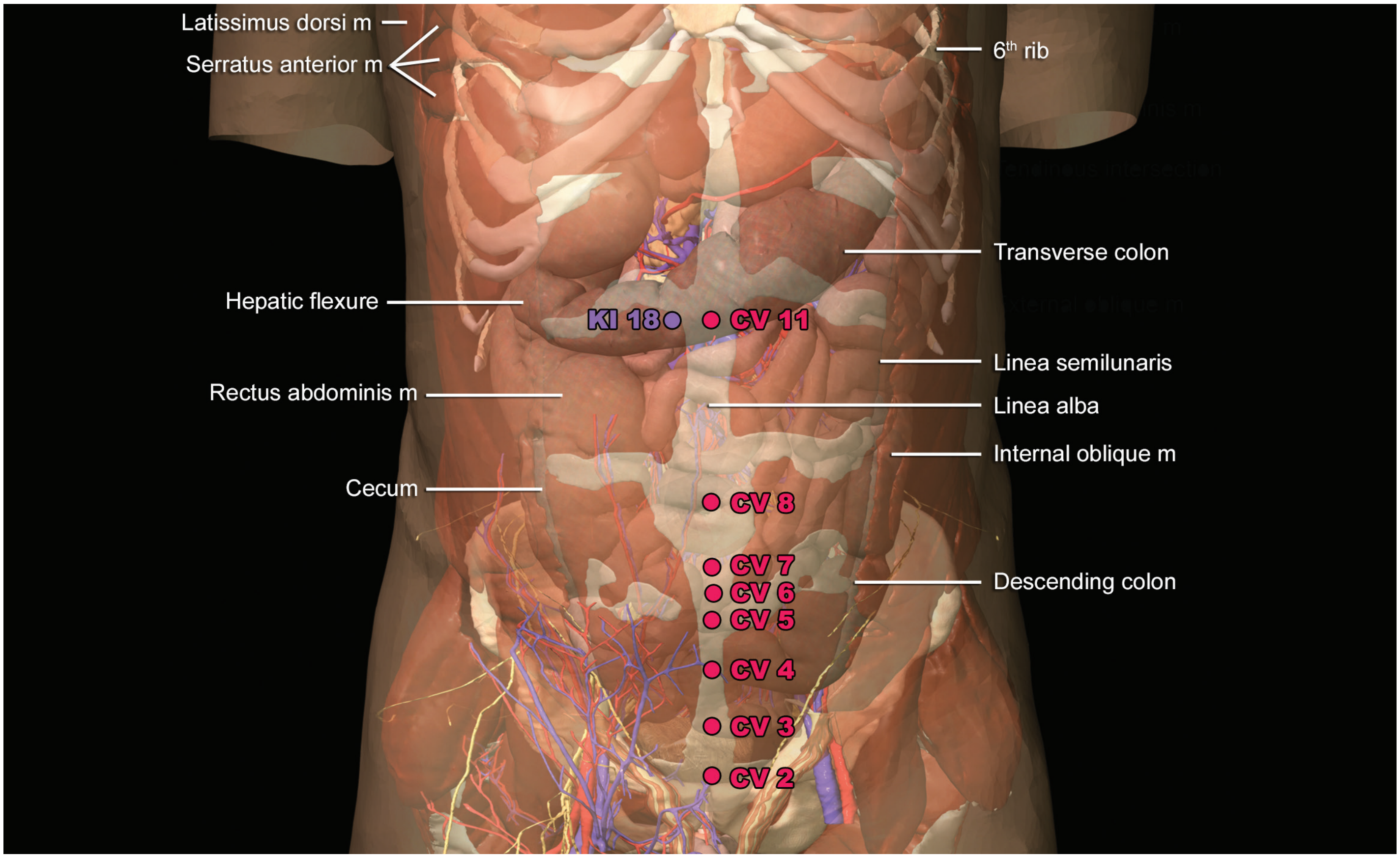


Figure 8-38. KI 18, as the "Stone Pass", connotes the palpation of hard masses in the transverse colon deep to this point in cases of constipation or calcified fecoliths.

became more prominent; a feature known as “Fothergill’s sign”.

Falciform Ligament

- This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. This explains the appearance of the ligament at KI 17-KI 21 but not at KI 16 and those more caudal. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI 18 and other locations in the region may offer adjunctive support but should delay appropriate diagnosis and surgical treatment if warranted. Furthermore, acupuncture at the KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the effect of needling might be able to indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation. The rectus abdominis muscle consists of a cranial and caudal portion demarcated by the arcuate line, landing about 5 cm caudal to the umbilicus, at about the level of KI 14. Transverse tendinous inscriptions or intersections further divide the muscle into segments.

Clinical Relevance: Caudal to the arcuate line of the abdomen, the rectus abdominis loses the protection its deep wall enjoyed cranial to the line. That is, the caudal aspect of the rectus sheath thins in this section of the abdomen as the connective tissue contribution of the obliques and the transversalis muscle dwindles. Thus, only a weak transversalis fascia and peritoneum separate the muscle from the abdominal compartment. This fact raises safety concerns for acupuncturists treating caudal abdominal acupuncture points along the CV, KI, ST, and SP lines, because deep needling carries more risk of entering the abdomen.

Trigger points in the more cranial rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral reflexes leading to feelings of abdominal fullness, nausea, and vomiting. Referred pain patterns from the abdominal oblique and transversus muscles can cause visceral symptoms such as “heartburn” and epigastric distress.

Rectus abdominis trigger points may secondarily arise as a result of internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature. At the level of the mid-abdomen at KI 18, trigger points can signal or provoke intestinal disturbance, or at least raise the worry of impending upset.

Nerves

- **8th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[9] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade

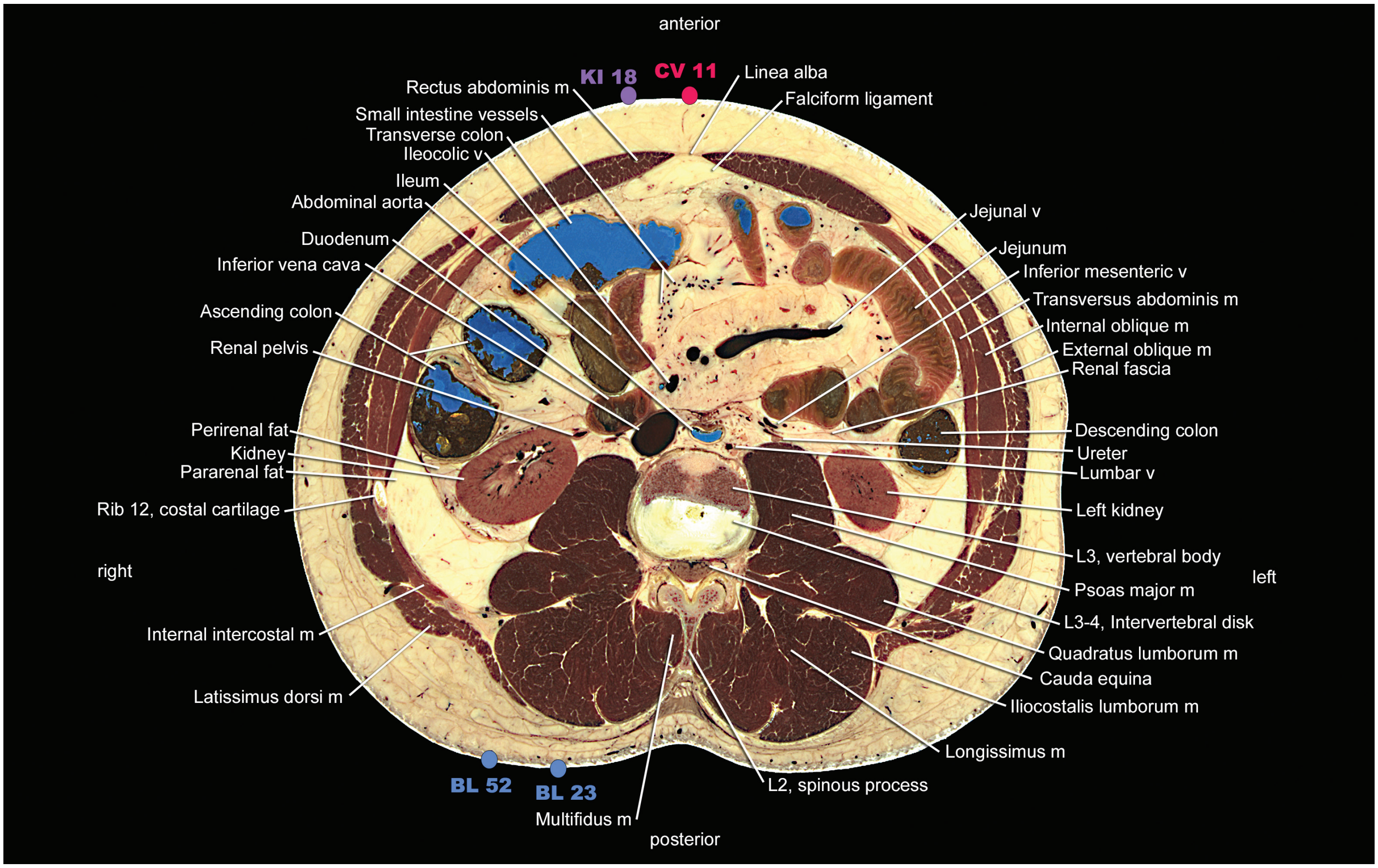

anterior
KI 18
CV 11
Linea alba
Falciform ligament
Rectus abdominis m
Small intestine vessels
Transverse colon
Ileocolic v
Ileum
Abdominal aorta
Duodenum
Inferior vena cava
Ascending colon
Renal pelvis
Perirenal fat
Kidney
Pararenal fat
Rib 12, costal cartilage
right
Internal intercostal m
Latissimus dorsi m
BL 52
BL 23
Multifidus m
posterior
L2, spinous process
Longissimus m
Iliocostalis lumborum m
Cauda equina
Quadratus lumborum m
L3-4, Intervertebral disk
Psoas major m
left
L3, vertebral body
Left kidney
Lumbar v
Ureter
Descending colon
Renal fascia
External oblique m
Internal oblique m
Transversus abdominis m
Inferior mesenteric v
Jejunum
Jejunal v

Figure 8-39. The falciform ligament begins to widen at the level of KI 18, providing further tissue cushion between KI 18 at the surface and the transverse colon.

as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[10] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[11] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[12] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial inferior epigastric vein is a tributary of the great saphenous vein while the superior epigastric vein drains deoxygenated blood into the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[13]

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[14] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Abdominal pain:** KI 18, ST 36, trigger points in the abdominal wall musculature.
- **Ptyalism (hypersalivation):** KI 18, CV 14, PC 6, ST 36.
- **Hiccoughs:** KI 18, ST 19.
- **Vomiting:** KI 18, ST 36, PC 6.
- **Constipation:** KI 18, ST 25, SP 15, BL 25, BL 27.

References

1. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery*. 2009;7:150-154.
2. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.
4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
9. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.
10. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.
11. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.
12. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.
13. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.
14. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

KI 19

Yin Du "Yin Metropolis"

On the epigastrium, 4 cun superior to the umbilicus, 0.5 cun lateral to the midline, level with CV 12.

Caution: Deep needling may penetrate the peritoneal cavity.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[1] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[2]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture. About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Falciform Ligament

- This sickle-shaped ligament attaches the liver to the ventral

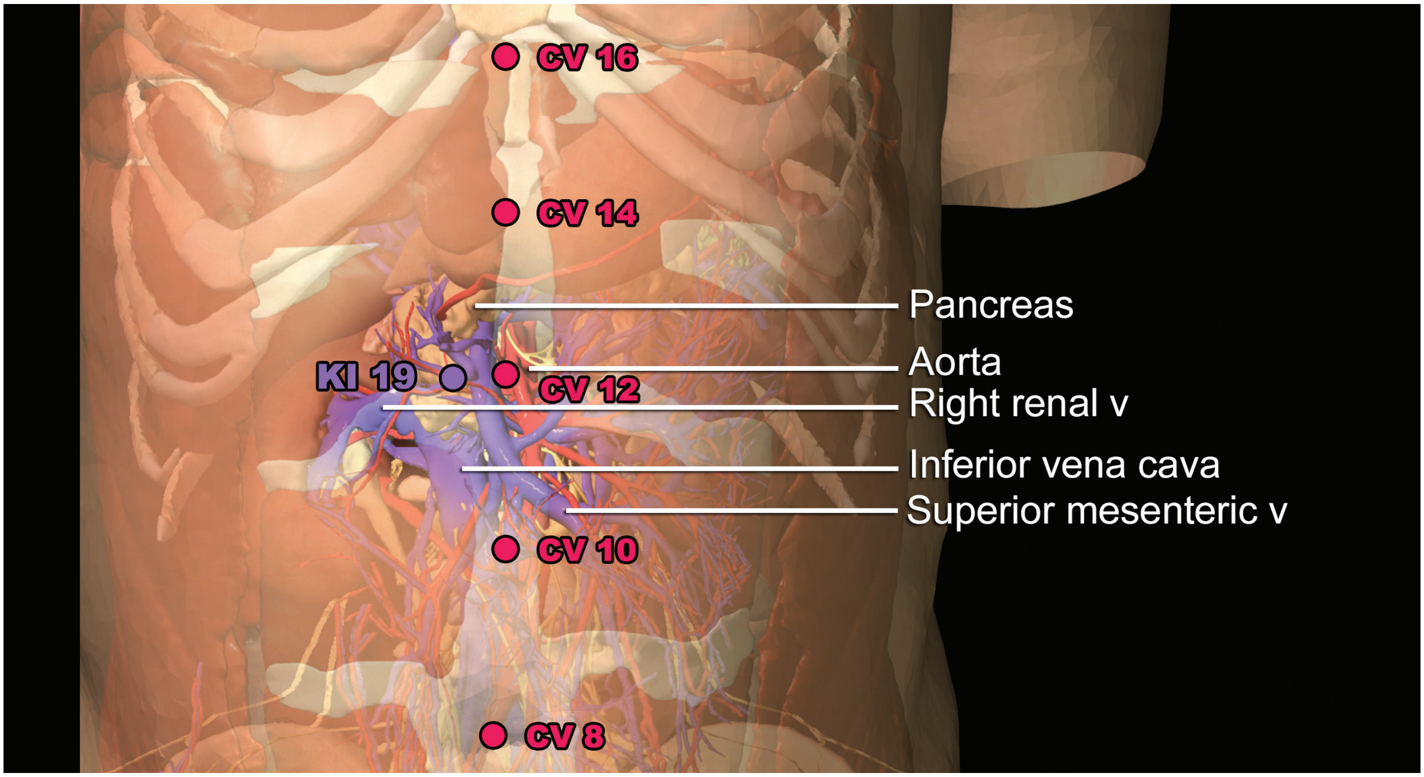


Figure 8-40. KI 19, the "Yin Metropolis", hovers over a complex array of vessels, usually covered by organs. "Yin" refers to the blood moved throughout these arteries and veins, coming and going as though along expressways interlacing betwixt and between buildings in a busy city, or metropolis.

body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. This explains the appearance of the ligament at KI 17-KI 21 but not at KI 16 and those more caudal. It comprises two mesothelial layers of peritoneum filled with extraperitoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI 19 and other locations in the region may offer adjunctive support but should delay appropriate diagnosis and surgical treatment if warranted. Furthermore, acupuncture at the KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the effect of needling might be able to indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature.

Nerves

- **7th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery:** Supplies the subcutaneous tissue and skin in the hypogastrium. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior epigastric artery.
- **Superior epigastric vein:** The superior epigastric veins are tributaries of the internal thoracic veins. They anastomose with the inferior epigastric veins inside the rectus sheath. These valveless veins can act as collateral routes for abdominopelvic blood return to the heart and provide a route for venous return from the lower extremities when needed. They allow venous blood to bypass the inferior vena cava in cases of obstruction or ligation and instead to drain into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[10] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[11]

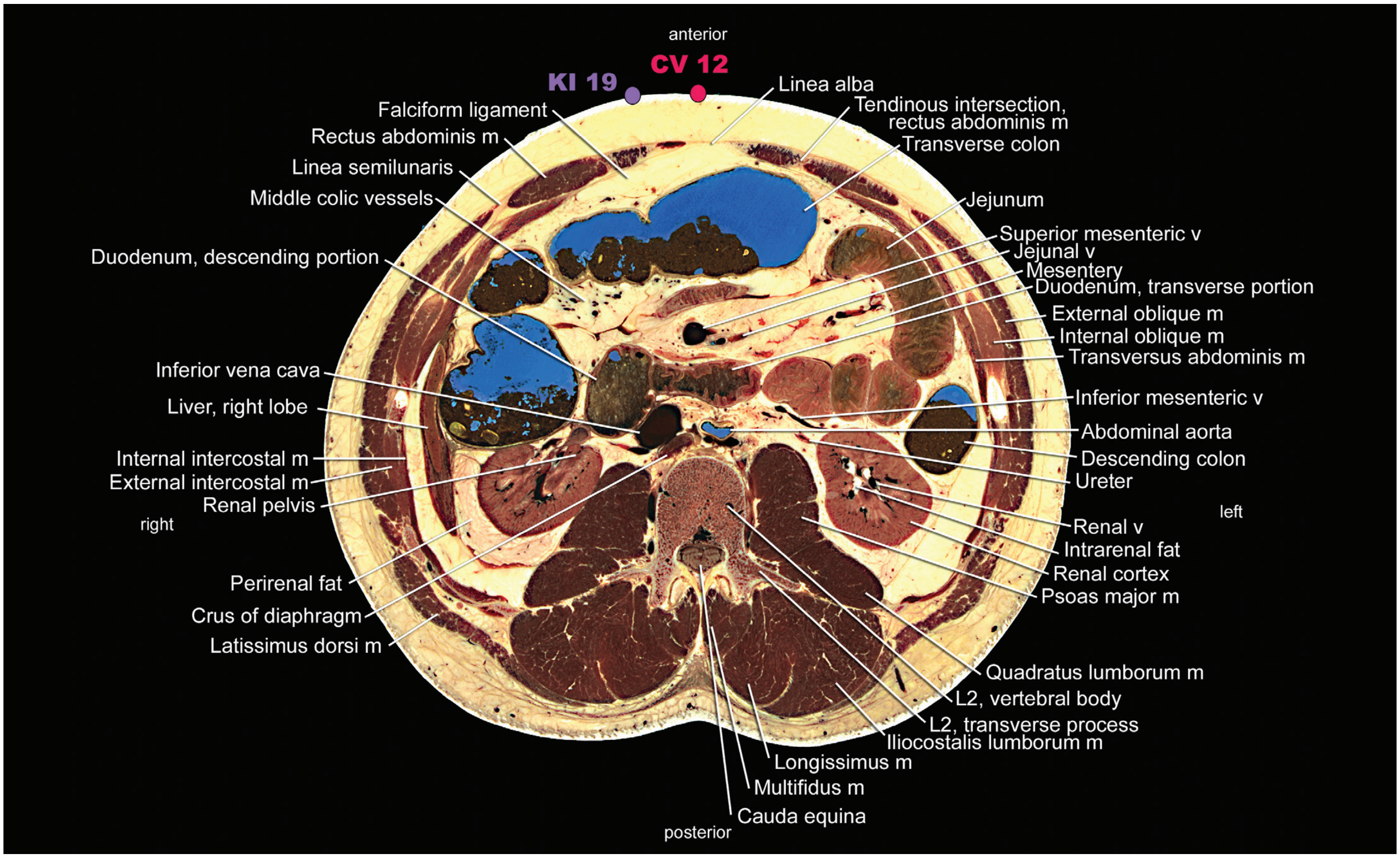

anterior
KI 19
CV 12
Falciform ligament
Rectus abdominis m
Linea semilunaris
Middle colic vessels
Duodenum, descending portion
Inferior vena cava
Liver, right lobe
Internal intercostal m
External intercostal m
Renal pelvis
right
Perirenal fat
Crus of diaphragm
Latissimus dorsi m
Linea alba
Tendinous intersection, rectus abdominis m
Transverse colon
Jejunum
Superior mesenteric v
Jejunal v
Mesentery
Duodenum, transverse portion
External oblique m
Internal oblique m
Transversus abdominis m
Inferior mesenteric v
Abdominal aorta
Descending colon
Ureter
left
Renal v
Intrarenal fat
Renal cortex
Psoas major m
Quadratus lumborum m
L2, vertebral body
L2, transverse process
Iliocostalis lumborum m
Longissimus m
Multifidus m
Cauda equina
posterior

Figure 8-41. This cross-section at the level of "Yin Metropolis", or KI 19, brings together organs and vessels like a city packed with office buildings and roadways, managing the day to day "business" of bodily functions.

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Abdominal distension, feeling of fullness in the chest:** KI 19, KI 22, CV 17, ST 36.

References

1. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.
2. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.
4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.
6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.
7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.
8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.
9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
10. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
11. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

KI 20

Fu Tong Gu "Open Valley", "Abdomen Connecting Valley"

On the epigastrium, 2 cun below the xiphoid process, 5 cun above the umbilicus, 0.5 cun lateral to the midline, level with CV 13.

Caution: Deep needling may penetrate the peritoneal cavity.

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[1] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[2]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[3] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Falciform Ligament

- This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as

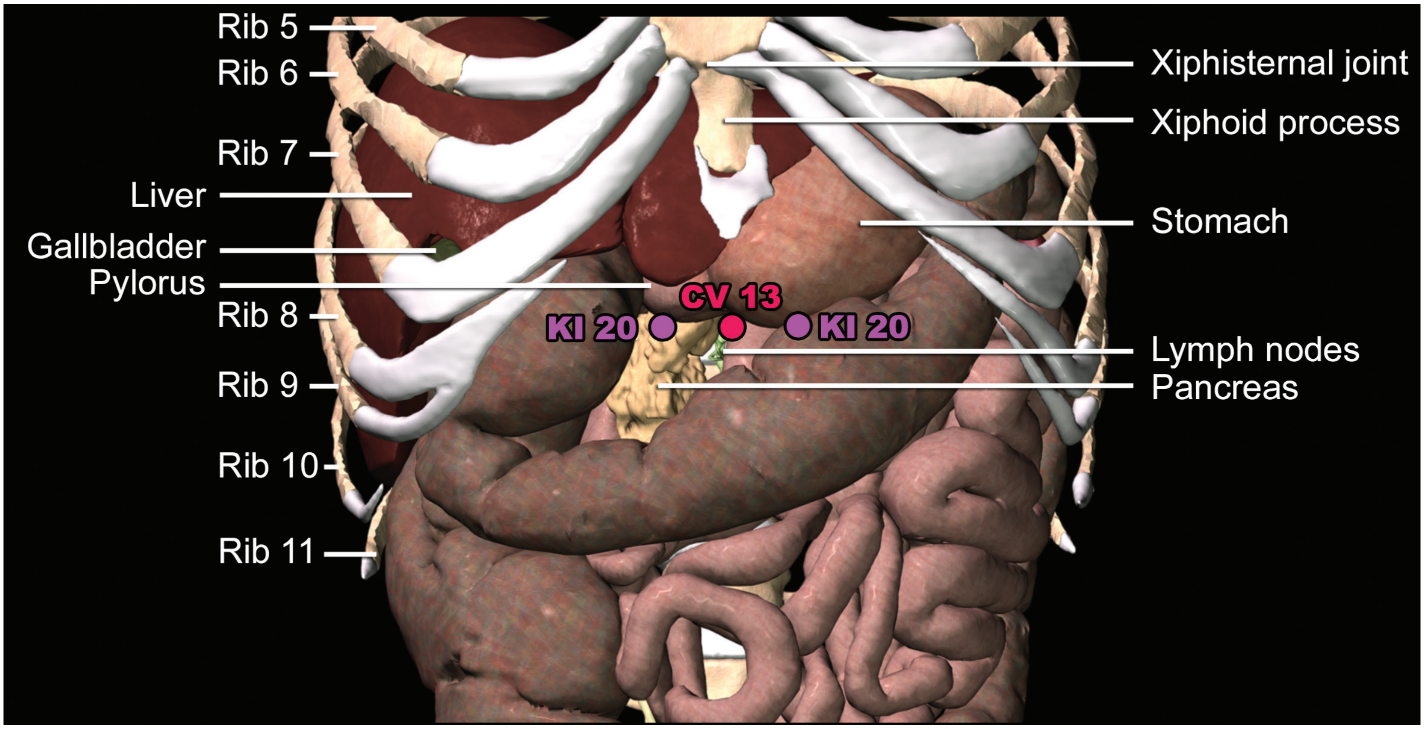


Figure 8-42. This image shows how the organs beneath KI 20 create an "Open Valley" beneath the point..

far down as the umbilicus. This explains the appearance of the ligament at KI 17-KI 21 but not at KI 16 and those more caudal. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI 20 and other locations in the region may offer adjunctive support but should delay appropriate diagnosis and surgical treatment if warranted. Furthermore, acupuncture at the KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the effect of needling might be able to indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature.

Nerves

- **7th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles and their aponeuroses.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the hypogastrium. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle.

It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior epigastric artery.

- **Superior epigastric vein:** The superior epigastric veins are tributaries of the internal thoracic veins. They anastomose with the inferior epigastric veins inside the rectus sheath. These valveless veins can act as collateral routes for abdominopelvic blood return to the heart and provide a route for venous return from the lower extremities when needed. They allow venous blood to bypass the inferior vena cava in cases of obstruction or ligation and instead to drain into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.

Clinical Relevance: Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[10] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[11]

Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic as in severe aortoiliac occlusive disease, these superficial vessels on the abdominal

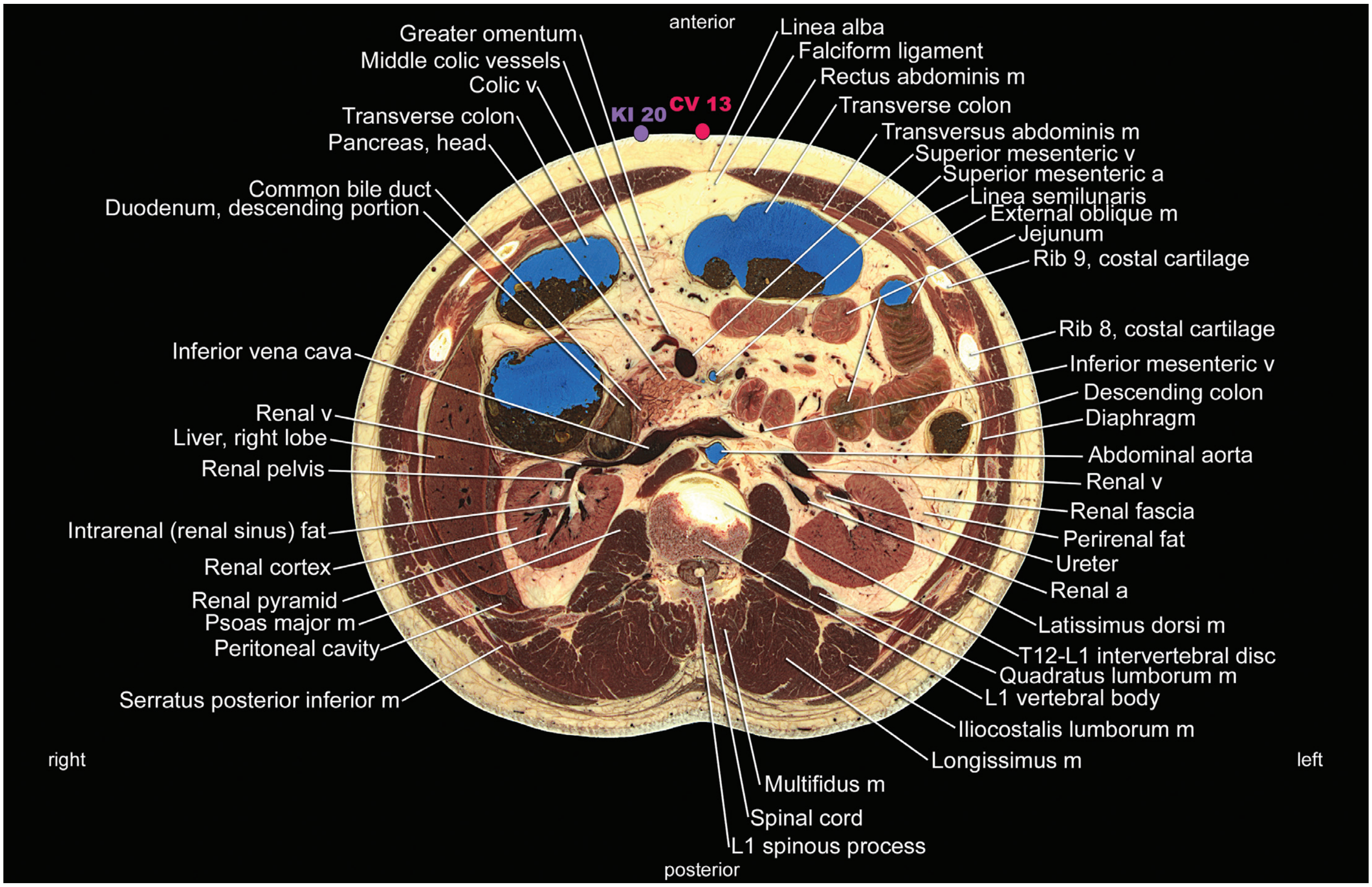

anterior
Greater omentum
Middle colic vessels
Colic v
Transverse colon
Pancreas, head
Common bile duct
Duodenum, descending portion
KI 20
CV 13
Linea alba
Falciform ligament
Rectus abdominis m
Transverse colon
Transversus abdominis m
Superior mesenteric v
Superior mesenteric a
Linea semilunaris
External oblique m
Jejunum
Rib 9, costal cartilage
Rib 8, costal cartilage
Inferior vena cava
Inferior mesenteric v
Descending colon
Renal v
Liver, right lobe
Diaphragm
Abdominal aorta
Renal pelvis
Renal v
Renal fascia
Intrarenal (renal sinus) fat
Perirenal fat
Renal cortex
Ureter
Renal a
Renal pyramid
Psoas major m
Latissimus dorsi m
Peritoneal cavity
T12-L1 intervertebral disc
Quadratus lumborum m
Serratus posterior inferior m
L1 vertebral body
Iliocostalis lumborum m
right
Longissimus m
left
Multifidus m
Spinal cord
L1 spinous process
posterior

Figure 8-43. The falciform ligament and omentum fill the "Open Valley" deep to KI 20.

wall provide collateral pathways for circulation. These communicating vessels course within loose areolar tissue deep to the rectus abdominis muscle. They constitute a lengthy anastomosis between the femoral vessels of the pelvis and the internal thoracic (internal mammary) vessels of the chest.

Acupuncture should be avoided in an area of abdominal wall expansion if rectus hematoma is suspected. However, after appropriate measures have controlled the bleeding and hypotensive consequences, neuromodulation may be attempted with non-invasive means to improve recovery of the area. That is, while acupuncture, laser therapy, and massage would be contraindicated in the acute phase where bleeding is active, they may be appropriate after the risk of hemorrhage has passed and if employed cautiously and judiciously to avoid and prevent further vessels damage.

Indications and Potential Point Combinations

- **Nausea, vomiting:** KI 20, PC 6.
- **Stomach pain:** KI 20, CV 12, ST 36, GV 20.
- **Hiccough:** KI 20, CV 14.

References

1. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery.* 2009;7:150-154.

2. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.

3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine.* 2005;29(1):101-102.

4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.

5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.

6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.

7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.

8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.

9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

10. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

11. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

KI 21

You Men "Hidden Gate", "Dark Gate"

On the epigastrium, 1 cun inferior to the xiphoid process, 6 cun superior to the umbilicus, 0.5 cun lateral to the midline, at approximately the 6th intercostal space.

(May overlie the pylorus. Also, deep needling may puncture the liver on the right and the peritoneum on the left.)

Fascia

- **Rectus sheath:** The rectus sheath represents the strong fibrous compartment incompletely enclosing the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.

Clinical Relevance: An epigastric artery rupture or rectus abdominis muscle tear can create a hematoma in the rectus sheath. Once considered rare, rectus sheath hematomata are increasing in frequency and severity.[1] More patients are receiving anti-coagulant medications and the population as a whole is advancing in age. Typically but not exclusively, the patient is an elderly female with acute onset of abdominal pain; examination reveals a palpable mass associated with the history of trauma to the abdomen but not, necessarily, surgery. Missing this diagnosis may lead to unnecessary surgery for a false acute abdomen. In addition, incising the abdominal wall could exacerbate the bleeding by eliminating the natural tamponade the rectus sheath provides, leading to uncontrolled hemorrhage.

The consequences of rectus sheath hematoma range from self-limiting disease to patient demise. Delaying proper treatment could allow a small, initially asymptomatic mass to enlarge and cause signs of abdominopelvic irritation accompanied by mild pyrexia and leukocytosis. Patients experiencing extensive hemorrhage into the rectus sheath exhibit tachycardia, tachypnea, sweating, and related signs of low blood volume.

In anti-coagulated patients with weakening of the rectus abdominis muscle, even apparently trivial trauma risks producing a rectus sheath hematoma. Activities such as coughing, sneezing, lifting, twisting, and other forms of exercise may tear a muscle or rupture a vessel. Paroxysms of coughing have been identified as a causative factor in over half of cases; patients with lung disease are thus at greater risk. Any needling of the rectus region could cause hematoma; even acupuncture has been cited as a cause of rectus sheath hematoma.[2]

One case report described the signs that presented in a patient who developed a rectus sheath hematoma after acupuncture.[3] About four hours after acupuncture, a 37 year-old woman experienced sharp, focal, constant abdominal pain in the right lower quadrant. Abdominal examination and history were otherwise unremarkable, except for a vague and non-moveable tender mass in the painful spot without overlying ecchymosis. Carnett's test was positive, meaning that the pain increased when the supine patient lifted her head when the examiner palpated the mass. This test helps to differentiate abdominal wall pain from intra-abdominal processes and thus raises the index of suspicion of a rectus sheath hematoma. Additionally, when the patient contracted the rectus muscle, the outline of the mass became more prominent; a feature known as "Fothergill's sign".

Falciform Ligament

- This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. This explains the appearance of the ligament at KI 17-KI 21 but not at KI 16 and those more caudal. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in

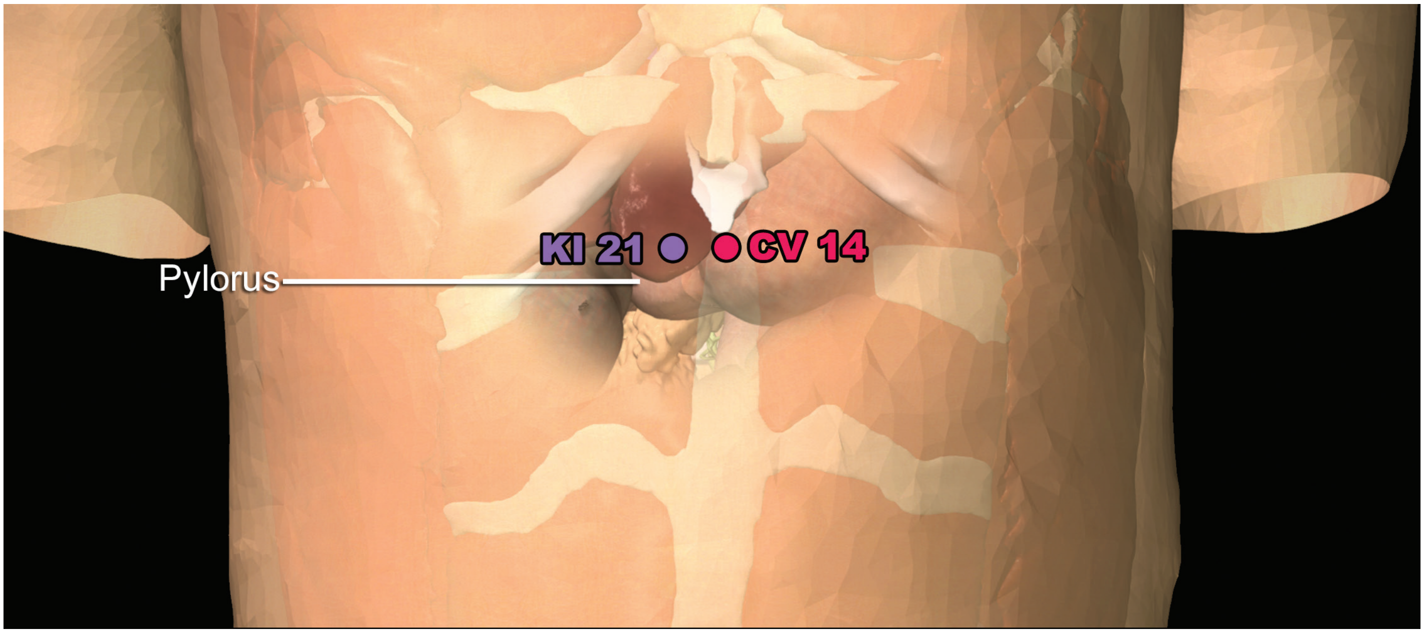


Figure 8-44. The descriptive titile for KI 21, "Hidden (or Dark) Gate" refers to the pylorus and its sphincter, revealed here deep to the point.

patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI 21 and other locations in the region may offer adjunctive support but should delay appropriate diagnosis and surgical treatment if warranted. Furthermore, acupuncture at the KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the effect of needling might be able to indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Muscles

- **Rectus abdominis muscle:** Flexes the trunk by flexing the lumbar vertebrae; compresses abdominal organs. A diaphragm antagonist, the rectus abdominis muscle assists exhalation.

Clinical Relevance: Trigger points in the rectus abdominis may refer to the back at similar spinal nerve levels. They may also cause somatovisceral discomfort including abdominal fullness, nausea, and vomiting. Rectus abdominis trigger points may arise from internal organ dysfunction, repeated episodes of vomiting or coughing, poor posture, stress, emotional trauma, motor vehicle accident, abdominal surgery, and over-exercise of abdominal musculature.

Nerves

- **6th intercostal nerve:** Supplies the skin in this region.
- **L1 spinal nerve:** Contributes to the nerve supply of the internal oblique and transverse abdominal muscles and their aponeuroses.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.

Clinical Relevance: Entrapment of spinal nerves' ventral rami has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous or osseofibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can contribute to nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

Vessels

- **Superior epigastric artery:** A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior epigastric artery.
- **Superior epigastric vein:** The superior epigastric veins are tributaries of the internal thoracic veins. They anastomose with the inferior epigastric veins inside the rectus sheath. These valveless veins can act as collateral routes for abdominopelvic blood return to the heart and provide a route for venous return from the lower extremities when needed. They allow venous blood to bypass the inferior vena cava in cases of obstruction or ligation and instead to drain into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.
- **6th intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.
- **6th intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: Should the major conduits of blood, i.e., the aorta and venae cavae, become obstructed or stenotic, these superficial vessels on the abdominal wall provide collateral pathways for circulation.

Indications and Potential Point Combinations

- **Feeling of fullness in the chest or epigastrium:** KI 21, CV 12, ST 36.
- **Back pain:** KI 21 for midthoracic pain refered by a trigger point in the rectus abdominis trigger point.
- **Aphasia:** KI 21[10]

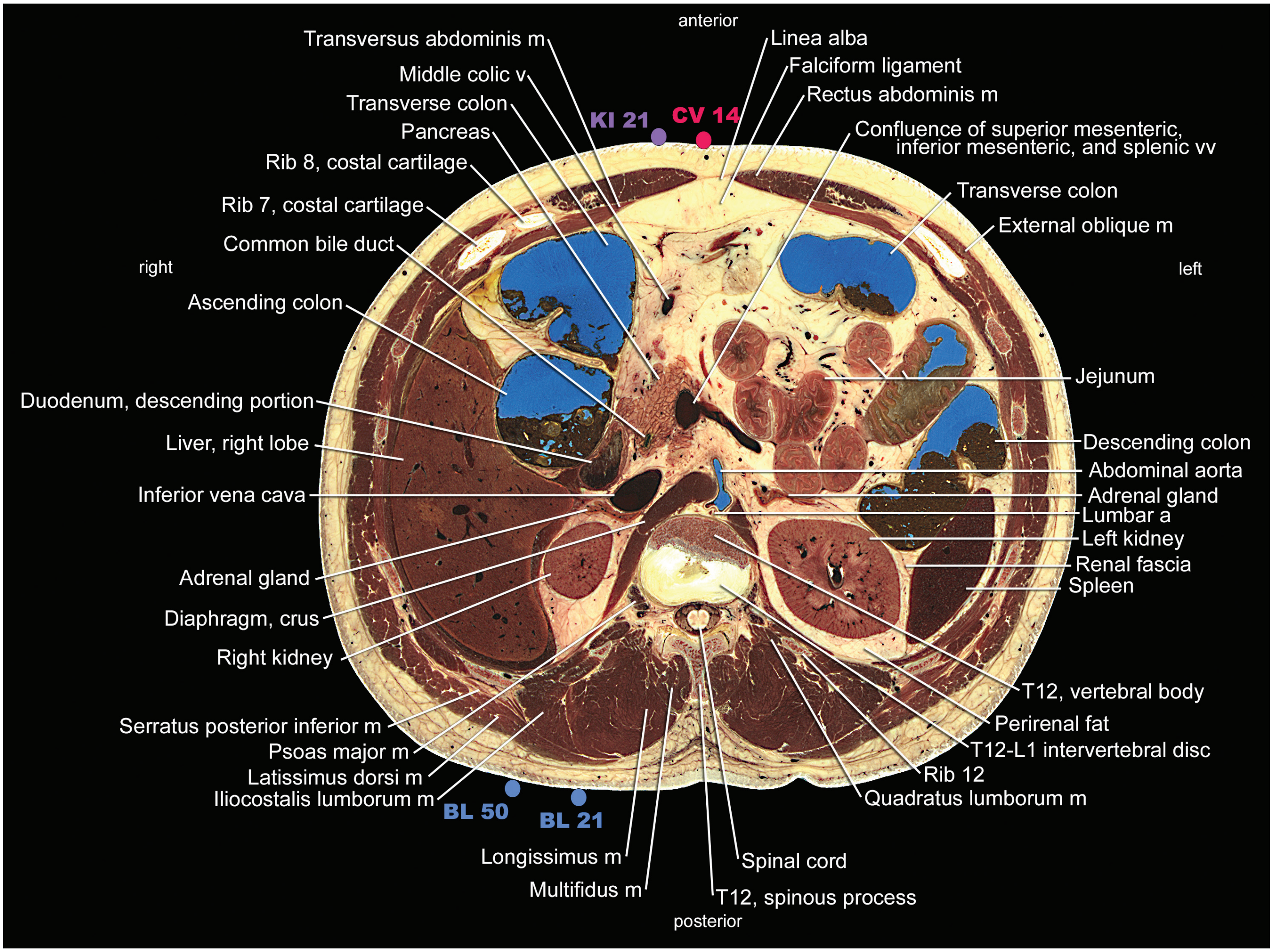

anterior
Transversus abdominis m
Middle colic v
Transverse colon
Pancreas
Rib 8, costal cartilage
Rib 7, costal cartilage
Common bile duct
right
Ascending colon
Duodenum, descending portion
Liver, right lobe
Inferior vena cava
Adrenal gland
Diaphragm, crus
Right kidney
Serratus posterior inferior m
Psoas major m
Latissimus dorsi m
Iliocostalis lumborum m
BL 50
BL 21
Longissimus m
Multifidus m
KI 21
CV 14
Linea alba
Falciform ligament
Rectus abdominis m
Confluence of superior mesenteric, inferior mesenteric, and splenic vv
Transverse colon
External oblique m
left
Jejunum
Descending colon
Abdominal aorta
Adrenal gland
Lumbar a
Left kidney
Renal fascia
Spleen
T12, vertebral body
Perirenal fat
T12-L1 intervertebral disc
Rib 12
Quadratus lumborum m
Spinal cord
T12, spinous process
posterior

Figure 8-45. With KI 21 over the pylorus, this cross section highlights this level's relationship to the stomach, as noted by the appearance of BL 21, the Back Shu point for the stomach, on this horizontal plane.

References

1. Fitzgerald JEF, Fitzgerald LA, Anderson FE, et al. The changing nature of rectus sheath haematoma: Case series and literature review. *International Journal of Surgery*. 2009;7:150-154.
2. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.
3. Cheng S-P and Liu C-L. Rectus sheath hematoma after acupuncture. *The Journal of Emergency Medicine*. 2005;29(1):101-102.
4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.
10. Zhang Z and Zhao C. Comparative observations on the curative results of the treatment of central aphasia by puncturing the yumen point versus conventional acupuncture methods. *J Tradit Chin Med*. 1990;10(4):260-263.

KI 22

Bu Lang "Walking Corridor"

On the chest, in the 5th intercostal space, 2 cun lateral to the midline, level with CV 16, adjacent to the sternum.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction. KI 22 overlaps with the location of the "cardiac arrhythmia" trigger point.[2] Note the proximity of the heart (seen with yellow denoting pericardial fat) to KI 22 in Figure 8-46.
- **Sternalis muscle:** An inconstant, strap-like muscle that may be unilateral, bilateral, or absent. It joins the rectus abdominis to the sternal head of the sternocleidomastoid muscle. Lies superficially and perpendicular to the pectoralis major muscle;[3] parallels the KI channel on either side of the sternum. Historically, the sternalis was considered a variant of the pectoralis major or rectus abdominis muscle. Its innervation varies as well.

Clinical Relevance: Sternalis trigger points develop anywhere along its course. Symptoms of sternalis trigger points include deep, intense, substernal pain; the sternum itself may become sore. As such, myofascial dysfunction in the sternalis at the level of KI 22 could mimic cardiogenic pain. Components of the referred pain pattern may extend to the ipsilateral PC or HT channel to PC 3 or HT 3.

Nerves

- **5th intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the clavicular and sternal portions of the pectoralis major muscle; may also innervate the sternalis muscle when present.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[4] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[5] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[6] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal

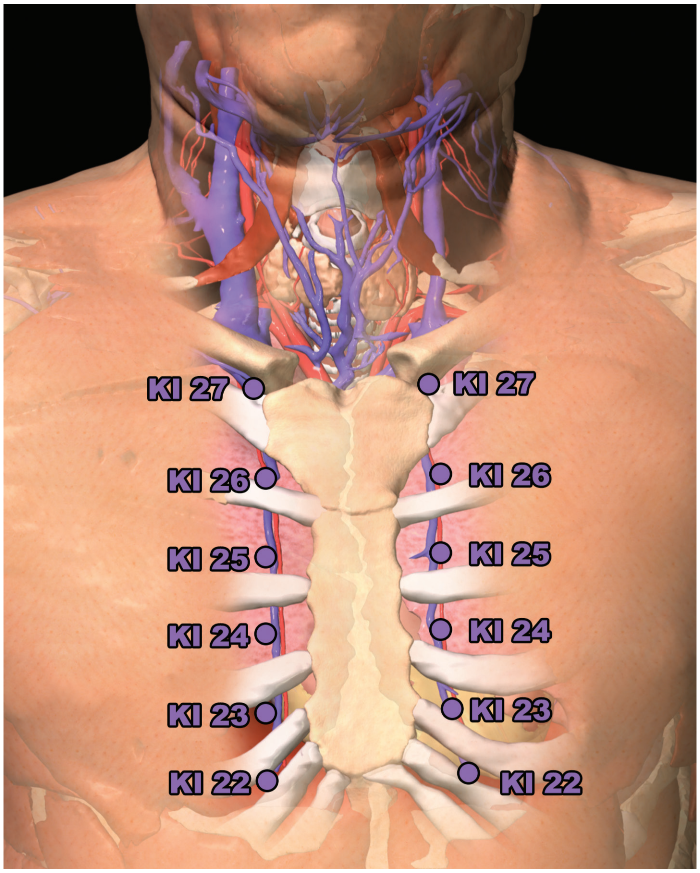


Figure 8-46. The corridor alluded to as "Walking Corridor" follows each side of the sternum in conjunction with the internal thoracic vessels, progressing step by step within each intercostal space. Note the relationship of the heart deep to KI 22 and KI 23, denoted in yellow by pericardial fat.

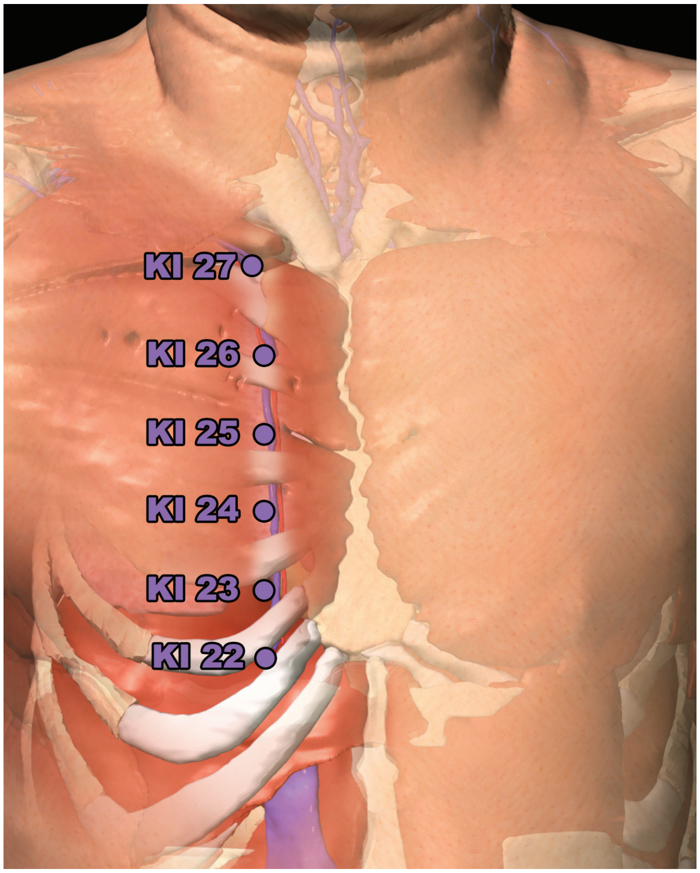


Figure 8-47. KI 22 overlies the diaphragm, thereby explaining its value for problems related to respiration insofar as moving air.

nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic (formerly, internal mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[7]
- **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.
- **5th intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.
- **5th intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[8]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Respiratory problems:** asthma, dyspnea, pleuritis, tracheitis, bronchitis: KI 22, LU 1, LU 2, BL 13.
- **Local pain, intercostal neuralgia:** KI 22, local trigger points.
- **Feeling of chest constriction, radiation of pain to the ulnar aspect of the arm to the ring and little fingers, mimicking pain of angina pectoris:** KI 22; check for trigger points in the pectoralis major attachment to the sternalis, in the location of KI 22.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Simons DG, Travell JG. and Simons LS. T*ravell & Simons' Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd Edition.* Baltimore: Williams & Wilkins, 1999. P. 822.
3. Raikos A, Praskevas GK, Tzika M, et al. Sternalis muscle: an underestimated anterior chest wall anatomical variant. *Journal of Cardiothoracic Surgery.* 2011;6:73.
4. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy.* 2012;25:559-575.
5. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery.* 2011;31:41-44.
6. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
7. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.
8. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

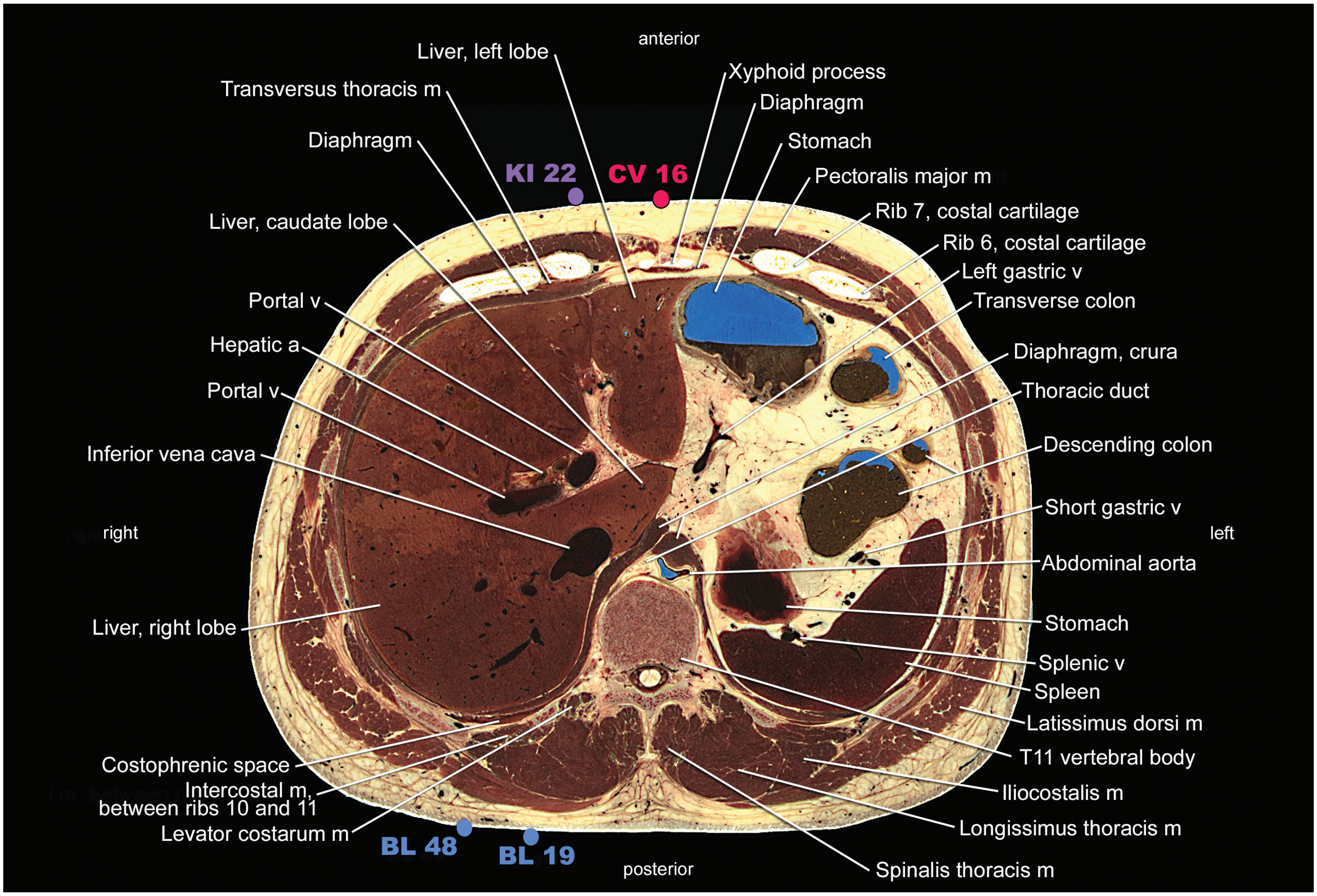

anterior
Liver, left lobe
Transversus thoracis m
Xyphoid process
Diaphragm
Diaphragm
Stomach
KI 22
CV 16
Pectoralis major m
Liver, caudate lobe
Rib 7, costal cartilage
Rib 6, costal cartilage
Left gastric v
Portal v
Transverse colon
Hepatic a
Diaphragm, crura
Portal v
Thoracic duct
Inferior vena cava
Descending colon
Short gastric v
right
left
Abdominal aorta
Liver, right lobe
Stomach
Splenic v
Spleen
Latissimus dorsi m
Costophrenic space
T11 vertebral body
Intercostal m, between ribs 10 and 11
Iliocostalis m
Levator costarum m
Longissimus thoracis m
BL 48
BL 19
posterior
Spinalis thoracis m

Figure 8-48. Tissues impacted directly by needling KI 22 include the skin, subcutaneous tissue, pectoralis major muscle, and the sternalis muscle, if present. Other structures of interest include the transversus thoracis muscle, diaphragm, and liver, all of which may be impacted by laser therapy, massage, and (albeit indirectly) acupuncture.

KI 23

Shen Feng "Spirit Border", "Spirit Seal"

On the chest, in the 4th intercostal space, 2 cun lateral to the midline, level with CV 17.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus mediad.
- **Sternalis muscle:** An inconstant, strap-like muscle that may be unilateral, bilateral, or absent. It joins the rectus abdominis to the sternal head of the sternocleidomastoid muscle. Lies superficial to and fibers run perpendicular to the pectoralis major muscle;[2] parallels the KI channel on either side of the sternum. Historically, the sternalis was considered a variant of the pectoralis major or rectus abdominis muscle. Its innervation varies.

Clinical Relevance: Sternalis trigger points develop anywhere along its course. Symptoms of sternalis trigger points include deep, intense, substernal pain; the sternum itself may become sore. As such, myofascial dysfunction in the sternalis in the region of KI 23 could mimic cardiogenic pain. Components of the referred pain pattern may extend to the ipsilateral PC or HT channel to PC 3 or HT 3.

Nerves

- **4th intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the cranial part of the pectoralis major muscle; may also innervate the sternalis muscle when present.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[3] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[4] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[5] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or

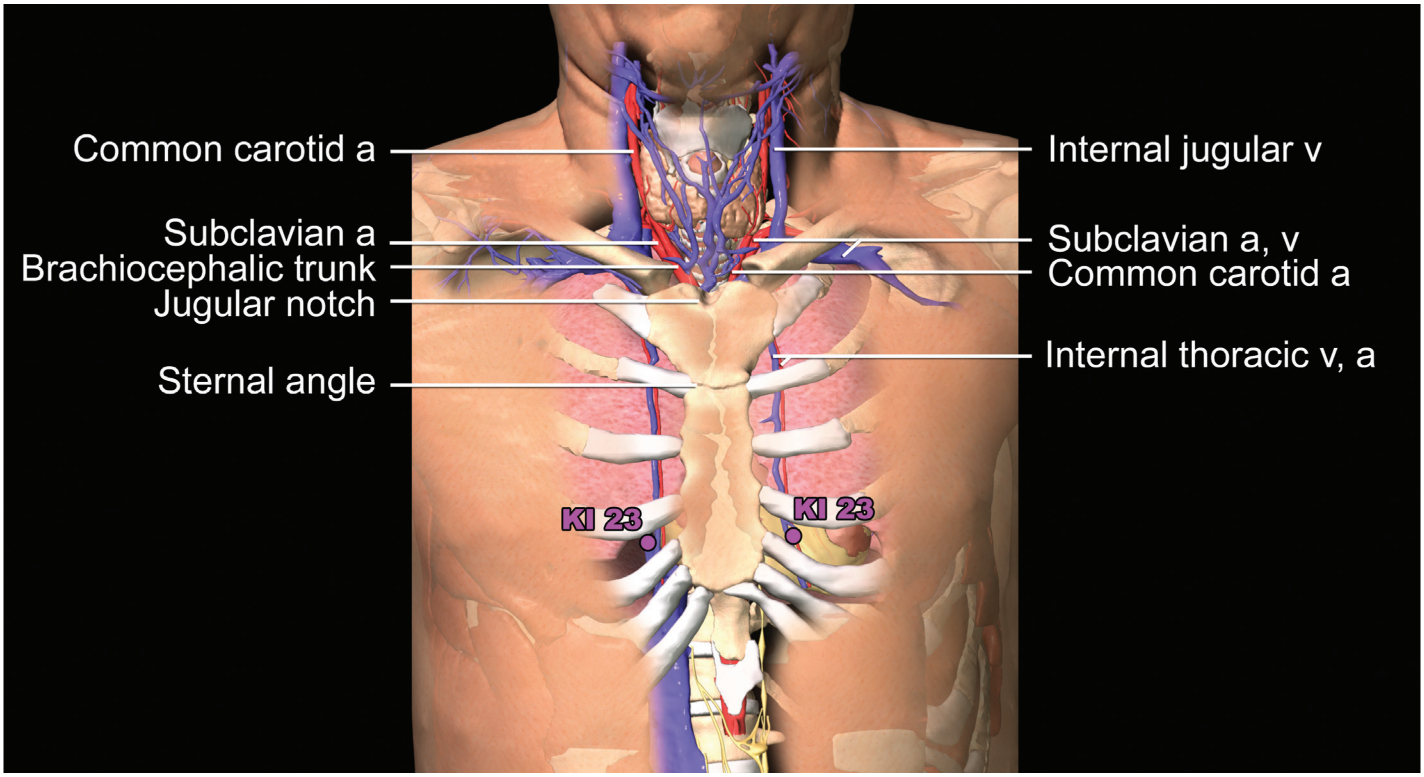


Figure 8-49. KI 23, "Spirit Border" or "Spirit Seal", sits over the heart, along its outline. In Chinese medicine, the spirit resides in the heart.

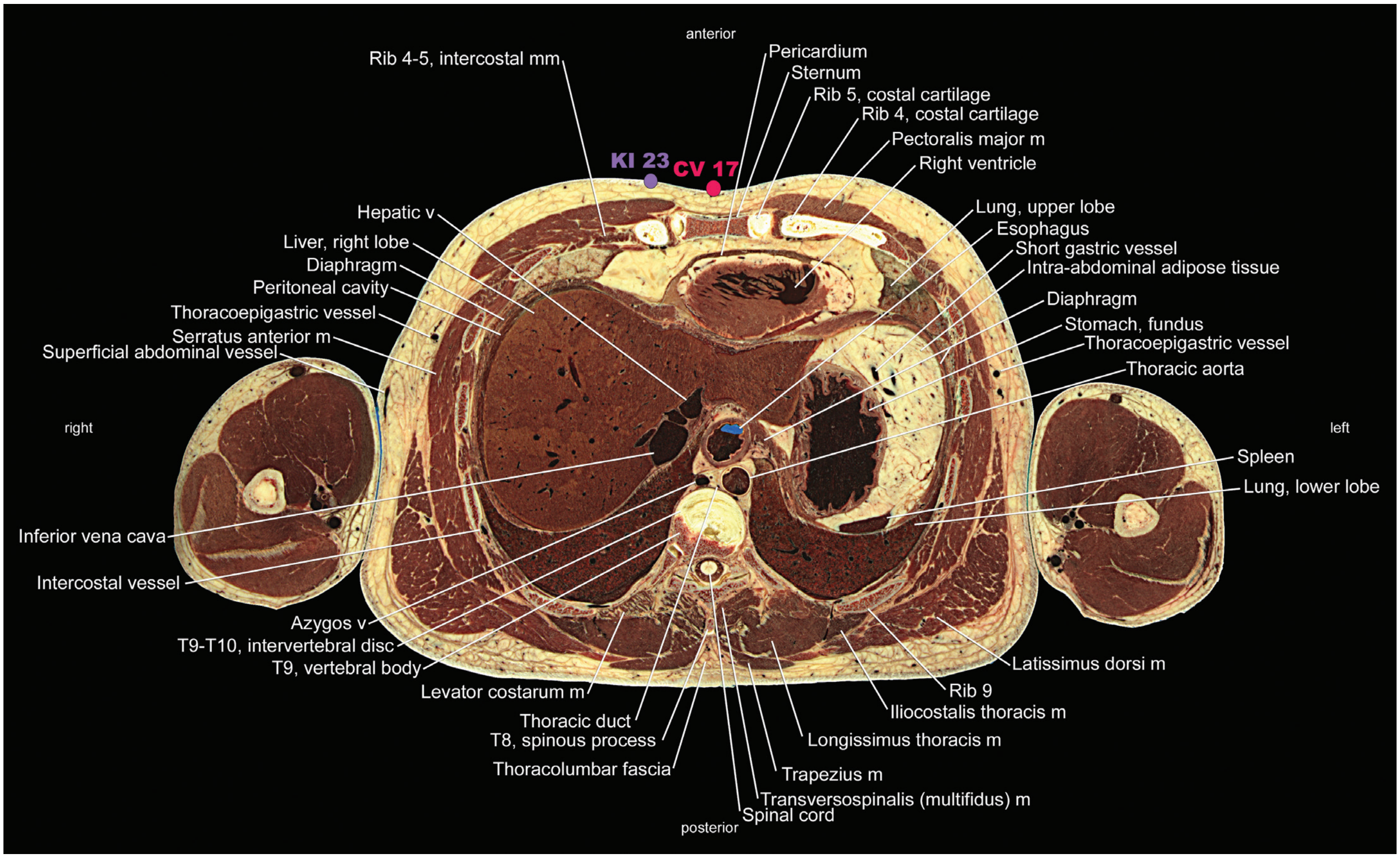

anterior
Rib 4-5, intercostal mm
Pericardium
Sternum
Rib 5, costal cartilage
Rib 4, costal cartilage
Pectoralis major m
Right ventricle
KI 23
CV 17
Hepatic v
Liver, right lobe
Diaphragm
Peritoneal cavity
Thoracoepigastric vessel
Serratus anterior m
Superficial abdominal vessel
Lung, upper lobe
Esophagus
Short gastric vessel
Intra-abdominal adipose tissue
Diaphragm
Stomach, fundus
Thoracoepigastric vessel
Thoracic aorta
right
left
Spleen
Lung, lower lobe
Inferior vena cava
Intercostal vessel
Azygos v
T9-T10, intervertebral disc
T9, vertebral body
Levator costarum m
Thoracic duct
T8, spinous process
Thoracolumbar fascia
Latissimus dorsi m
Rib 9
Iliocostalis thoracis m
Longissimus thoracis m
Trapezius m
Transversospinalis (multifidus) m
Spinal cord
posterior

Figure 8-50. Imagine the spirit living in the heart in this cross-section, as the ancient Chinese acupuncturists did. KI 23 watches over this spirit vessel at its outer edges.

needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

• **Internal thoracic (formerly, mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[6]

• **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.

• **4th intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.

• **4th intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[7]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Insomnia, anxiety, agitation:** KI 23, PC 6, PC 7, HT 3, GV 20.
- **Feeling of fullness in the chest:** KI 23, CV 17, PC 1.
- **Pleuritis, asthma:** KI 23, LU 1, ST 12, ST 13, BL 12, BL 13.
- **Mastitis:** KI 23, ST 18, ST 14, ST 36.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.
2. Raikos A, Praskevas GK, Tzika M, et al. Sternalis muscle: an underestimated anterior chest wall anatomical variant. *Journal of Cardiothoracic Surgery*. 2011;6:73.
3. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy*. 2012;25:559-575.
4. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.
5. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg*. 1989;69:81-82.
6. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology*. 2011;58(6):654.
7. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg*. 2006;43:707-713.

KI 24

Ling Xu "Spirit Hill" or "Spirit Residence"

On the chest, in the 3rd intercostal space, 2 cun lateral to the midline, level with CV 18.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Sternalis muscle:** An inconstant, strap-like muscle that may be unilateral, bilateral, or absent. It joins the rectus abdominis to the sternal head of the sternocleidomastoid muscle. Lies superficial to and fibers run perpendicular to the pectoralis major muscle;[2] parallels the KI channel on either side of the sternum. Historically, the sternalis was considered a variant of the pectoralis major or rectus abdominis muscle. Its innervation varies.

Clinical Relevance: Sternalis trigger points develop anywhere along its course. Symptoms of sternalis trigger points include deep, intense, substernal pain; the sternum itself may become sore. As such, myofascial dysfunction in the sternalis in the region of KI 24 could mimic cardiogenic pain. Components of the referred pain pattern may extend to the ipsilateral PC or HT channel to PC 3 or HT 3.

Nerves

- **3rd intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle, clavicular and sternal portions. May also innervate the sternalis muscle.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[3] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[4] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[5] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

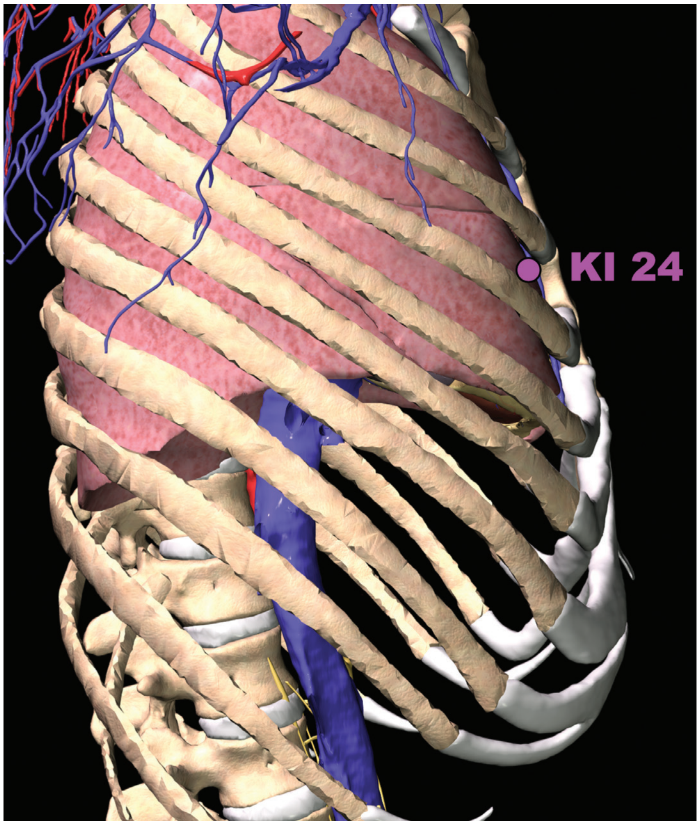


Figure 8-51. KI 24, "Spirit Residence", indicates the location on the chest where the KI line runs over the hill, or heart, the house of the spirit in Chinese medicine.

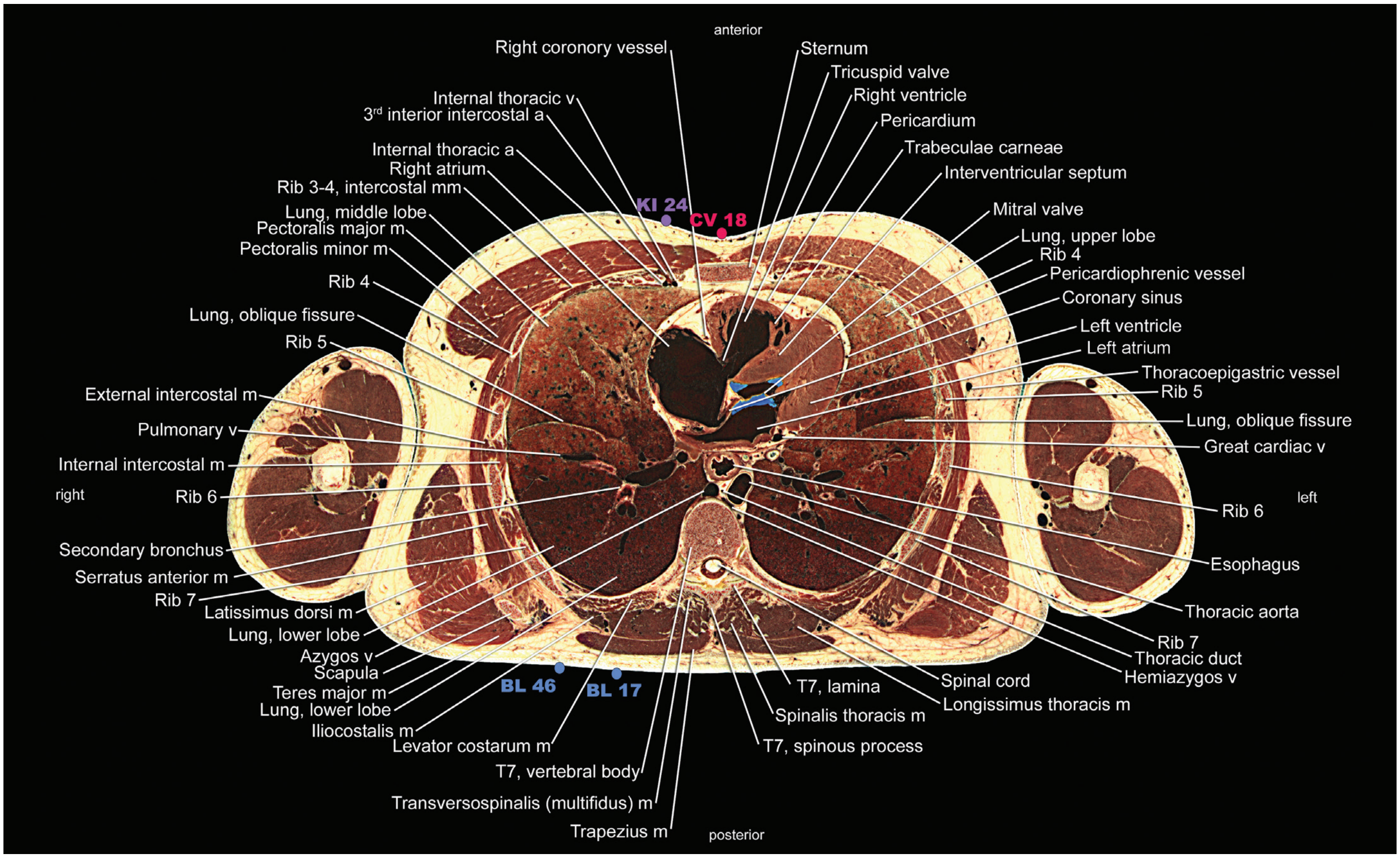

anterior
Right coronory vessel
Internal thoracic v
3rd interior intercostal a
Internal thoracic a
Right atrium
Rib 3-4, intercostal mm
Lung, middle lobe
Pectoralis major m
Pectoralis minor m
KI 24
CV 18
Rib 4
Lung, oblique fissure
Rib 5
External intercostal m
Pulmonary v
Internal intercostal m
right
Rib 6
Secondary bronchus
Serratus anterior m
Rib 7
Latissimus dorsi m
Lung, lower lobe
Azygos v
Scapula
Teres major m
Lung, lower lobe
Iliocostalis m
BL 46
BL 17
Levator costarum m
T7, vertebral body
Transversospinalis (multifidus) m
Trapezius m
posterior
Sternum
Tricuspid valve
Right ventricle
Pericardium
Trabeculae carneae
Interventricular septum
Mitral valve
Lung, upper lobe
Rib 4
Pericardiophrenic vessel
Coronary sinus
Left ventricle
Left atrium
Thoracoepigastric vessel
Rib 5
Lung, oblique fissure
Great cardiac v
left
Rib 6
Esophagus
Thoracic aorta
Rib 7
Thoracic duct
Hemiazygos v
Spinal cord
Longissimus thoracis m
T7, lamina
Spinalis thoracis m
T7, spinous process

Figure 8-52. This cross section at KI 24 reveals the relationship between KI 24, the heart (the organ where the spirit supposedly resides), and the internal thoracic vessels, the vascular basis of the KI channel.

Vessels

- **Internal thoracic (formerly, internal mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[6]
- **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.
- **3rd intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.
- **3rd intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[7]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Insomnia, anxiety, agitation:** KI 24, CV 17, BL 14, PC 6, GV 20.
- **Substernal pain that mimics the ache of myocardial infarction or angina pectoris, with a left-sided pattern that can extend to the ulnar aspect of the left forearm and hand:** KI 24, BL 15; check for trigger points in the variable sternalis muscle.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. Journal of Orthopaedic Surgery. 2005;13(3):300-302.

2. Raikos A, Praskevas GK, Tzika M, et al. Sternalis muscle: an underestimated anterior chest wall anatomical variant. *Journal of Cardiothoracic Surgery.* 2011;6:73.

3. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy.* 2012;25:559-575.

4. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery.* 2011;31:41-44.

5. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.

6. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.

7. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

KI 25

Shen Cang "Spirit Storehouse"

On the chest, in the 2nd intercostal space, 2 cun lateral to the midline, level with CV 19.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Sternalis muscle:** An inconstant, strap-like muscle that may be unilateral, bilateral, or absent. It joins the rectus abdominis to the sternal head of the sternocleidomastoid muscle. Lies superficial to and fibers run perpendicular to the pectoralis major muscle;[2] parallels the KI channel on either side of the sternum. Historically, the sternalis was considered a variant of the pectoralis major or rectus abdominis muscle. Its innervation varies.

Clinical Relevance: Sternalis trigger points develop anywhere along its course. Symptoms of sternalis trigger points include deep, intense, substernal pain; the sternum itself may become sore. As such, myofascial dysfunction in the sternalis in the region of KI 25 could mimic cardiogenic pain. Components of the referred pain pattern may extend to the ipsilateral PC or HT channel to PC 3 or HT 3.

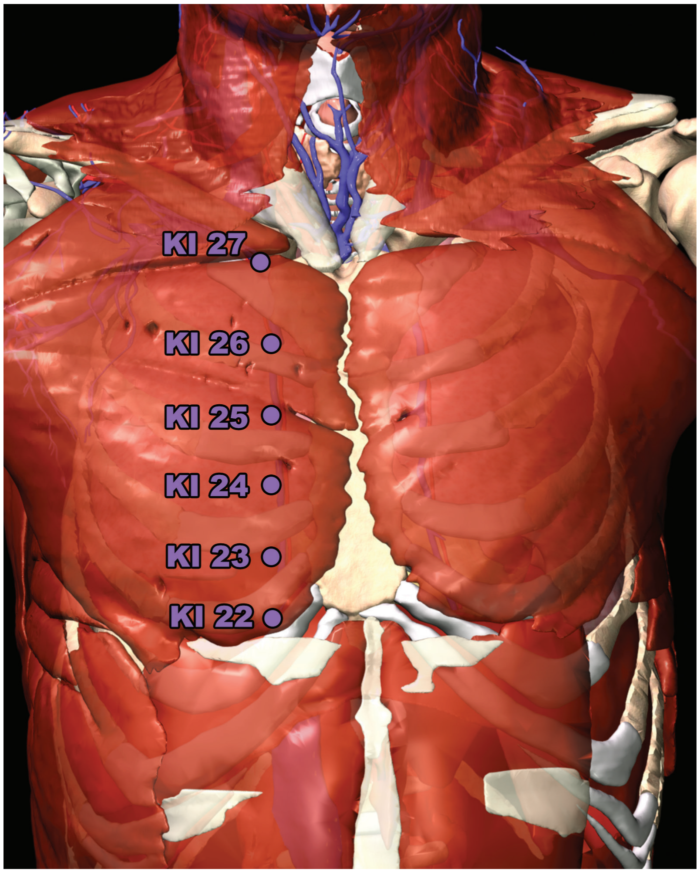


Figure 8-53. KI 25 occupies the 2nd intercostal space. Trigger points in the pectoralis major and sternalis muscles can produce local and referred discomfort similar to angina pectoris symptomatology. This individual lacked an obvious sternalis muscle.

Nerves

- **2nd intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle, clavicular and sternal portions. May also innervate the sternalis muscle.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[3] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[4] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[5] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

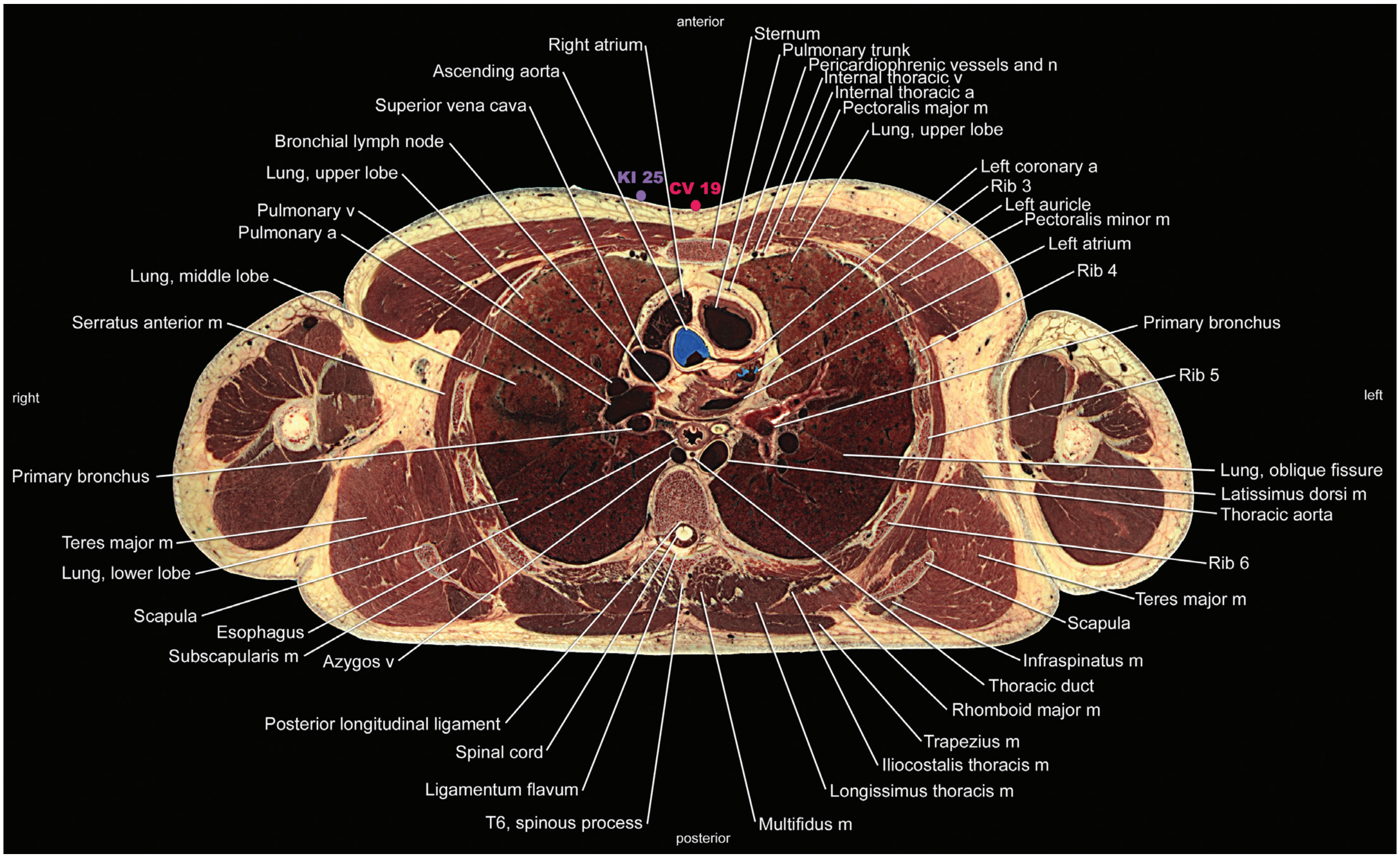

anterior
Right atrium
Ascending aorta
Superior vena cava
Bronchial lymph node
Lung, upper lobe
Pulmonary v
Pulmonary a
Lung, middle lobe
Serratus anterior m
right
Primary bronchus
Teres major m
Lung, lower lobe
Scapula
Esophagus
Subscapularis m
Azygos v
Posterior longitudinal ligament
Spinal cord
Ligamentum flavum
T6, spinous process
posterior
KI 25
CV 19
Sternum
Pulmonary trunk
Pericardiophrenic vessels and n
Internal thoracic v
Internal thoracic a
Pectoralis major m
Lung, upper lobe
Left coronary a
Rib 3
Left auricle
Pectoralis minor m
Left atrium
Rib 4
Primary bronchus
Rib 5
left
Lung, oblique fissure
Latissimus dorsi m
Thoracic aorta
Rib 6
Teres major m
Scapula
Infraspinatus m
Thoracic duct
Rhomboid major m
Trapezius m
Iliocostalis thoracis m
Longissimus thoracis m
Multifidus m

Figure 8-54. "Spirit Storehouse" (KI 25) lives at the level of a vessel epicenter, as shown here.

Vessels

- **Internal thoracic (formerly, internal mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[6]

- **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.

- **2nd intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.

- **2nd intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[7]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Feeling of fullness in the chest, restriction of chest movement:** KI 25, check for other trigger points in the pectoralis major and possibly the sternalis muscle.
- **Cough:** KI 25, BL 12, GB 21, CV 22, LI 4.
- **Intercostal neuralgia:** KI 25, local trigger points above and below the dysfunctional intercostal space.
- **Insomnia, anxiety, agitation:** KI 25, CV 17, BL 14, PC 6, GV 20.

- **Substernal pain that mimics the ache of myocardial infarction or angina pectoris, with a left-sided pattern that can extend to the ulnar aspect of the left forearm and hand:** KI 25; check for trigger points in the variable sternalis muscle.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Raikos A, Praskevas GK, Tzika M, et al. Sternalis muscle: an underestimated anterior chest wall anatomical variant. *Journal of Cardiothoracic Surgery.* 2011;6:73.
3. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy.* 2012;25:559-575.
4. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery.* 2011;31:41-44.
5. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
6. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.
7. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

KI 26

Yu Zhong "Lively Center" or "Chest Comfort"

In the infraclavicular region, in the 1st intercostal space, 2 cun lateral to the midline, level with CV 20.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Sternalis muscle:** An inconstant, strap-like muscle that may be unilateral, bilateral, or absent. It joins the rectus abdominis to the sternal head of the sternocleidomastoid muscle. Lies superficial to and fibers run perpendicular to the pectoralis major muscle;[4] parallels the KI channel on either side of the sternum. Historically, the sternalis was considered a variant of the pectoralis major or rectus abdominis muscle. Its innervation varies.

Clinical Relevance: Sternalis trigger points develop anywhere along its course. Symptoms of sternalis trigger points include deep, intense, substernal pain; the sternum itself may become sore. As such, myofascial dysfunction in the sternalis in the region of KI 26 could mimic cardiogenic pain. Components of the referred pain pattern may extend to the ipsilateral PC or HT channel to PC 3 or HT 3.

Nerves

- **1st intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle, clavicular and sternal portions. May also innervate the sternalis muscle.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[5] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[6] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[7] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic

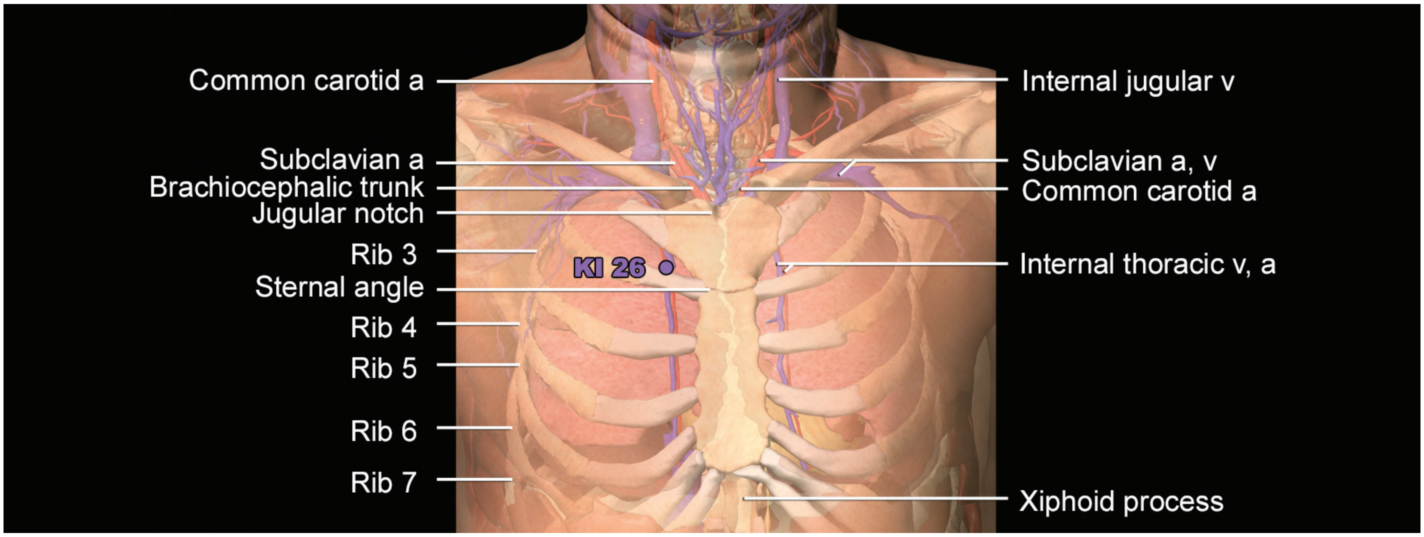


Figure 8-55. The names "Lively Center" and "Chest Comfort" for KI 26 refer to the emotions of tension, anxiety, upset, and psychological pain that afflict the chest.

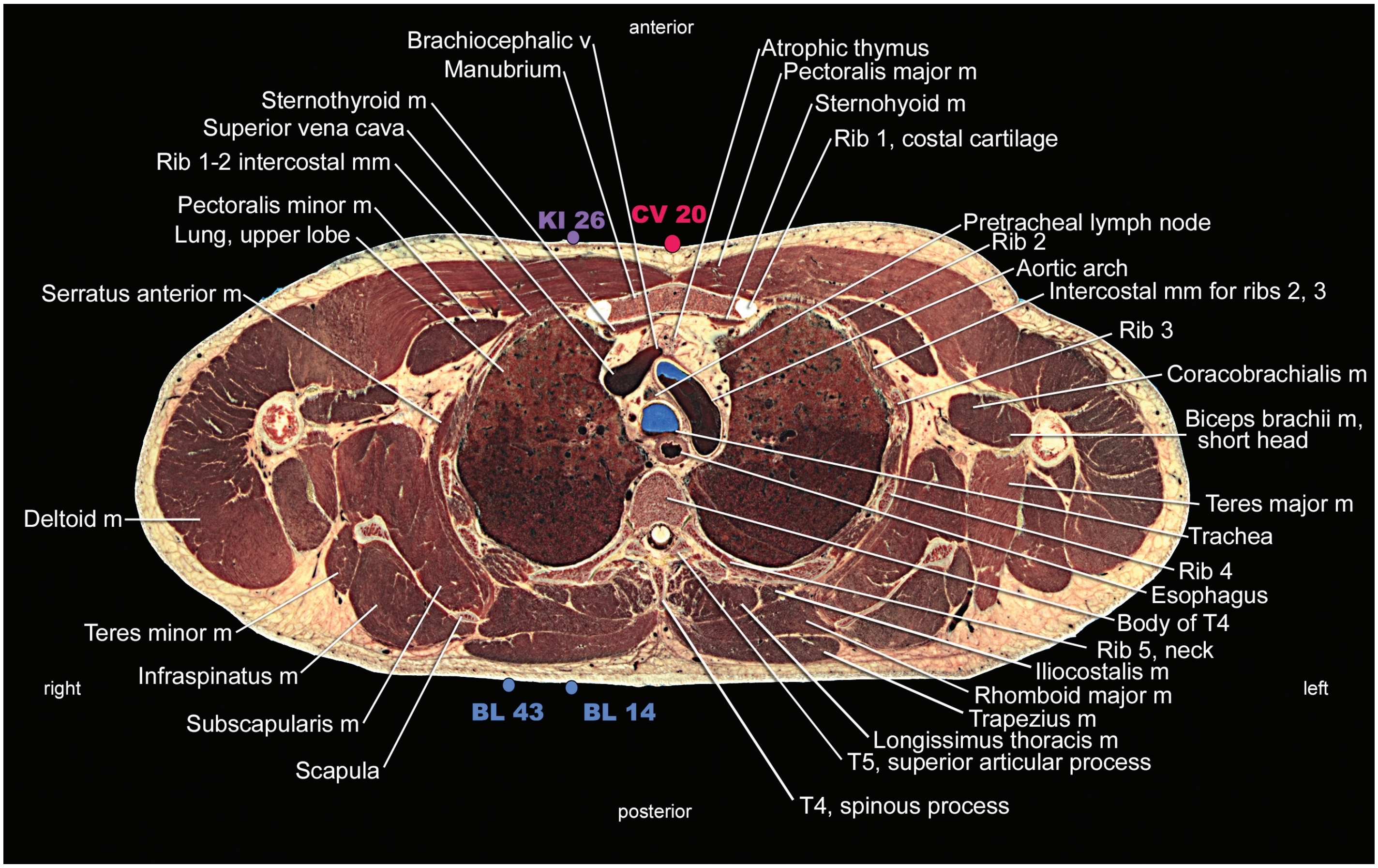

anterior
Brachiocephalic v
Manubrium
Sternothyroid m
Superior vena cava
Rib 1-2 intercostal mm
Pectoralis minor m
Lung, upper lobe
Serratus anterior m
KI 26
CV 20
Atrophic thymus
Pectoralis major m
Sternohyoid m
Rib 1, costal cartilage
Pretracheal lymph node
Rib 2
Aortic arch
Intercostal mm for ribs 2, 3
Rib 3
Coracobrachialis m
Biceps brachii m, short head
Deltoid m
Teres major m
Trachea
Rib 4
Esophagus
Body of T4
Rib 5, neck
Teres minor m
Infraspinatus m
right
Subscapularis m
Scapula
BL 43
BL 14
Iliocostalis m
Rhomboid major m
Trapezius m
Longissimus thoracis m
T5, superior articular process
T4, spinous process
left
posterior

Figure 8-56. That KI 26 lives on the same level as BL 14 and BL 43 reinforces the emotional and agitation-related perturbations associated with this point. Nearby structures inside the mediastinum such as the esophagus and trachea help explain the indications for KI 26 of dysphagia and cough.

dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic (formerly, internal mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery, through its connections to the inferior epigastric artery, provides an avenue for collateral blood supply to a chronically ischemic pelvic limb in cases of aortoiliac occlusive disease.[2,3]

- **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.

- **1st intercostal artery:** Supplies the intercostal muscles, overlying skin, and parietal pleura.

- **1st intercostal vein:** Drains the intercostal muscles, overlying skin, and parietal pleura.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[8]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Fullness, pain, phlegm in chest, cough, asthma:** KI 26, LU 1, LU 2, BL 23, ST 36.
- **Esophageal pain, dysphagia:** KI 26, CV 22, CV 14, ST 36, PC 6.
- **Anxiety,[9] emotional upset, agitation, apprehension:** KI 26, PC 3, PC 7, CV 17, GV 20.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Hayashida N, Kai E, Enomoto N, et al. Internal thoracic artery as a collateral source to the ischemic lower extremity. *European Journal of Cardio-thoracic Surgery.* 2000;18:613-616.
3. Yurdakul M, Tola M, Oxdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43(4):707-713.
4. Raikos A, Praskevas GK, Tzika M, et al. Sternalis muscle: an underestimated anterior chest wall anatomical variant. *Journal of Cardiothoracic Surgery.* 2011;6:73.
5. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy.* 2012;25:559-575.
6. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery.* 2011;31:41-44.
7. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
8. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.
9. Jeffres A. A unique application of KI 26 (Yu Zhong) acupuncture point for the treatment of anxiety. *Medical Acupuncture.* 2012;24(3):156-160.

KI 27

Shu Fu "Storehouse Transport"

In a depression inferior to the clavicle near its sternal end, approximately 2 cun lateral to the midline. One can locate 2 cun from the midline by dividing in two the distance between the midline and the midclavicular line.

One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1]

Muscles

- **Platysma muscle:** The platysma muscle arises in the fascia covering the deltoid and pectoralis major muscles. These fibers sweep over the clavicle to insert on the inferior border of the mandible. Cutaneous nerves pierce the platysma muscle. When contracted, the playsma conveys expressions of tension, stress, or a grimace.
- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Subclavius muscle:** Depresses and anchors the clavicle, which helps stabilize the clavicle during arm movements.

Clinical Relevance: A myofascial trigger point in the subclavius muscle directly coincides with KI 27. This common but under recognized source of subclavicular and thoracic limb discomfort refers pain from the clavicle to the biceps region, the radial aspect of the antebrachium, and both dorsal and palmar surfaces of the hand, including the thumb, index, and middle fingers. The course of the pain pattern overlaps the LU and LI channel routes.

Figure 8-57A reveals how the platysma muscle attaches to the infraclavicular region, predisposing patients to attachment trigger points. It also indicates the intersection of KI 27 at the border of the adjacent sternal and clavicular parts of the pectoralis muscle.

Nerves

- **Supraclavicular nerves (C3, C4):** Supply the skin over the shoulder and clavicle.
- **1st thoracic intercostal nerve:** Supplies the skin over this region.
- **Cervical branch of the facial nerve (CN VII):** Innervates the platysma muscle.
- **Nerve to the subclavius (C5 and C6):** Supplies the subclavius muscle.
- **Medial pectoral nerve (C7, C8, T1):** Supplies the caudal portion of the pectoralis major as well as the pectoralis minor muscle. May also innervate the sternalis muscle when present.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle, clavicular and sternal portions. May also innervate the sternalis muscle.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[2] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[3] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) has the potential to produce chronic pain syndromes: postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[4] The latter condition arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves. The neuromas typically appear on the left intercostal spaces and develop following insertion of sternal wires or needles located at the sternal margin of the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

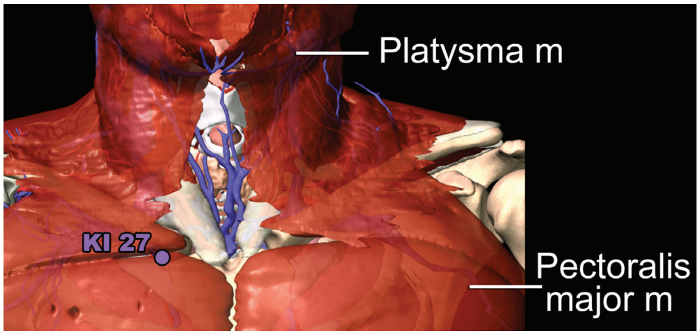


Figure 8-57A. Palpating KI 27 frequently elicits reports of tenderness, considering the various pulls on the site from the attachments of the platysma as well as the clavicular and sternal attachments of the pectoralis muscle.

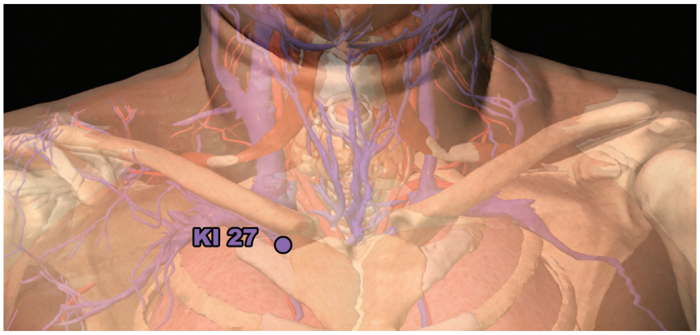


Figure 8-57B. "Storehouse Transport" metaphorically connects the "Storehouse" (heart) with its vascular conduits. Note how the subclavian, brachiocephalic, and internal thoracic vessels intersect at KI 27.

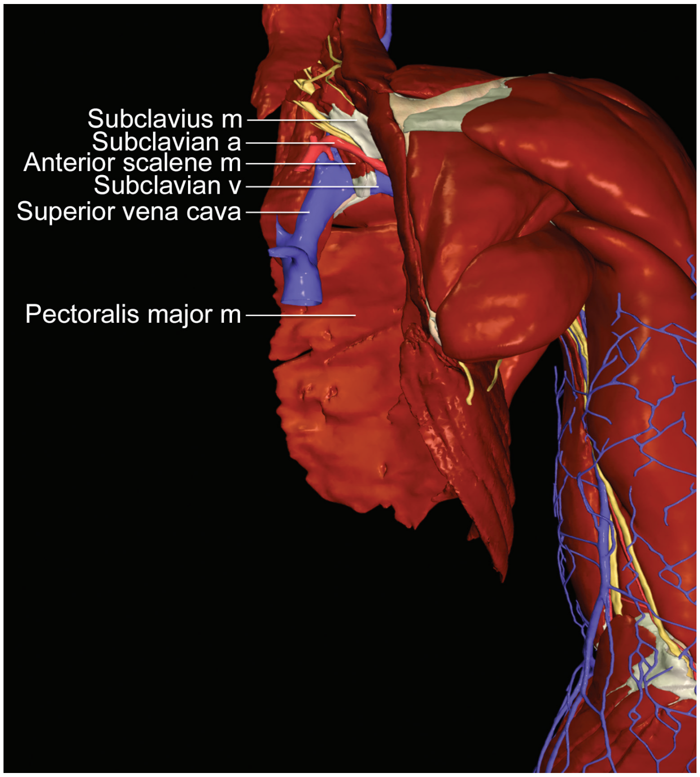


Figure 8-58A. This "view from the inside" of the chest wall provides a "behind the scenes" look of the muscular, vascular, and neural structures caudal to KI 27.

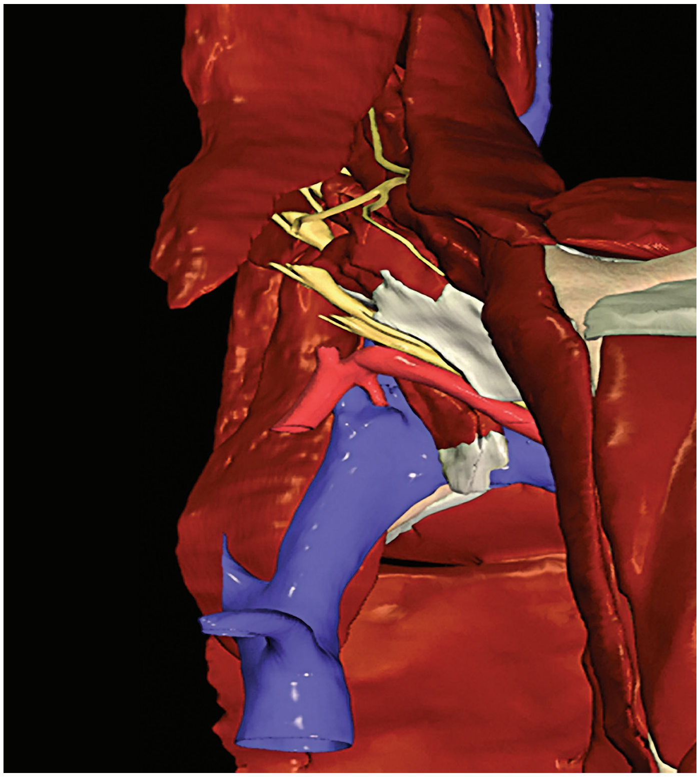


Figure 8-58B. The image provides a close-up view of the structures deep to KI 27, labeled in Figure 8-58A.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Treatment with acupuncture at KI 27, at the cranial limit of the KI channel, may benefit patients with thoracic outlet syndrome. View a portion of the region affected in these patients in Figure 8-58. These patients typically describe pain, paresthesias, swelling, weakness of the thoracic limb, and color changes in that limb when they carry objects overhead or that are heavy.[5] Compression of neurovascular structures in the cervical and axillary region precipitates this condition. Etiologies include anatomic anomalies such as the presence of a cervical rib, long transverse process of C7, congenital bands, and aberrant musculature such as a subclavius posticus muscle.

Clavicular fracture and post-traumatic scarring may produce supraclavicular nerve entrapment,[6] along with compression of the nerve to the subclavius muscle. Neurogenic thoracic outlet syndrome can also follow neck trauma and first rib fracture.[7]

Vessels

- **Internal thoracic (formerly, internal mammary) artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries.
- **Internal thoracic (formerly, internal mammary) vein:** The internal thoracic veins accompany the internal thoracic arteries. The anterior intercostal veins are tributaries of the internal thoracic veins.

Clinical Relevance: The internal thoracic vessels (formerly known as the internal mammary vessels) represent a continuation from the superior epigastric vessels that also parallel the KI channel. At each intercostal space demarcated by KI 22 to KI 26, the internal thoracic vessels connect to the intercostal arteries and veins. At KI 27, the internal thoracic artery arises from the subclavian artery near its origin while its venous partner terminates in the brachiocephalic vein. By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[8]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing

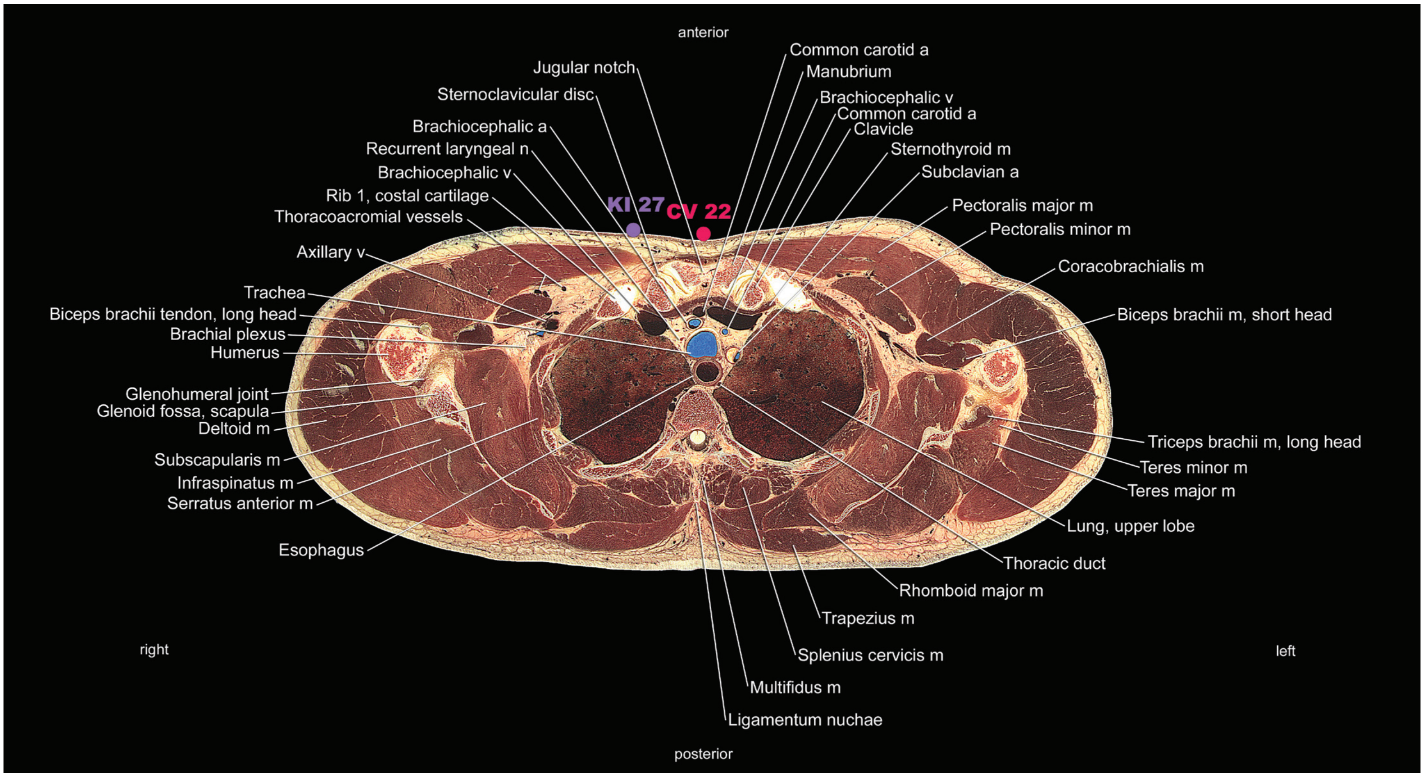

anterior
Jugular notch
Sternoclavicular disc
Brachiocephalic a
Recurrent laryngeal n
Brachiocephalic v
Rib 1, costal cartilage
Thoracoacromial vessels
Axillary v
Trachea
Biceps brachii tendon, long head
Brachial plexus
Humerus
Glenohumeral joint
Glenoid fossa, scapula
Deltoid m
Subscapularis m
Infraspinatus m
Serratus anterior m
Esophagus
right
KI 27
CV 22
Common carotid a
Manubrium
Brachiocephalic v
Common carotid a
Clavicle
Sternothyroid m
Subclavian a
Pectoralis major m
Pectoralis minor m
Coracobrachialis m
Biceps brachii m, short head
Triceps brachii m, long head
Teres minor m
Teres major m
Lung, upper lobe
Thoracic duct
Rhomboid major m
Trapezius m
Splenius cervicis m
Multifidus m
Ligamentum nuchae
left
posterior

Figure 8-59. This image shows, in cross-section, the conduits through which blood and spirit course deep to KI 27, the "Storehouse Transport".

severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Cough:** KI 27, BL 12, BL 13, CV 20.
- **Sore throat:** KI 27, CV 22, LI 4, LI 18.
- **Apprehension, irritability, insomnia:** KI 27, PC 3, PC 7.
- **Chest pain mimicking angina pectoris:** KI 27, check for a trigger point in the subclavius muscle near KI 27 that radiates pain down the arm, more along LU line than HT line, however.
- **Clavicular pain, with or without radiation along the ipsilateral arm:** KI 27, LU 2, PC 2, LU 5, other pertinent trigger points.

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery*. 2005;13(3):300-302.

2. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy*. 2012;25:559-575.

3. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.

4. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg*. 1989;69:81-82.

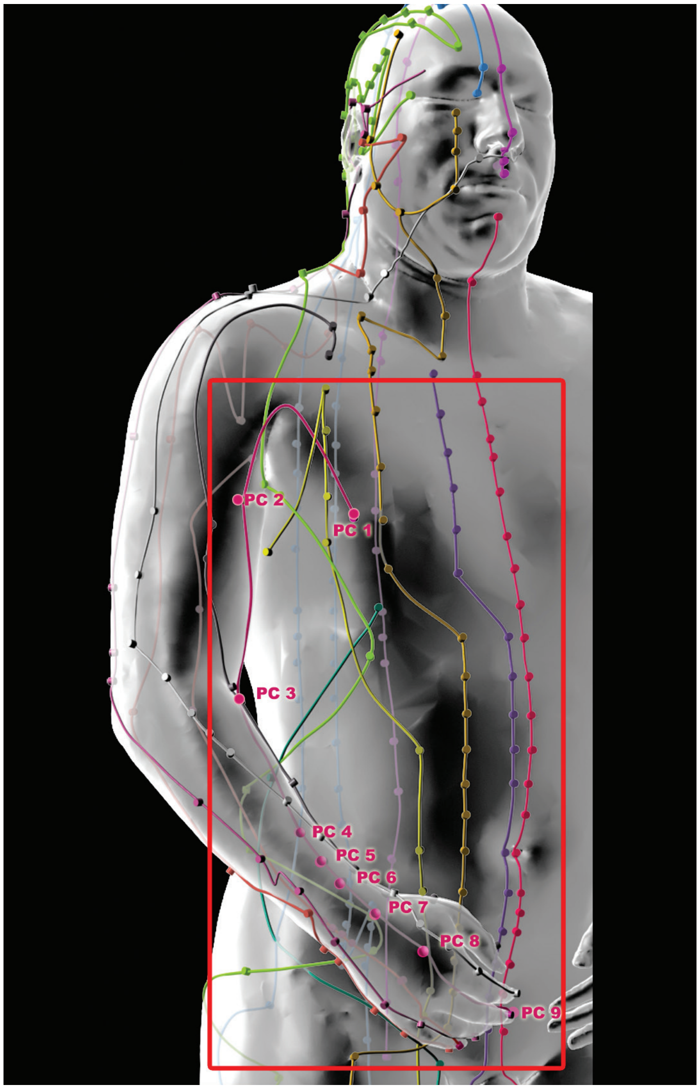
5. Ozcakar L, Guney MS, Ozdag F, et al. A sledgehammer on the brachial plexus: thoracic outlet syndrome, subclavius posticus muscle, and traction in aggregate. *Arch Phys Med Rehabil*. 2010;91:656-658.

6. O'Neill K, Stutz C, Duvernay M, et al. Supraclavicular nerve entrapment and clavicular fracture. *J Orthop Trauma*. 2012;26(6):e63-65.

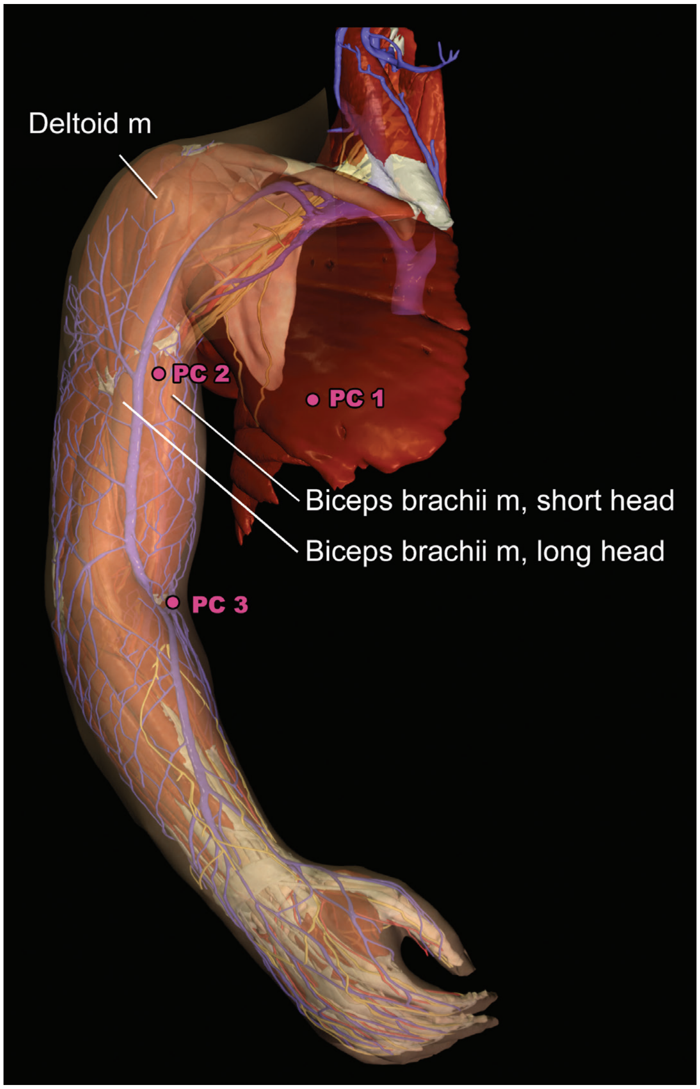
7. Subramonia S and Holdsworth JD. Neurogenic thoracic outlet syndrome secondary to non-union of unrecognised first rib fracture. *EJVES Extra*. 2004;7:40-42.

8. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg*. 2006;43:707-713.

Channel 9:: The Pericardium (PC)


PC 2
PC 1
PC 3
PC 4
PC 5
PC 6
PC 7
PC 8
PC 9

The PC channel begins lateral to the nipple in the 4th intercostal space. It ascends to the anterior axilla then descends down the medial aspect of the biceps brachii muscle. Distal to the elbow, the PC channel tours the interosseous groove along the palmar antebrachial surface. It makes its way across the palm between the 2nd and 3rd metacarpal bones. Where the channel ends at PC 9 has raised debate, with some placing it on the radial nail angle of the dorsal middle finger. Others end the channel at the midpoint of the fingertip. In this image, the distal PC channel, coursing on the palmar antebrachium, appears through translucent distal limb and emerges at the tip of the middle finger.


Deltoid m
PC 2
PC 1
Biceps brachii m, short head
Biceps brachii m, long head
PC 3

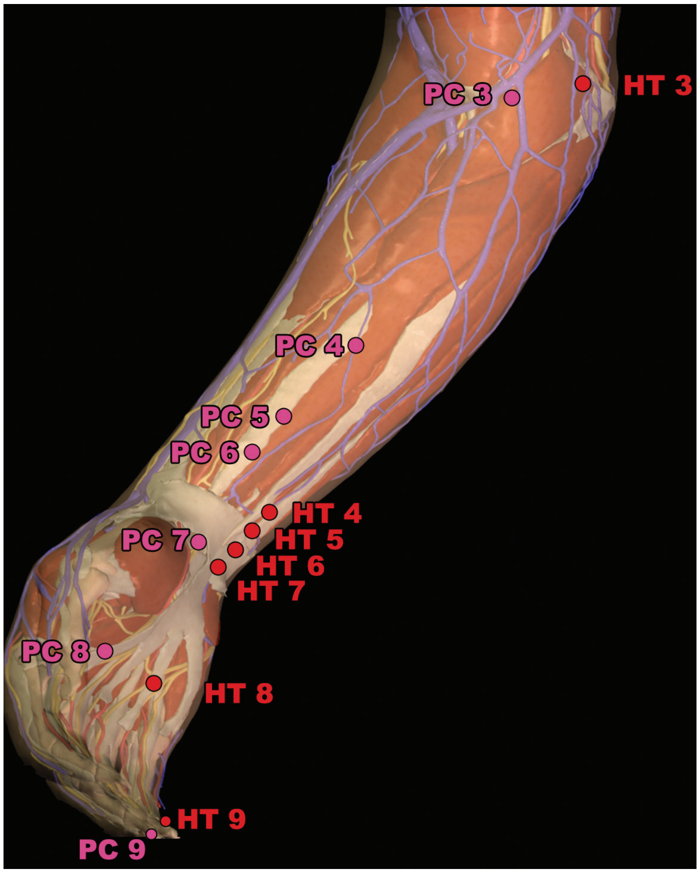
This image illustrates the relationship between the first three PC points and the muscular anatomy of the thoracic limb.

One can identify connective tissue connections, or trains, that follow acupuncture channels in addition to neurovascular passageways.[4] Myofascial chains, trains, or interlocking fascial planes participate in similar directional movements, supporting a structure-function relationship. Expansions of muscle into fascia create a vehicle for bidirectional communication and reciprocal feedback between fascia and muscles. That is, fascia can perceive and diffuse tension in a muscle or from muscle groups. Muscle spindle activation informs the central nervous system about the state of contraction not only of the muscle it supplies but also attaching fascia.

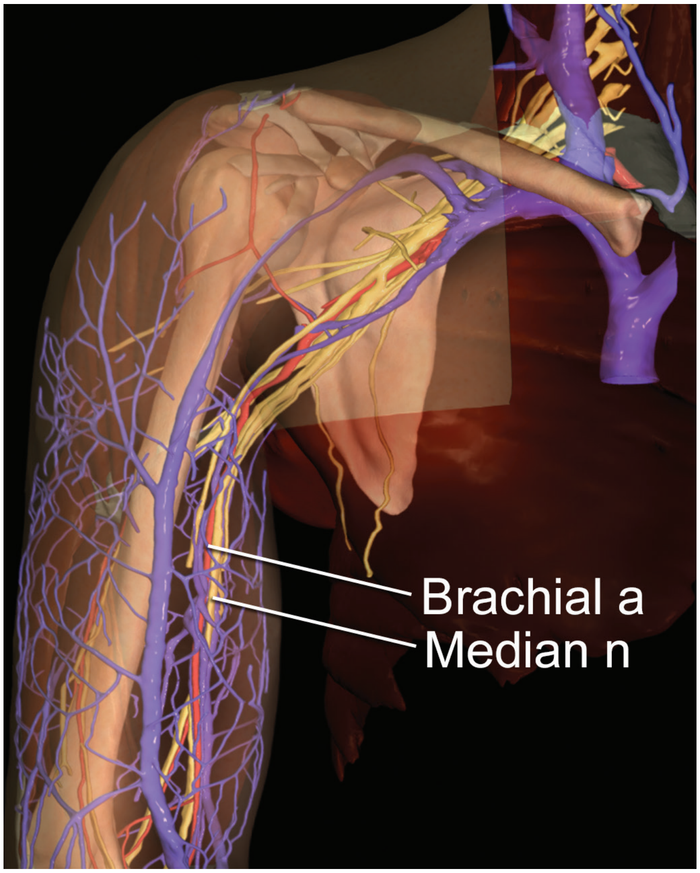
While these myofascial continua usually do not define the channel trajectories precisely or *in toto,* they lend insight into why individuals report sensations of pulling, traveling, and tissue release during needle stimulation. Their innervation reinforces the neuroanatomic basis of the channel. For the PC channel, its closest soft tissue continuum connects the pectoralis major, biceps brachii, bicipital aponeurosis/lacertus fibrosus, and palmaris longus muscles.

For example, contracting pectoralis major fibers (affected by PC 1), particularly from the clavicular portion (KI 27, the end of the KI channel that connects to the beginning of the PC channel at PC 1), stretch the brachial fascia through its expansions onto the cranial aspect of the brachium (PC 2). Elbow flexion by means of biceps brachii contraction tenses the bicipital aponeurosis (PC 3), thereby stretching antebrachial fascia (PC 4, 5). With wrist flexion, the palmaris longus (when present, adjacent to PC 6) tenses the flexor retinaculum (PC 7), palmar aponeurosis (PC 8), and thenar fascia (extending to PC 9).

These lines of force generate a conduit that "pulls together" myofascial components of the PC channel, providing feedback to the nervous system through mechanoreceptors immersed in fibrous stroma concerning movement patterns, directions of force, and amount of tension in the system. This extensive network of information housed within the soft tissues prevents over-maximal stretch

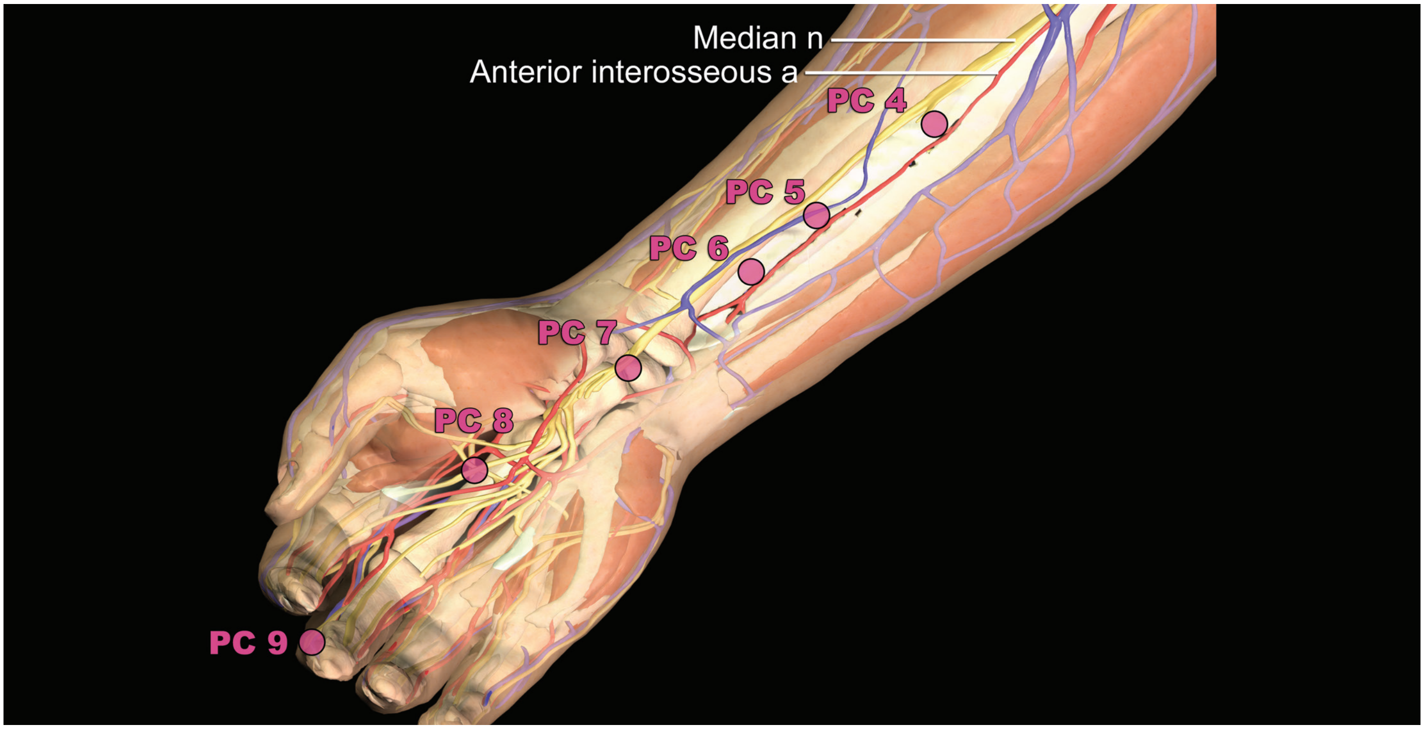


The PC channel parallels the HT channel in terms of trajectory, numbering, and certain clinical applications related to the heart, spirit, and psyche.[1] Anatomically, the heart and its enveloping pericardium exhibit intimately connections as well.



The neurovascular basis of the HT and PC channels closely relate, in keeping with the similarity of their trajectories and numbering. As shown by this image, the brachial artery (vascular basis of the HT channel) and median nerve (representing the PC pathway) course to the elbow side by side. Furthermore, while the median nerve provides no voluntary motor or cutaneous function to the brachium, it does supply sympathetic branches to the brachial artery as nervi vasorum.

The musculocutaneous nerve, truncated in this depiction, also associates with the PC channel in the brachium, in that it supplies the biceps brachii muscle; PC 2 nestles between its short and long heads. The musculocutaneous and median nerves sometimes form plexuses in the brachium. Their communicating branches can reach down to the elbow.[2,3]



Distal to the elbow, PC sticks with the median nerve and its vascular partner, the anterior interosseous artery. Research on PC points of the antebrachium verifies their physiologic effects as arising from neuromodulation of the median nerve.[5,6,7]

or contraction that could injure the individual. In contrast, in cases of abnormal fascial feedback, central and peripheral nervous system sensitization, or decreased myofascial elasticity, self-monitoring may falter, manifesting as injury or pain as tissues become overstretched or overstrained. In addition, patients with pre-existing spinal cord "wind-up" tend to emit excessive volleys of motor neuron stimulation to the muscles, keeping them in sustained states of tension. Furthermore, tension held within the myofascia due to unhealthful loss of elasticity or the inability to psychologically or physically relax can activate fascial receptors. Incessant stimulation of afferents causes connective tissue sensors to remain in a heightened state of activity even when the individual is still or asleep. Over time, allodynia ensues and mechanoreceptors acquire nociceptive function. By then, even normal physiologic stretch on a soft tissue plane or system may induce discomfort and initiate or aggravate myofascial pain syndromes.

References

1. Rong P and Zhu B. Mechanism of relation among heart meridian, referred cardiac pain and heart. *Sci China C Life Sci*. 2002;45(5):538-545.
2. Maeda S, Kawai K, Koizumi M, et al. Morphological study of the communication between the musculocutaneous and median nerves. *Anat Sci Int*. 2009;84:34-40.
3. Maeda S, Kawai K, Koizumi M, et al. Morphological study, by teasing examination, of the communication from the musculocutaneous to median nerves. *Anat Sci Int*. 2009;84:41-46.
4. Stecco A, Macchi V, Stecco C, et al. Anatomical study of myofascial continuity in the anterior region of the upper limb. Journal of Bodywork and Movement Therapies. 2009;13:53-62.
5. Tsou M-T, Huang C-H, and Chiu J-H. Electroacupuncture on PC 6 (Neiguan) attenuates ischemia/reperfusion injury in rat hearts. Am J Chin Med. 2004;32(6):951-965
6. Tjen-A-Looi SC, Li P, and Longhurst JC. Midbrain vlPAG inhibits rVLM cardiovascular sympathoexcitatory responses during electroacupuncture. Am J Physiol Heart Circ Physiol. 2006;290(6):H2543-2553
7. Li P, Tjen-A-Looi SC, Guo ZL, et al. Long-loop pathways in cardiovascular electroacupuncture responses. J Appl Physiol. 2009;106(2):620-630.

PC 1

Tian Chi "Celestial Pool" or "Heavenly Pool"

On the chest, in the 4th intercostal space, approximately 1 cun lateral to the nipple.

(Alternate location: the most sensitive site palpated immediately medial to the anterior axillary crease.)

Caution: Deep needling at PC 1 may cause pneumothorax.

Muscles

- **Pectoralis major muscle:** A powerful adductor of the arm. Rotates the humerus in a medial direction.
- **Pectoralis minor muscle**: Stabilizes the scapula by holding it anteriorly against the thoracic wall and by drawing it inferiorly.

Clinical Relevance: Pectoralis minor trigger points in the vicinity of PC 1 radiate diffusely over the pectoralis major region, the deltoid, and the PC and HT trajectories. Trigger point pathology in the sternal section of the pectoralis major muscle near PC 1 send pain to the pectoral region, PC and HT lines to the elbow, and the proximoulnar elbow region. Trigger point pathology along the lateral margin of the pectoralis can refer pain strongly to the central breast and nipple, extending from PC 1 to PC 2.

Nerves

- **4th intercostal nerve:** Supplies the skin and muscles in this region.
- **Medial pectoral nerve (C7, C8, T1):** Supplies both the pectoralis minor and major muscles.
- **Lateral pectoral nerve (C5-C7):** Supplies the pectoralis major muscle.

Clinical Relevance: The pectoral nerves exhibit wide variability in their course, origin communications with other nerves, and presence or absence of sensory fibers.[1] They are susceptible to injury from direct trauma, compression from hypertrophied musculature, and iatrogenic injury during mastectomy and breast augmentation. Chronic pain affects up to half of patients undergoing augmentation mammoplasty. The pain centers on the breasts or refers to other regions, including the sternum, infraclavicular tissue, lateral chest wall to the axilla, or interscapular territory on the back.[2] Sternal pain likely results from traction on the lateral pectoral nerve during surgery, given that the nerve supplies both the clavicular and sternal portions of the pectoralis major muscle. Before pursuing invasive methods to treat neuralgia affecting the intercostal or pectoral nerves, acupuncture, manual therapy, and laser therapy (for nonmalignant conditions) should be considered. Caution is warranted, however, with needling near breast implants.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation in the region of PC 1. Mechanisms involve somato-somatic and viscerosomatic reflexes as well as

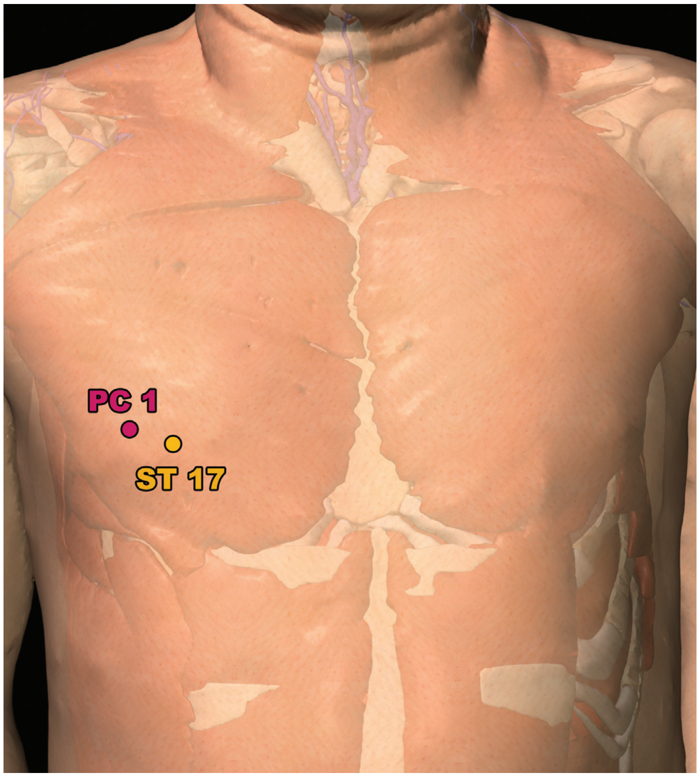


Figure 9-1. PC 1, "Celestial (Heavenly) Pool" couples an allusion to the upper part of the body (the sky) with the concept that milk pours out of the nipple (at ST 17) from an adjacent pool (PC 1).

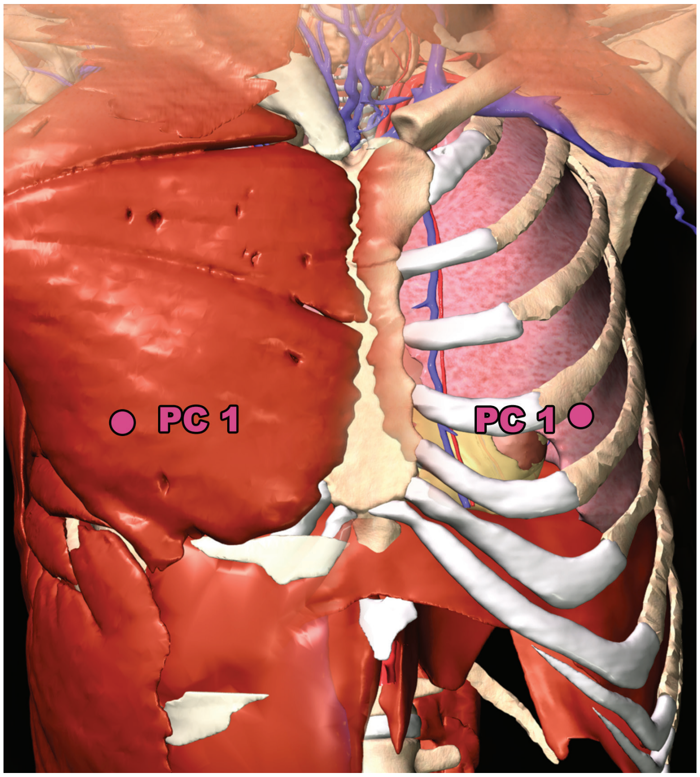


Figure 9-2. One needs to remain mindful of the underlying breast and lungs when needling PC 1, as illustrated here. Ideally, one should avoid needling through the female breast to reach the pectoralis muscle. In cases of pectoralis trigger points requiring treatment, judiciously applied manual therapy, gentle heat, or other measures are safer and usually better received.

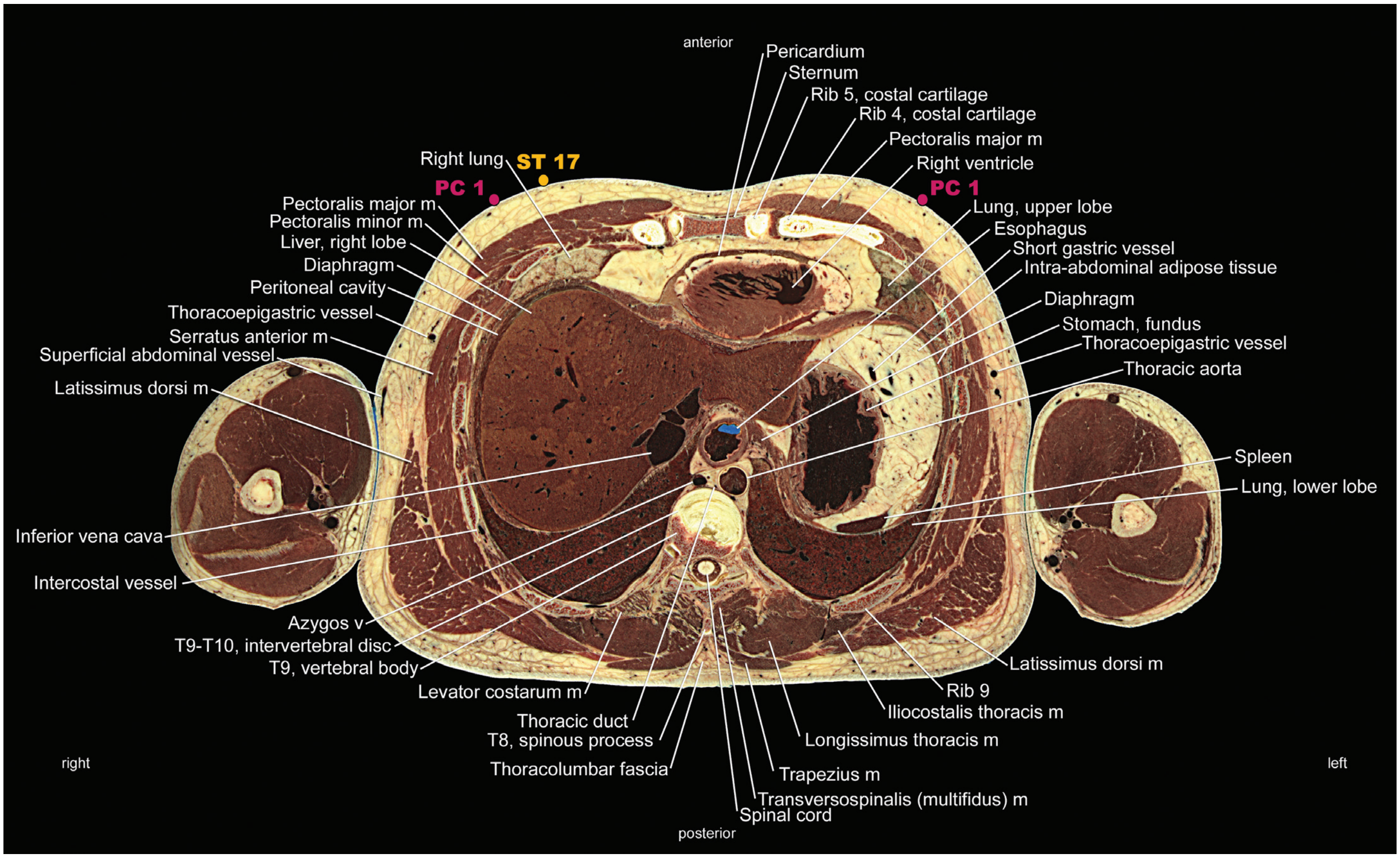

anterior
Pericardium
Sternum
Rib 5, costal cartilage
Rib 4, costal cartilage
Pectoralis major m
Right ventricle
Right lung
ST 17
PC 1
PC 1
Pectoralis major m
Pectoralis minor m
Liver, right lobe
Diaphragm
Peritoneal cavity
Thoracoepigastric vessel
Serratus anterior m
Superficial abdominal vessel
Latissimus dorsi m
Lung, upper lobe
Esophagus
Short gastric vessel
Intra-abdominal adipose tissue
Diaphragm
Stomach, fundus
Thoracoepigastric vessel
Thoracic aorta
Spleen
Lung, lower lobe
Inferior vena cava
Intercostal vessel
Azygos v
T9-T10, intervertebral disc
T9, vertebral body
Levator costarum m
Thoracic duct
T8, spinous process
Thoracolumbar fascia
Latissimus dorsi m
Rib 9
Iliocostalis thoracis m
Longissimus thoracis m
Trapezius m
Transversospinalis (multifidus) m
Spinal cord
right
left
posterior

Figure 9-3. Between the breast and the lung, potentially troublesome trigger points in the pectoralis major (and minor) could cause confusing chest and axillary pain. Palpating carefully to determine the presence of trigger points and the source(s) of referred pain can lend insight into a myofascial provocation of otherwise potentially alarming chest pain.

irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Lateral thoracic (formerly, external mammary) artery and vein:** Supply and drain, respectively, the lateral thorax and breast. Also extend branches to the serratus anterior and pectoralis major muscle, serratus anterior muscles, the subscapularis muscle, and the axillary lymph nodes. These vessels anastomose with the internal thoracic, subscapular, and intercostal vessels as well as the pectoral branch of the thoracoacromial artery.

Clinical Relevance: The lateral thoracic artery and vein provide an external mammary branch that rounds the edge of the pectoralis major muscle and supplies and drains the breast. Compression of these vessels may compromise oxygenation, nutrition, and elimination of metabolic waste products from the mammary tissue.

Indications and Potential Point Combinations

- **Strong emotional states:** PC 1, CV 17, HT 7, ST 36.
- **Pain in the breast, shoulder, and medial brachial region, potentially radiating to the medial proximal antebrachium from trigger points in the intermediate sternal section of the pectoralis major muscle:** PC 1, local trigger points in the pectoralis major and/or minor muscles, LU 1, HT 3.
- **Intercostal pain in the 4th intercostal space:** PC 1, BL 14, BL 15, CV 17, other local trigger points.
- **Pain and swelling in the axilla related to serratus anterior muscle trigger points:** PC 1, consider GB 22, GB 23, medial scapular border trigger points in the vicinity of BL 16, BL 17, where the serratus anterior attaches and pulls.

References

1. Porzionato A, Macchi V, Stecco C, et al. Surgical anatomy of the pectoral nerves and the pectoral musculature. *Clinical Anatomy.* 2012;25:559-575.
2. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery.* 2011;31:41-44.

PC 2

Tian Quan "Celestial Spring" or "Heavenly Spring"

On the anterior brachium, 2 cun distal to the end of the anterior axillary fold, between the two heads of the biceps brachii muscle.

Muscles

- **Biceps brachii muscle:** The biceps brachii muscle supinates and then flexes the forearm.
- **Brachialis muscle:** Flexes the forearm.
- **Coracobrachialis tendon:** Assists in arm flexion and adduction.

Clinical Relevance: Tension in the proximal brachium may respond to treatment at PC 2; depending on the depth and angle of the needle and muscles affected. See Figure 9-6 for more information. Proximal to the elbow, the coracobrachialis muscle may entrap the musculocutaneous nerve proximal to the elbow.[1] PC 2 is located where the musculocutaneous nerve pierces the coracobrachialis muscle. As such, treating PC 2 may address neuromuscular dysfunction or nerve entrapment.[2]

The V-like depression between the short and long heads of the biceps brachii muscle often exhibits tenderness to palpation.

Schematic mapping of biceps brachii motor points explains the sensitivity felt at the juncture of the short and long heads, indicating where dysfunctional motor endplates (i.e., contributors to trigger point formation) from the musculocutaneous nerve reside.[3]

Nerves

- **Medial brachial cutaneous nerve (C8, T1):** Supplies the skin on the medial brachium (arm).
- **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. Courses with the basilic vein; sends branches to the skin of the medial brachium. Several branches pierce the fascia to supply the skin proximal to the medial epicondyle. Continues as the lateral antebrachial cutaneous nerve.

Clinical Relevance: Excessive tension in the brachial flexors (biceps brachii, brachialis, or coracobrachialis muscles) from strenuous physical activity or contracture may compress the musculocutaneous nerve.

Communication between the median and musculocutaneous nerves is fairly common but unpredictable. These connections occur proximal or distal to the coracobrachialis muscle or sometimes within the structure.[4] Unpredictable neuroanatomy elevates the risk of nerve injury during shoulder surgery or other plastic and reconstructive repair procedures. Entrapment syndromes can arise as a result of scarring and contracture,[5] as has been reported following biceps tenodesis.[6]

Brachioplasty surgery, i.e., provided for patients undergoing bariatric surgery procedures to manage excess skin on the arm from massive weight loss, can injure the medial brachial cutaneous nerve.[7]

Vessels

- **Cephalic vein:** Ascends from the radial portion of the dorsal venous network. Courses along the radial aspect of the wrist and anterolateral forearm and arm. Communicates with the median

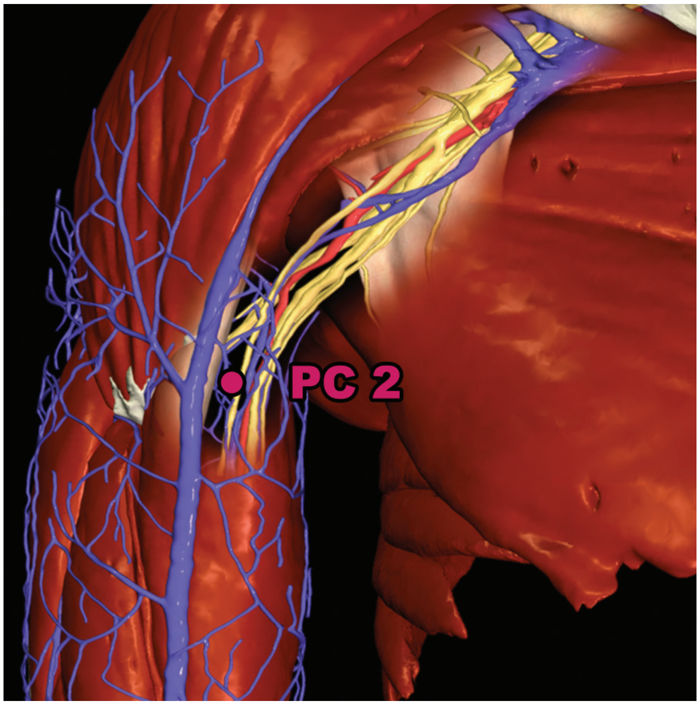


Figure 9-4. PC 2 sits between the short and long head of the biceps brachii muscle, and as seen here, atop a bundle of prominent neurovascular structures. Communications between the musculocutaneous and median nerves at times take place here.

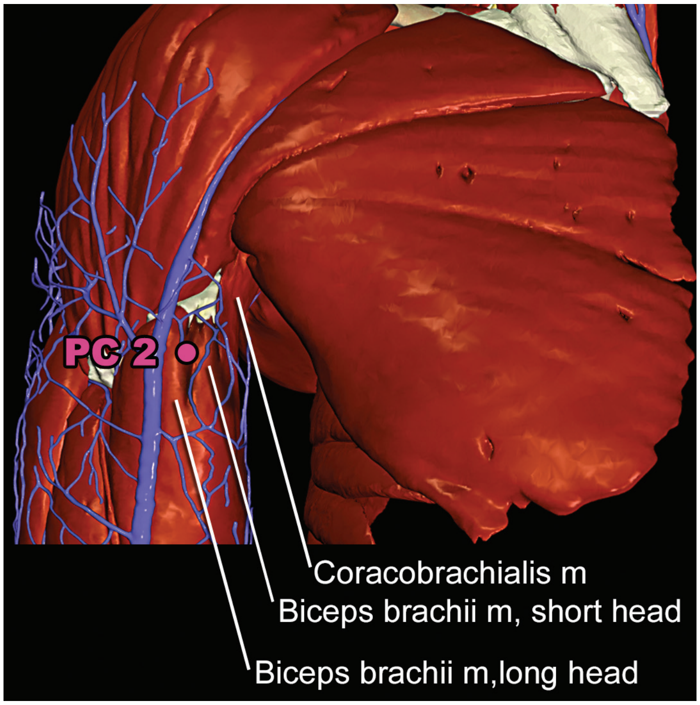


Figure 9-5. The descriptive term for PC 2, "Celestial Spring", connotes a continuation of flow from PC 1, "Celestial Pool".

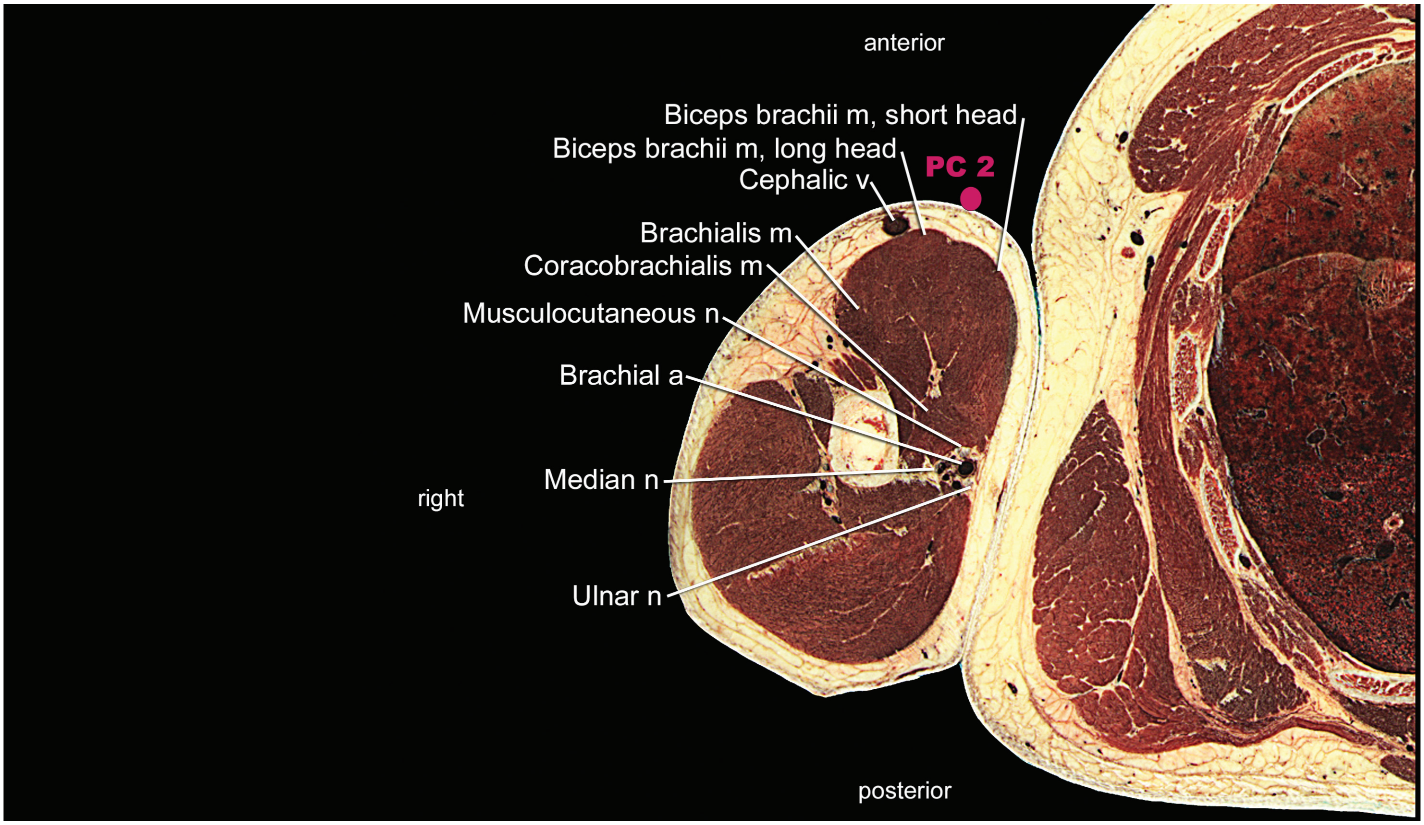


Figure 9-6. This cross-section reveals the abundant muscle tissue available at PC 2 for trigger point deactivation. Note the depth and direction required for a needle to reach myofascial dysfunction in the short or long head of the biceps brachii or coracobrachialis.

cubital vein (which lies anterior to the brachial artery) in the anterior elbow, then passes across the anterior elbow to join with the basilic vein. Ultimately empties into the axillary vein.

Brachial artery: A continuation of the axillary artery, the brachial artery provides the main arterial supply to the arm. The brachial artery gives rise to the radial and ulnar arteries. Other main branches include the deep artery of the arm (profunda brachii artery) and the superior and inferior ulnar collateral arteries, which help form the elbow arterial anastomoses. The median nerve accompanies the brachial artery as it courses along the brachium.

- **Brachial veins:** The brachial veins accompany the brachial artery and frequently encompass it, forming a common vascular sheath by means of their anastomotic interconnections. Blood draining from the brachial vein is further pushed along its pathway by the brachial artery's pulsations. The brachial veins form from the veins which travel with the radial and ulnar arteries. They drain into the axillary vein after joining with the basilic vein.

Clinical Relevance: The arterial patterns of the thoracic limb vary widely. Lack of awareness of possible variations can complicate surgery with ischemia or hematoma. Unusual vascular patterns of the hand could pose problems following injection where local necrosis and ischemia could occur.[8]

Indications and Potential Point Combinations

- **Chest pain:** First, ensure that proper medical measures to rule out a cardiac source have taken place. For chest pain of referred musculoskeletal origin from the subclavius muscle, consider PC 2, in addition to the subclavius trigger point at KI 27, in addition to distal points along the LU line to the fingertips. Triggers from the clavicular section of the pectoralis major muscle, at LU 1 and LU 2, may refer pain to the deltoid region ant PC 2.
- **Cough:** PC 2 if the cough generates pull on the biceps brachii muscle in this region. Consider adding CV 22, LU 1, LI 11, GV 14, BL 23.
- **Arm pain related to the biceps brachii[9] and brachialis muscles:** PC 2, PC 3, LU 3, LU 4, local trigger points.
- **Shoulder restriction:** PC 2, LU 15, TH 14, trigger points as required.

References

1. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther.* 2005;18:216-229.
2. Guerri-Guttenberg RA and Ingolotti M. Classifying musculocutaneous nerve variations. *Clinical Anatomy.* 2009;22:671-683.
3. Lee J-H, Kim H-W, Im S, et al. Localization of motor entry points and terminal intramuscular nerve endings of the musculocutaneous nerve to biceps and brachialis muscles. *Surg Radiol Anat.* 2010;32(3):213-20.
4. Loukas M and Aqueelah H. Musculocutaneous and median nerve connections within, proximal and distal to the coracobrachialis muscle. *Folia Morphol.* 2005;64(2):101-108.
5. Venieratos D and Anagnostopoulou S. Classification of communications between the musculocutaneous and median nerves. *Clinical Anatomy.* 1998;11:327-331.
6. Ma H, Van Heest A, Glisson C, et al. Musculocutaneous nerve entrapment: an unusual complication after biceps tenodesis. *Am J Sports Med.* 2009;37(12):2467-2469.
7. Chowdhry S, Elston JB, Lefkowitz T, et al. Avoiding the medial brachial cutaneous nerve in brachioplasty: an anatomical study. *ePlasty.* Accessed at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2817572/pdf/eplasty10e16.pdf on 010213.
8. Klimek-Piotrowska W, Pacholczak R, and Walocha J. Multiple variations of the arterial pattern in upper extremities: a case report and embryological pathogenesis. *Clin Anat.* 2013;26(8):1031-1035.
9. Fragoso APS and Ferreira AS. Immediate effects of acupuncture on biceps brachii muscle function in healthy and post-stroke subjects. *Chinese Medicine.* 2012;7:7.

PC 3

Qu Ze "Marsh at the Crook"

On the cubital crease, on the ulnar side of the biceps brachii tendon, just medial to the pulsation of the brachial artery. Locate with the elbow slightly flexed.

Fascia

- **Bicipital aponeurosis or lacertus fibrosus:** This triangular, membranous band forms a distal continuation of the biceps brachii muscle. It courses from the biceps tendon, across the cubital fossa, to blend with the deep antebrachial fascia, blanketing the flexor muscles of the forearm. The proximal end of the lacertus fibrosus, closer to the biceps tendon, is palpable as it courses obliquely over the brachial artery and median nerve. The lacertus protects this neurovascular couple from trauma; it also dissipates load away from the biceps tendon entheses, reducing pull on the radial biceps tendon.[1]

Clinical Relevance: Excessive tension in the lacertus fibrosus could compress the median nerve and brachial artery.[2] Acute, partial rupture of the myotendinous junction of the biceps brachii can also increase compression of the median nerve by a tethered lacertus fibrosus.[3] Repair of the lacertus after rupture may compress the median nerve if the width or length of the lacertus becomes too short.[4]

Acupuncture at PC 3, along with laser therapy and soft tissue manual treatment for a restrictive lacertus fibrosus in order to lessen pressure on the median nerve and brachial vessels.

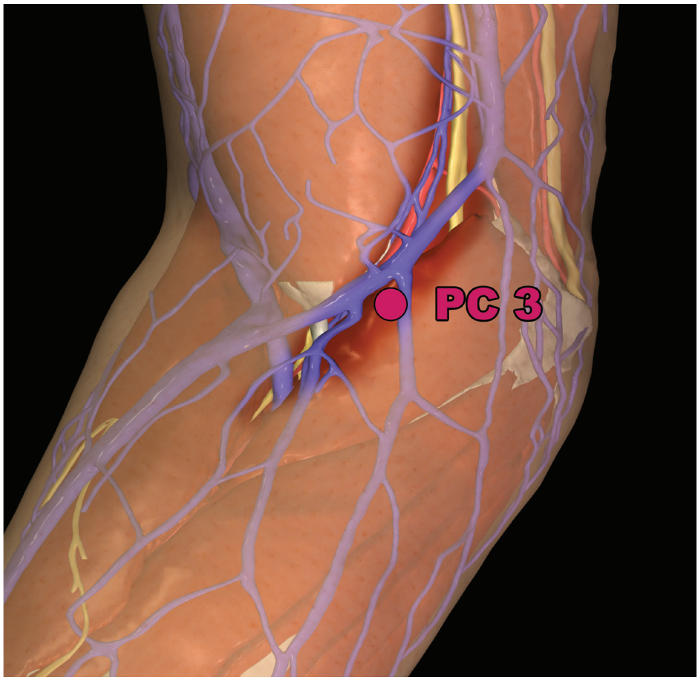


Figure 9-7. The wide, shallow, "Marsh at the Bend" known as PC 3, shows itself best with the elbow partially flexed. The metaphor of a "marsh" connotes a boggy, soft, fluid-filled feel to PC 3 when palpating the region. By creating a window in the muscle layer at the medial elbow shown here, one can examine the neurovascular structures responsible for generating tenderness and fullness. They include the brachial artery, accompanying veins, basilic vein, and the myofascial cleavage plane medial to the distal tendon of the biceps brachii muscle.

Muscles

- **Biceps brachii muscle:** The biceps brachii muscle supinates and then flexes the forearm. Both heads (the short and long) coalesce into a single distal tendon that inserts on the ulnar aspect of the bicipital tuberosity of the radius.[10]
- **Brachialis muscle:** Flexes the forearm.

Clinical Relevance: Tendon degeneration and compromised circulation may precipitate rupture or avulsion of the distal biceps tendon.[11] Surgical repair may be supported by acupuncture and related techniques, improving circulation and tissue recovery. An incompletely ruptured distal tendon of the biceps at its insertion can compress the median nerve by the lacertus fibrosus. Patients with partial tendon rupture also typically exhibit the formation of a cyst or hematoma, along with proximal biceps muscle bulge and elongation of the distal tendon. Partial rupture of the distal biceps brachii tendon has been reported to compress the median nerve and anterior interosseous vessels, secondary to development of a large synovial bursa.[12]

Treatment of myofascial dysfunction of the elbow should be treated first with acupuncture and related techniques, as trigger point injection introduces risk of myositis ossificans as well as other problems related to inserting medications deep into the elbow, potentially inciting tissue reactions.[13] In addition, the beveled tip of a hypodermic needle can lacerate one or more of the many vessels anastomosing here, leading to hemorrhage, vascular stasis, tissue hypoxia, and release of calcium from muscle, i.e., factors that induce myositis ossificans.

Nerves

- **Medial brachial cutaneous nerve (C8, T1):** Supplies the skin on the medial brachium (arm).
- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Musculocutaneous nerve (C5-C7):** Supplies the coracobrachialis, biceps brachii, and brachialis muscles. Courses with the basilic vein; sends branches to the skin of the medial brachium. Several branches pierce the fascia to supply the skin proximal to the medial epicondyle. It continues as the lateral antebrachial cutaneous nerve.
- **Median nerve (C6-T1):** Accompanies the brachial artery along the arm but supplies no branches except for some small twigs to the brachial artery. The median nerve does supply articular branches to the elbow as it courses past the joint. Muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except the flexor carpi ulnaris and medial half of the flexor digitorum profundus muscle.

Clinical Relevance: Brachioplasty surgery, i.e., provided for patients undergoing bariatric surgery procedures to manage excess skin on the arm from massive weight loss, can injure the medial brachial cutaneous nerve.[14]

Women with macromastia may exhibit neurologic deficits in function of the medial antebrachial cutaneous nerve and median nerve due to chronic bilateral T1 denervation.[15] Somatic dysfunction of the spine can complicate the identification of

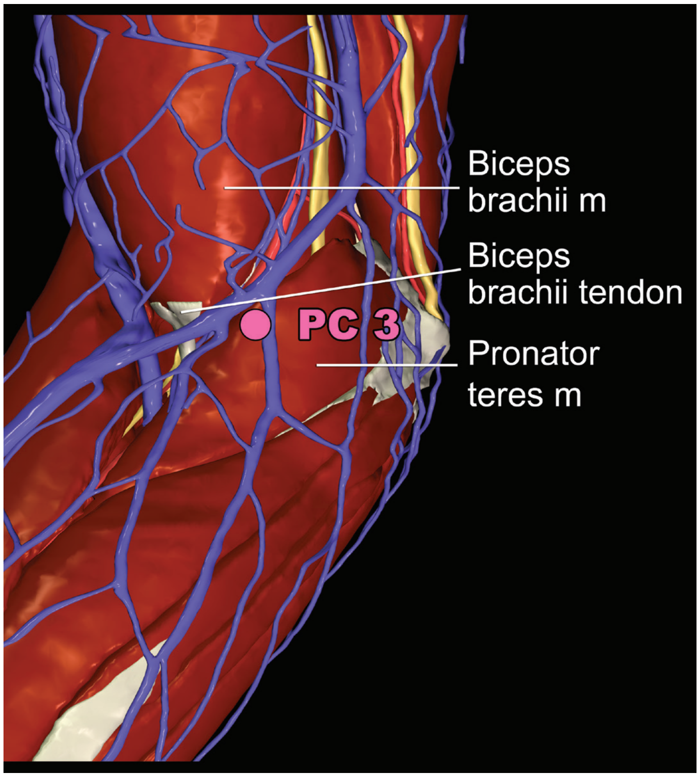


Figure 9-8. This medial view of the right elbow illustrates how PC 3 relates to the biceps brachii tendon, the pronator teres muscle and the lacertus fibrosus, not shown here. The lacertus fibrosus crisscrosses the pronator teres and lies superficial to it.

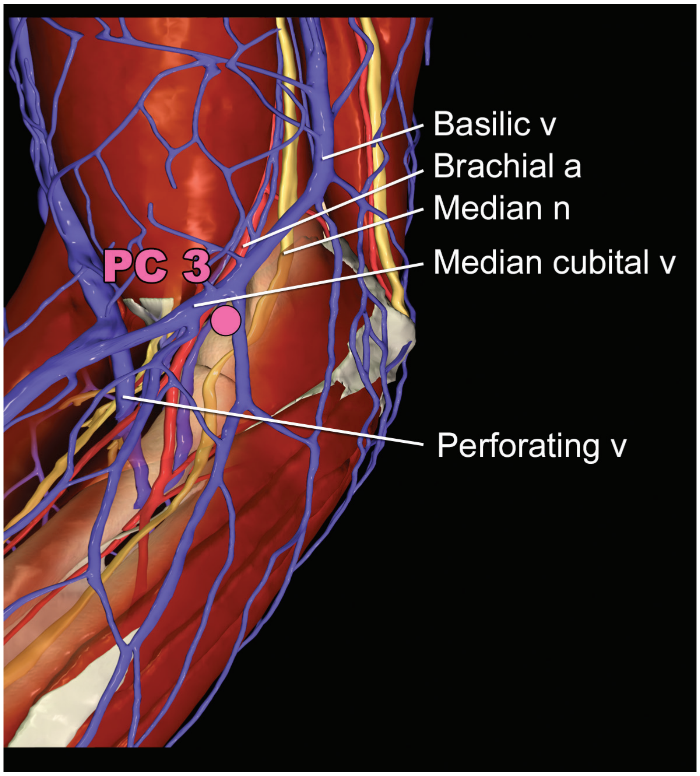


Figure 9-9. This depiction reveals the busy neurovascular traffic coursing along the PC channel and inhabiting PC 3.

neuropathic pain and dysesthesia; upper thoracic radiculopathy can produce thoracic limb pain.[16]

Musculocutaneous nerve compression may arise from an injury following hyperextension and pronation; it typically produces pain and paresthesias that radiate along the radial aspect of the antebrachium.[17]

Communication between the median and musculocutaneous nerves is fairly common but unpredictable. These connections occur proximal or distal to the coracobrachialis muscle or sometimes within the structure.[18] Unpredictable neuroanatomy elevates the risk of nerve injury during shoulder surgery or other plastic and reconstructive repair procedures. Entrapment syndromes can arise as a result of scarring and contracture,[19] as has been reported following biceps tenodesis.[20]

Regardless of the nerve undergoing compression or entrapment, conservative treatment with physical medicine measures should reduce or eliminate symptoms of decreased sensation and motor weakness, ideally implemented well in advance of the need for surgery.

The median nerve may face compression by several structures along its route in addition to those at the carpal tunnel. Potential sources of compression include the lacertus fibrosus, ligament of Struthers, the two heads of the pronator teres between which it may course, anomalous muscles such as the accessory head of the flexor pollicis longus muscle (known as Gantzer's muscle), and the sublime bridge.[5]

Sources of nerve compression also obstruct blood vessels that supply and drain the nerves. This reduces venous return and thereby invites edema, capillary vasodilation, and segmental anoxia.[21] The presence of edema furthers the compression, causing abnormalities in axonal and cellular communication.

In addition to nerve compression, myofascial dysfunction or fibrous restriction may tether a nerve, thereby limiting its mobility. Joint motion places traction on the nerves, sometimes producing a block in nerve conduction. Median nerve compression syndromes often involve traction as a pathophysiologic component.

By the time the median nerve reaches PC 3, it may have undergone compression by the ligament of Struthers, a ligament that extends from the supracondylar ridge of the humerus to the medial epicondyle, forming a bridge or arcade over the median nerve. Just distal to PC 3 on the proximal antebrachium, the median nerve may suffer compression by the superficial and deep heads of the pronator teres muscle. At this same section of the forearm, the anterior interosseous nerve branches from the median to travel along the interosseous groove between the radius and ulna. It, too, can experience compression or tethering from the pronator teres and fibrous arcade of the flexor digitorum superficialis muscles.

By reaching from the interosseous region of the mid-forearm to the medial epicondyle of the humerus, the enigmatic "Gantzer's muscle", or accessory head of the flexor pollicis longus muscle can compress both structures, i.e., the anterior interosseous and median nerves. This happens between PC 3 and PC 4. From PC 4 to PC 5, an aberrant flexor carpi radialis brevis or palmaris profundus muscle may harm the anterior interosseous nerve.

Right at PC 3, the lacertus fibrosus can place abnormal pressure on both the brachial artery and median nerve within or distal to the cubital fossa as the lacertus courses mediad to insert on the

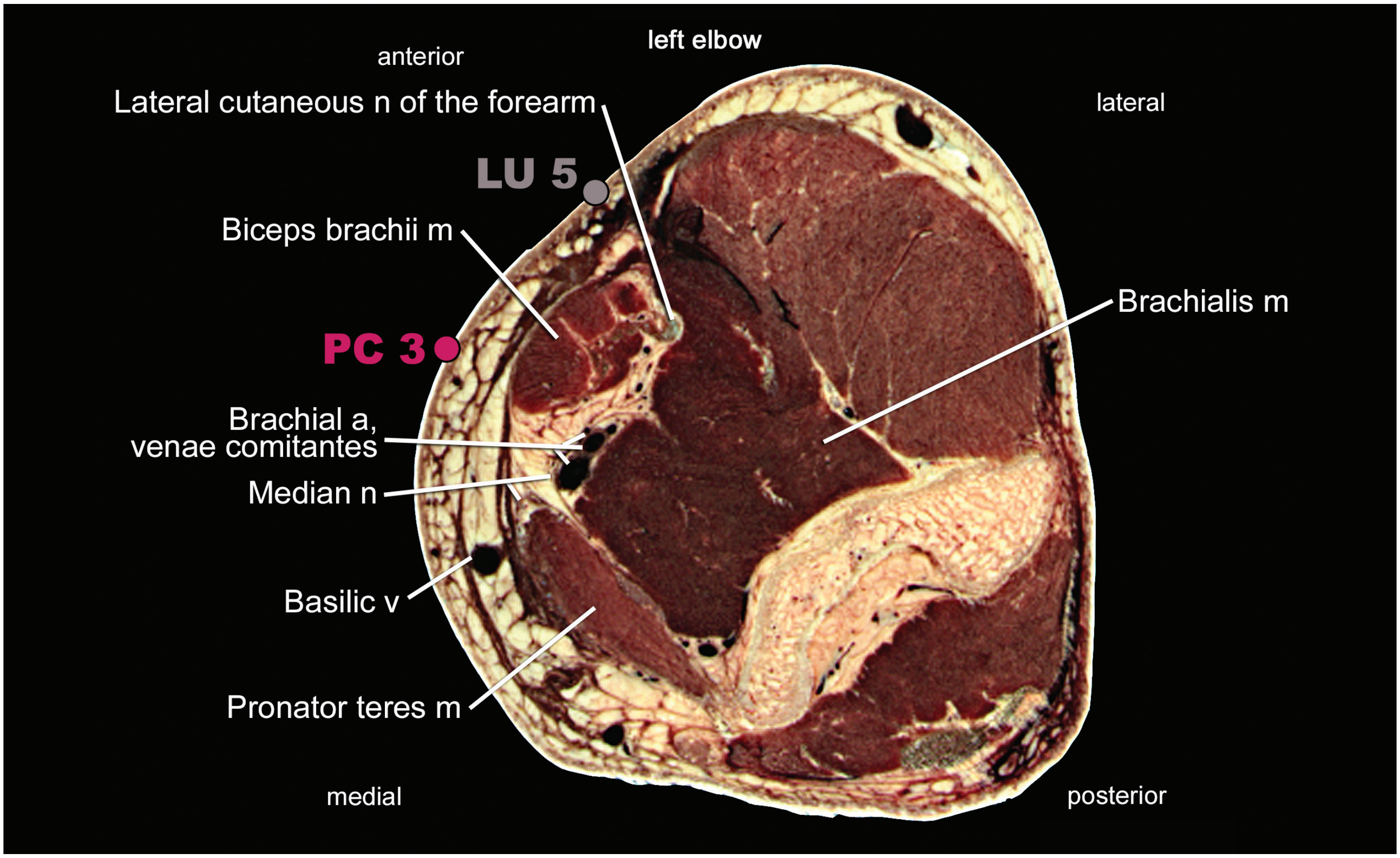


Figure 9-10. This cross-section at the level of PC 3 reveals the many myofascial and neurovascular structures one could influence with treatment at this site.

ulna. Between PC 3 and PC 4, a fibrous arcade associated with the middle finger's portion of the flexor digitorum superficialis overlies the nerve, potentially producing problems.

Vessels

- **Brachial artery:** A continuation of the axillary artery, the brachial artery supplies the main arterial supply to the arm. The brachial artery gives rise to the radial and ulnar arteries. Other main branches include the deep artery of the arm (profunda brachii artery) and the superior and inferior ulnar collateral arteries, which help form the elbow arterial anastomoses. The median nerve accompanies the brachial artery as it courses along the brachium.
- **Brachial vein:** The pair of brachial veins accompanies the brachial artery and frequently encompasses the artery, forming a common vascular sheath by means of their anastomotic interconnections.

Blood draining from the brachial vein is further pushed along its pathway by the brachial artery's pulsations. The brachial veins form as a result of the union of veins which travel with the radial and ulnar arteries. They drain into the axillary vein after joining with the basilic vein.

- **Basilic vein:** The basilic vein courses along the medial aspect of the arm and ultimately empties into the axillary vein after merging with the brachial veins. The basilic vein arises from the medial aspect of the dorsal venous network of the hand and ascends along the posteromedial forearm. At the elbow, it joins the median cubital vein.

Clinical Relevance: The arterial patterns of the thoracic limb vary widely. Lack of awareness of possible variations can complicate surgery with ischemia or hematoma. Unusual vascular patterns of the hand could pose problems following injection where local necrosis and ischemia could occur.[22]

Brachial artery entrapment by the lacertus fibrosus in the cubital fossa may impair arterial perfusion of the biceps tendon, increasing the risk of degeneration and rupture. Arterial entrapment syndrome (by the lacertus fibrosus) can result from arterial anomalies, thoracic limb hypertrophy, and lacertus fibrosus restriction.[23] Symptoms of brachial artery compression include cold intolerance as well as loss of both radial and ulnar pulses with pronation of the wrist and hand.

Indications and Potential Point Combinations

- **Chest pain:** PC 3, PC 6, CV 17.
- **Tremors in the arms and hands:** PC 3, HT 7, LI 4.
- **Elbow and hand pain:** Check for median nerve compression at the elbow from the lacertus fibrosus, an accessory lacertus fibrosus, a supracondylar process with the ligament of Struthers, pronator teres compression, chronic compartment syndrome, or partial rupture of the distal biceps insertion with the development of a hematoma or compressive bursa.[6]
- **Median neuropathy due to pronator teres syndrome:**[7] PC 3, PC 4. HT 3, local pronator teres muscle trigger points.
- **Medial epicondylitis:** PC 3, HT 3, local trigger points.

Evidence-Based Applications

- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma patients.**[8]
- Electroacupuncture stimulation of PC 3 at 10 Hz for 15 minutes improved blood circulation at PC 4 by means of increasing nitric oxide (NO) release. Cyclic GMP was found to mediate the signaling functions of nitric oxide to improve **local microcirculation.** This study suggests that one of the mechanisms of action for how acupuncture works locally to improve or modulate blood flow involves increasing local tissue levels of NO.[9,24]

References

1. Benjamin M. Review. The fascia of the lim bs and back – a review. *J Anat.* 2009;214:1-18.
2. Landa J, Bhandari S, Strauss EJ, et al. The effect of repair of the lacertus fibrosus on distal biceps tendon repairs. *Am J Sports Med.* 2009;37:120.
3. Seitz WH Jr, Matsuoka H, McAdoo J, et al. Acute compression of the median nerve at the elbow by the lacertus fibrosus. *J Shoulder Elbow Surg.* 2007;16(1):91-94.
4. Landa J, Bhandari S, Strauss EJ, et al. The effect of repair of the lacertus fibrosus on distal biceps tendon repairs. *Am J Sports Med.* 2009;37:120-123.
5. Tubbs RS, Marshall T, Loukas M, et al. The sublime bridge: anatomy and implications in median nerve entrapment. *J Neurosurg.* November 6, 2009. DOI: 10.3171/2009.10.JNS091251.
6. Seitz WH Jr, Matsuoka H, McAdoo J, et al. Acute compression of the median nerve at the elbow by the lacertus fibrosus. *J Shoulder Elbow Surg.* 2007;16(1):91-94.
7. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect.* 2008;57:177-185.
8. 8. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate bronchodilating response in asthma patients. *J Chin Med Assoc.* 2005;68(12):591-594.
9. Jou NT and Ma SX. Responses of nitric oxide-cGMP release in acupuncture point to electroacupuncture in human skin in vivo using dermal microdialysis. *Microcirculation.* 2009;16(5):434-443.
10. Athwal GS, Steinmann SP, and Rispoli DM. The distal biceps tendon: footprint and relevant clinical anatomy. *J Hand Surg.* 2007;32A:1225-1229.
11. Athwal GS, Steinmann SP, and Rispoli DM. The distal biceps tendon: footprint and relevant clinical anatomy. *J Hand Surg.* 2007;32A:1225-1229.
12. Foxworthy M and Kinninmonth AWG. Median nerve compression in the proximal forearm as a complication of partial rupture of the distal biceps brachii tendon. *Journal of Hand Surgery (British Volume).* 1992;17B:515-517.
13. Shin S-J and Kang SS. Myositis ossificans of the elbow after a trigger point injection. *Clinics in Orthopedic Surgery.* 2011;3:81-85.
14. Chowdhry S, Elston JB, Lefkowitz T, et al. Avoiding the medial brachial cutaneous nerve in brachioplasty: an anatomical study. *ePlasty.* Accessed at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2817572/pdf/eplasty10e16.pdf on 010213.
15. Ansell JR and Buchholz MC. Chronic bilateral T1 denervation in women with macromastia. *Muscle Nerve.* 2013;47(2):183-187.
16. Sebastian D. T2 radiculopathy: a differential screen for upper extremity radicular pain. *Physiotherapy Theory and Practice.* 2013;29(1):75-85.
17. Seitz WH, Matsuoka H, McAdoo J, et al. Actue compression of the median nerve at the elbow by the lacertus fibrosus. *J Shoulder Elbow Surg.* 2007;16:91-94.
18. Loukas M and Aqueelah H. Musculocutaneous and median nerve connections within, proximal and distal to the coracobrachialis muscle. *Folia Morphol.* 2005;64(2):101-108.
19. Venieratos D and Anagnostopoulou S. Classification of communications between the musculocutaneous and median nerves. *Clinical Anatomy.* 1998;11:327-331.
20. Ma H, Van Heest A, Glisson C, et al. Musculocutaneous nerve entrapment: an unusual complication after biceps tenodesis. *Am J Sports Med.* 2009;37(12):2467-2469.
21. Koo JT and Szabo RM. Compression neuropathies of the median nerve. *Journal of the American Society for Surgery of the Hand.* 2004;4(3):156-175.
22. Klimek-Piotrowska W, Pacholczak R, and Walocha J. Multiple variations of the arterial pattern in upper extremities: a case report and embryological pathogenesis. *Clin Anat.* 2013;26(8):1031-1035.
23. De Santis F, Martini G, Decaminada N, et al. Arterial entrapment syndrome in the cubital fossa: a rare cause of acute stress-related arterial thrombosis in a patient with brachial artery duplication. *G Chir.* 2012;33(11-12):383-386.
24. Huang T, Wang R-H, Zhang W-B, et al. The influence of different methods of acupuncture on skin surface perfusion. *J Traditional Chinese Medicine.* 2012;32(1):40-44.

PC 4

Xi Men "Xi-Cleft Gate"

On the flexor aspect of the antebrachium, 5 cun proximal to the wrist crease (and PC 7) on a line adjoining PC 3 and PC 7. Along the ulnar side of the flexor carpi radialis tendon, or between the tendons of the flexor carpi radialis and the palmaris longus, when the latter is present.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central band inhabits the region of PC 4 and extends to PC 5. The central portion of the interosseous membrane exhibits the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface.

The interosseous membrane provides longitudinal stability to the forearm.[7] The forearm can be regarded as a joint with the interosseous membrane acting as the ligamentous connection.[8] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[9]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[10] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[11] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles and Tendons

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges of the fingers at the distal interphalangeal joints.
- **Palmaris longus tendon:** Tightens the palmar aponeurosis and flexes the hand at the wrist. Not present in all individuals.
- **Flexor carpi radialis muscle:** Flexes and abducts the hand at the wrist.

Clinical Relevance: Trigger point pathology in the following muscles at or near PC 4 lead to their respective pain referral patterns:

- **Flexor digitorum superficialis and profundus:** Radial head of each muscle group refers pain to the palmar middle finger from PC 8 to PC 9.
- **Palmaris longus:** Pain from a palmaris longus trigger point just proximal to PC 4 sends pain along the PC channel to the palm between PC 8 and HT 8, where it centralizes.
- **Flexor carpi radialis:** Issues pain along the PC channel to the wrist, centered strongly over PC 7 and spilling toward LU 9. At times, extends to the palm near PC 8.

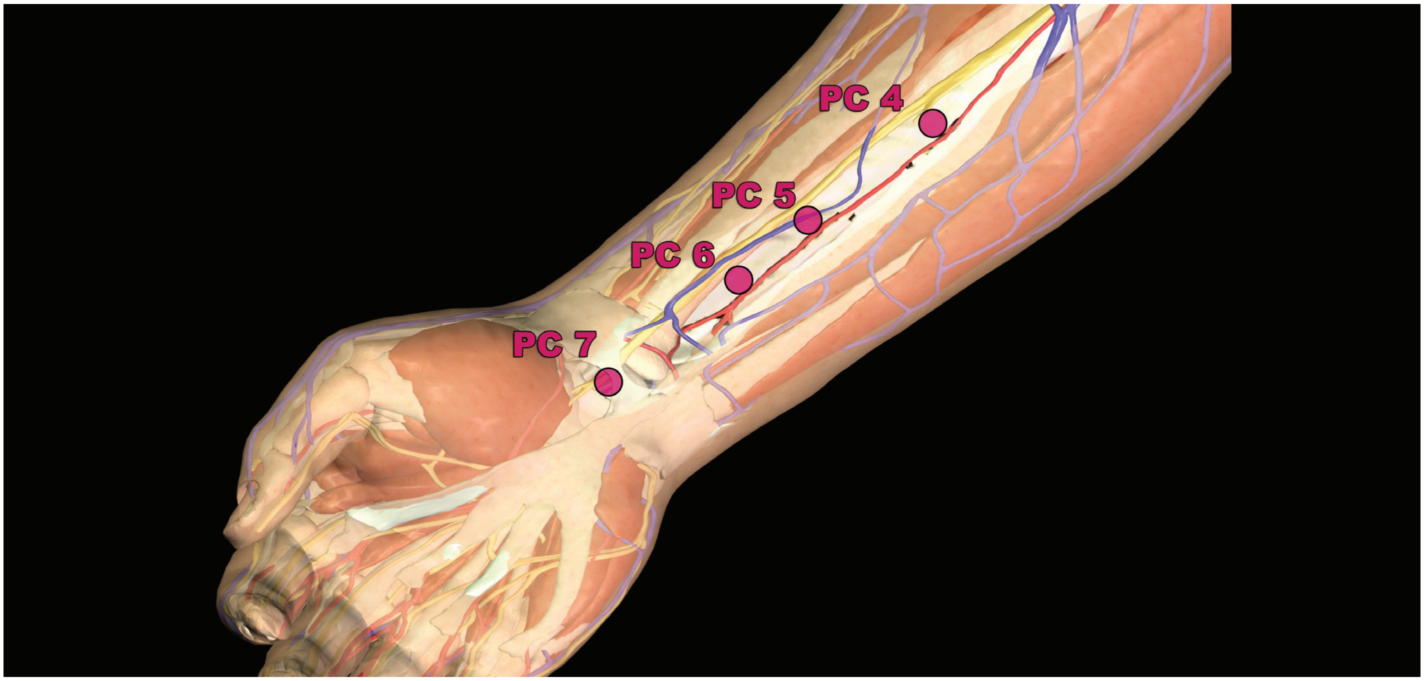


Figure 9-11. PC 4 through PC 7 line up neatly along the median nerve, as indicated here.

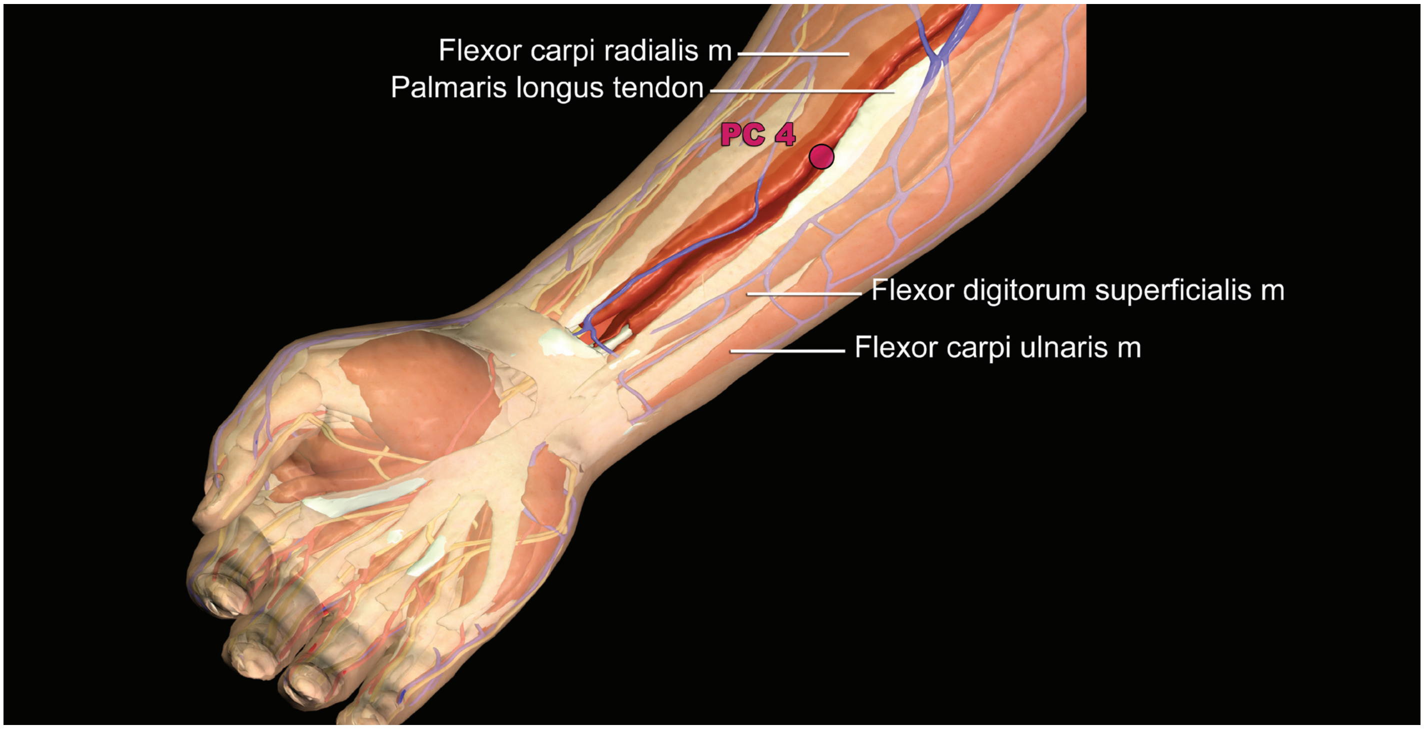

Flexor carpi radialis m
Palmaris longus tendon
PC 4
Flexor digitorum superficialis m
Flexor carpi ulnaris m

Figure 9-12. The descriptive term for PC 4, "Cleft Gate", refers to its role as a xi-cleft point according to Chinese medicine. Xi-cleft points are advocated for acute musculoskeletal trauma or pain along the channel. As shown here, PC 4 reflects the anatomical characteristic shared by other xi-cleft points of occurring at the myotendinous junction. Mechanosensitive receptors at or near the myotendinous junction not only regulate muscle function, but they also provoke reflexes that regulate cardiovascular responses during exercise.[19] Golgi tendon organs (GTO) heavily invest myotendinous locations; stimulation of these mechanoreceptors fosters an autogenic inhibition reflex via Ib afferent fibers acting on interneurons in the spinal cord. These interneurons regulate muscle activity by coordinating impulses from both the spinal cord and cerebellum that govern movement. Thus, acupuncture at xi-cleft points may neuromodulate muscle responses to stretch and contraction.[20]

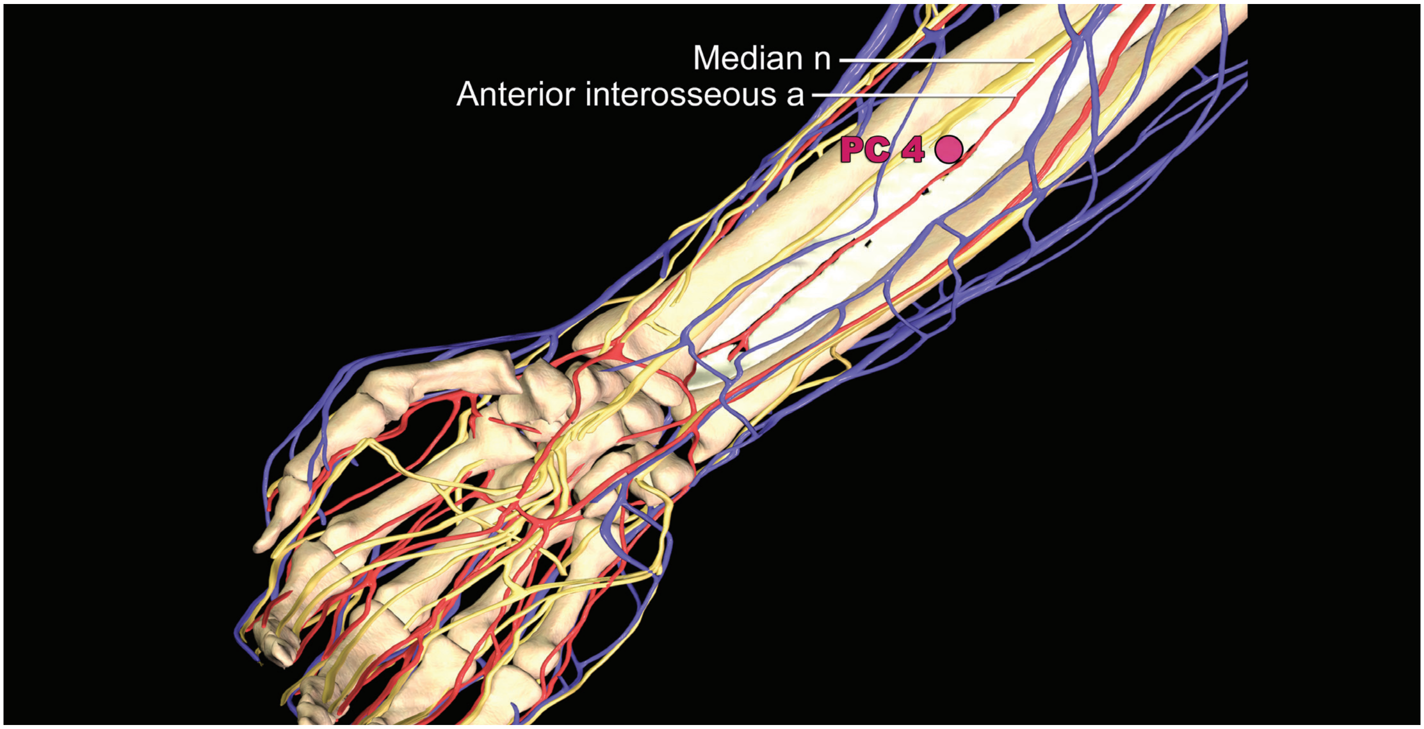

Median n
Anterior interosseous a
PC 4

Figure 9-13. This image depicts the neurovasculature related to PC 4; i.e., the median nerve and and the anterior interosseous artery. The anterior interosseous nerve accompanies its companion vessels along the interosseous groove, although the nerve does not appear in this image.

In addition, a myofascial trigger point in the medial head of the triceps can cause pain to travel from the elbow at PC 3-HT 3 where it localizes strongly. The pain pattern then extends down the PC/HT line to the ring finger and pinky.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm. A branch of the ulnar nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.
- **Median nerve (C6-T1):** The median nerve in the PC 4-PC 6 region is responsible for issuing the mechanosensitive signals to the brain that stimulate cardiopulmonary modulatory reflexes through the rostral ventrolateral medulla. In addition, muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except the flexor carpi ulnaris and medial half of the flexor digitorum profundus muscle. The median nerve then innervates all of the thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Also supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), along with the radial aspect of the ring finger, as well as the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis.

The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

- **Anterior interosseous nerve:** Arises from the median nerve.

Supplies the flexor digitorum profundus to the index and middle fingers, the flexor pollicis longus, and the pronator quadratus muscles. Also supplies the anterior surface of the interosseous membrane. The only motor nerve that innervates the deep muscles of the forearm. A pure motor nerve.

Clinical Relevance: Median nerve anatomy on the forearm varies eight ways.[12] As one example, the median nerve may divide in the proximal or middle third of the forearm and travel as a couple, split by a persistent median artery or muscle. It may then rejoin proximal to the transverse carpal ligament. Compression at any site of the median nerve, from root to destination, can cause abnormalities of sensation and function. “Double-crush” phenomenon refers to two sites of pressure producing problems for the nerve. As such, one should palpate the entire course of the nerve for evidence of entrapment.

Compression of the median nerve can be best understood by considering the course of the nerve as it travels from cubital fossa to wrist. First, the nerve passes between the two heads of the pronator teres muscle. It then courses deep to the fibrous arch formerly known as the “subliimis bridge”, created by the two heads of origin of the flexor digitorum superficialis muscle; these heads arise from the medial humeral epicondyle and the radius.[13]

The most common source of median nerve compression is carpal tunnel syndrome; that said, however, nerve dysfunction may arise from pressure elsewhere along its path. Space-occupying lesions in the carpal tunnel produce pain and paresthesias in the radial side of the palmar aspect of the hand. Problems typically worsen at night or following repetitive and forceful hand motion. Nonsurgical management of carpal tunnel syndrome and other median neuropathies should include acupuncture, massage, and/or laser therapy directed to both the source of compression and nearby sites. Proximal points can include PC 4.

Isolated anterior interosseous nerve compression may occur after repetitivemovement involving flexion of the elbow and/or pronation of theforearm.[1] Injury of the anterior interosseous nerve manifests as weakness in interphalangeal joint flexion or paresis of the distal interphalangeal joints of the index and middle fingers.[14] Compression of the anterior interosseous nerve occurs along the course of the PC channel and follows trauma, iatrogenic injury (dressings, slings, venipuncture), and elbow or shoulder arthroscopy. Anatomic sources of compression include: 1) the tendinous origin of the deep head of either the pronator teres or flexor digitorum superficialis to the middle finger; 2) a site of thrombosis of the ulnar collateral vessels crossing the anterior interosseous nerve; 3) accessory muscles or tendons of the flexor digitorum superficialis or the flexor pollicis longus (i.e., Gantzer’s muscle); 4) an aberrant radial artery; 5) tendinous portions of the palmaris longus or flexor carpi radialis brevis muscles, or 6) an enlarged bicipital bursa in the vicinity of PC 3.

Entrapment sites of the anterior interosseous and median nerves resemble one another because they pursue parallel trajectories. No matter which nerve becomes compressed, physical medicine can improve the symptoms by releasing the dysfunction at the heart of the entrapment.

Median nerve stimulation itself may prove therapeutic for a number of conditions. First and foremost, neuromodulation of the median nerve facilitates its recovery from the problems described above, wherein chronic pressure compromises nerve health. In addition, median nerve stimulation affords an array of homeostatic effects based on its neuromodulation of rostral ventrolateral medulla (RVLM) function. The RVLM affects cardiopulmonary physiology; neuromodulation through physical medicine modalities modulates cardiovascular excitatory responses.[15] Acupuncture points along the median nerve regulate blood pressure and protect against hypotension.

Median nerve stimulation also treats causalgia, otherwise known as complex regional pain syndrome type II (CRPS II).[16] It also reduces neuropathic pain in cases of median nerve damage following carpal tunnel surgery.[17]

Chronic regional pain disorders typically exhibit autonomic features such as vasomotor or sudomotor dysfunction. CRPS type I (reflex sympathetic dystrophy) produces: skin color changes, edema, abnormal sweating (sudomotor activity),

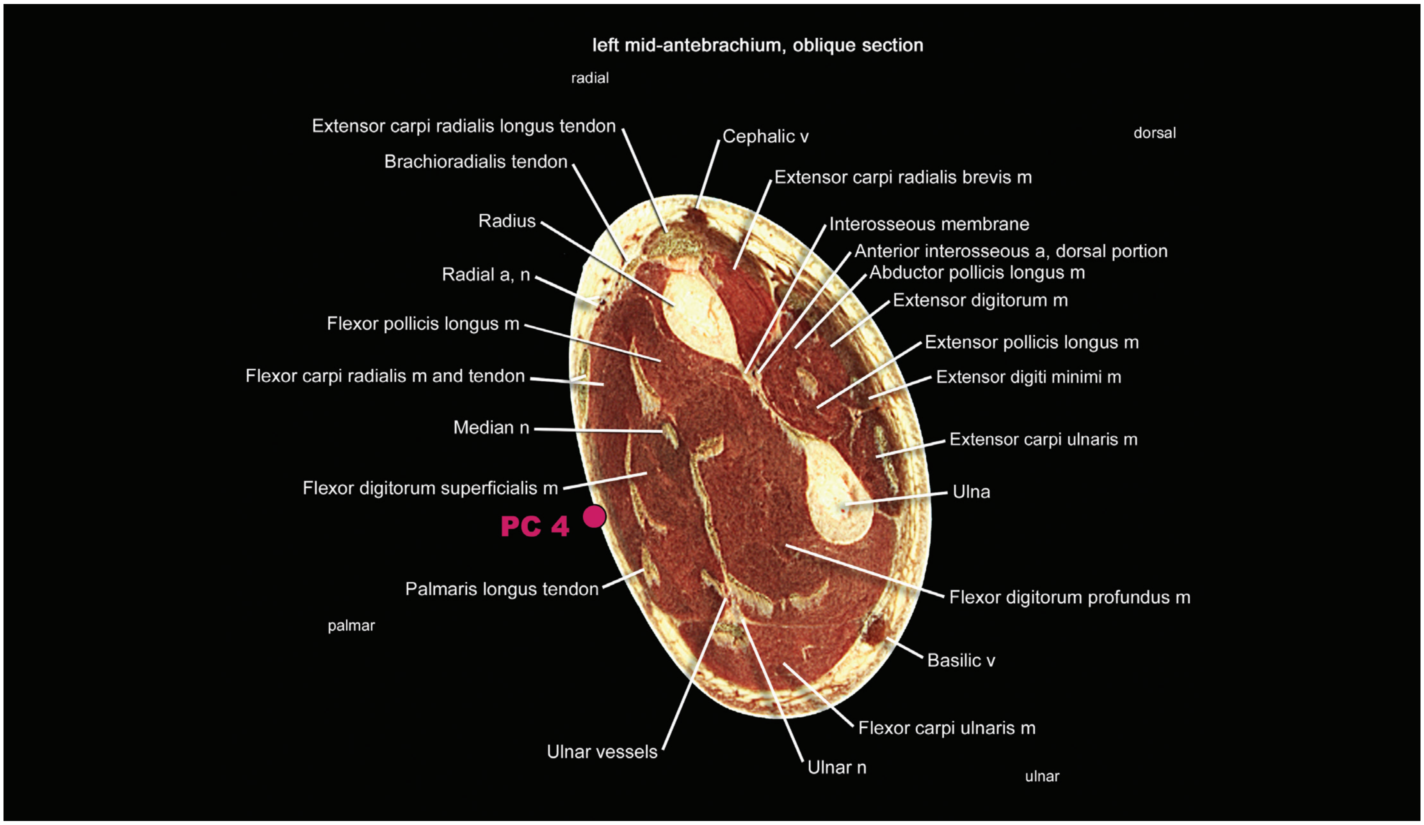

left mid-antebrachium, oblique section
radial
dorsal
Extensor carpi radialis longus tendon
Cephalic v
Brachioradialis tendon
Extensor carpi radialis brevis m
Radius
Interosseous membrane
Anterior interosseous a, dorsal portion
Abductor pollicis longus m
Radial a, n
Extensor digitorum m
Flexor pollicis longus m
Extensor pollicis longus m
Flexor carpi radialis m and tendon
Extensor digiti minimi m
Median n
Extensor carpi ulnaris m
Flexor digitorum superficialis m
Ulna
PC 4
Palmaris longus tendon
Flexor digitorum profundus m
palmar
Basilic v
Flexor carpi ulnaris m
Ulnar vessels
Ulnar n
ulnar

Figure 9-14. The density of muscle and tendon tissue deep to PC 4 illustrates the point's applicability in cases of myofascial restriction of the palmar, or volar, surface of the antebrachium. Note, too, the position of the median nerve between the flexor digitorum superficialis and flexor digitorum profundus muscles. Consider how forceful and sustained flexion of the digits could compress the nerve.

regional pain, dysesthesia, temperature changes, and a history of trauma or a noxious event. CRPS type II adds a peripheral nerve lesion such as neuroma. Peripheral nerve stimulation provided by acupuncture and related techniques should precede implanted nerve stimulators or spinal cord stimulation, in that the non-invasive neuromodulation affords a safer and more comfortable method of fostering nerve repair and analgesia.

Vessels

- **Anterior interosseous artery and vein:** The larger partners of the posterior interosseous vessels, the anterior osseous vessels supply and drain the interosseous membrane and deep myofascia. Both vessels issue perforators to each other through the membrane; segmental vessels supply the periosteum of the radius and ulna.[18]
- **Median artery:** A branch of the anterior or common interosseous artery, the median artery arises from the proximal part of the interosseous artery and supplies the median nerve throughout its course along the forearm. In some individuals, the median arterial branch is sizeable and continues into the hand to join in the formation of the superficial palmar arch. When present, the median artery adds to the already crowded carpal canal and may cause compression of the median nerve, leading to carpal tunnel syndrome.
- **Median antebrachial vein:** Sometimes absent, the median antebrachial vein begins at the base of the dorsum of the thumb. It makes its way around the radial aspect of the wrist and moves proximally in the middle of the anterior aspect of the forearm. Its course runs between the cephalic and basilic veins. It occasionally divides into intermediate median cephalic and basilic veins, which drain into their respective veins. The median cubital vein often receives this median vein of the forearm, otherwise known as the median antebrachial vein.

Clinical Relevance: Extraneous fibrous bands and variant muscles occur with notable frequency in the antebrachium. Their oblique courses cross both nerves and vessels. Gantzer's muscle is also a well-known culprit inciting neurovascular compression, as noted above.

Indications and Potential Point Combinations

- **Acute disorders of cardiac and circulatory systems such as angina pectoris, chest pain, tachycardia:** PC 5, PC 6, HT 3, ST 36.
- **Anterior interosseous nerve syndrome, exhibited by inability to make the "OK" sign with the thumb firmly opposing the tip of the index finger**. The nerve impingement generated by compression at the fibrous arch of the flexor digitorum superficialis and pronator teres can affect flexion at the interphalangeal joint of the thumb (because of weakness in the flexor pollicis longus muscle) as well as flexion of the distal interphalangeal joint of the index finger (because the anterior interosseous nerve supplies the radial half of the flexor digitorum profundus):[2] PC 4, PC 5, trigger points in the flexor digitorum superficialis and pronator teres muscles. LU 6, PC 6, PC 7 to stimulate return of motor function in afflicted muscles.

Evidence-Based Applications

- Benefits patients with **coronary insufficiency.**[3]
- Electroacupuncture at PC 4 and PC 6 regulates blood pressure in cases of **hypotension.**[4]
- Acupuncture on PC 4 decreased **heart rate** by increasing cardiac vagal activity and decreasing cardiac sympathetic activity.[5]
- Electroacupuncture stimulation of PC 3 at 10 Hz for 15 minutes improved blood circulation at PC 4 by means of increasing nitric oxide release. Cyclic GMP was found to mediate the signaling functions of nitric oxide to improve **local microcirculation.**[6]

References

1. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect*. 2008;57:177-185.
2. Tsai P and Steinberg DR. Median and radial nerve compression about the elbow. *Instr Course Lect*. 2008;57:177-185.
3. Yin K and Jia C. Treatment of chronic coronary insufficiency with acupuncture on Ximen point. *Journal of Traditional Chinese Medicine*. 1991;11(2):99-100.
4. Yin S, Cao Y, and Zhang J. Treatment of primary hypotension by electroacupuncture at Neiguan and Gongsun. *Journal of Traditional Chinese Medicine*. 2004;24(3):193.
5. Nishijo K, Mori H, Yosikawa K, and Yazawa. Decreased heart rate by acupuncture stimulation in humans via facilitation of cardiac vagal activity and suppression of cardiac sympathetic nerve. *Neuroscience Letters*. 1997;227:165-168.
6. Jou NT and Ma SX. Responses of nitric oxide-cGMP release in acupuncture point to electroacupuncture in human skin in vivo using dermal microdialysis. *Microcirculation*. 2009;16(5):434-443.
7. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg*. 2005;9(1):29-34.
8. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main*. 2007;26(6):255-277.
9. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther*. 2006;19:137-145.
10. Green JB and Zelouf DS. Forearm instability. *J Hand Surg*. 2009;34A:953-961.
11. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A:1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg*. 2009;34A:953-961.
12. Koo JT and Szabo RM. Compression neuropathies of the median nerve. *Journal of the American Society for Surgery of the Hand*. 2004;4(5):156-175.
13. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther*. 2005;18:216-229.
14. Ulrich D, Piatkowski A, and Pallua N. Anterior interosseous nerve syndrome: retrospective analysis of 14 patients. *Arch Orthop Trauma Surg*. 2011;131:1561-1565.
15. Zhou W, Hsiao I, Lin VWH, et al. Modulation of cardiovascular excitatory responses in rats by transcutaneous magnetic stimulation: role of the spinal cord. *J Appl Physiol*. 2006;100:926-932.
16. Jeon I-C, Kim M-S, and Kim S-H. Median nerve stimulation in a patient with complex regional pain syndrome type II. *J Korean Neurosurg Soc*. 2009;46:273-276.
17. Mirone G, Natale M, and Rotondo M. Peripheral median nerve stimulation for the treatment of iatrogenic complex regional pain syndrome (CRPS) type II after carpal tunnel surgery. *Journal of Clinical Neuroscience*. 2009;16:825-827.
18. Wright TW. Interosseous membrane of the forearm. *Journal of the American Society for Surgery of the Hand*. 2001;1(2):123-134.
19. Nakamoto T and Matsukawa K. Muscle receptors close to the myotendinous junction play a role in eliciting exercise pressor reflex during contraction. *Auton Neurosci*. 2008;138(1-2):99-107.
20. Stuart DG, Goslow GE, Mosher CG, and Reinking RM. Stretch responsiveness of Golgi tendon organs. *Exp Brain Res*. 1970;10:463-476.

PC 5
Jian Shi "Intermediate Messenger", "Intermediary Courier", "Minister Space"

On the flexor surface of the distal antebrachium, 3 cun proximal to the wrist crease (and PC 7), on the ulnar aspect of the flexor carpi radialis tendon, or between the tendons of the flexor carpi radialis and palmaris longus (when the latter is present). The point occurs one quarter of the distance from the wrist to the elbow.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central band spans the region of PC 4 and PC 5. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface.

The interosseous membrane provides longitudinal stability to the forearm.[2] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[3] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[4]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[5] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[6] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles and Tendons

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges of the fingers at the distal interphalangeal joints.
- **Palmaris longus tendon:** Tightens the palmar aponeurosis and flexes the hand at the wrist.
- **Flexor carpi radialis muscle and tendon:** Flexes and abducts the hand at the wrist.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius and ulna.

Clinical Relevance: Trigger point pathology in the following muscles at or near PC 5 lead to their respective pain referral patterns:

  - **Flexor digitorum superficialis and profundus:** Radial head of each muscle group refers pain to the palmar middle finger from PC 8 to PC 9.
  - **Palmaris longus:** Pain from a palmaris longus trigger point just proximal to PC 4 sends pain along the PC channel to the palm between PC 8 and HT 8, where it centralizes.
  - **Flexor carpi radialis:** Issues pain along the PC channel to the wrist, centered strongly over PC 7 and spilling toward LU 9. At times, extends to the palm near PC 8.

In addition, a myofascial trigger point in the medial head of the triceps can cause pain to travel from the elbow at PC 3-HT 3 where it localizes strongly. The pain pattern then extends down the PC/HT line to the ring finger and pinky.

Excessive tension in the pronator quadratus muscle predisposes a patient to entrapment of the anterior interosseous nerve, as indicated in Figure 9-16.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm. A branch of the ulnar nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.

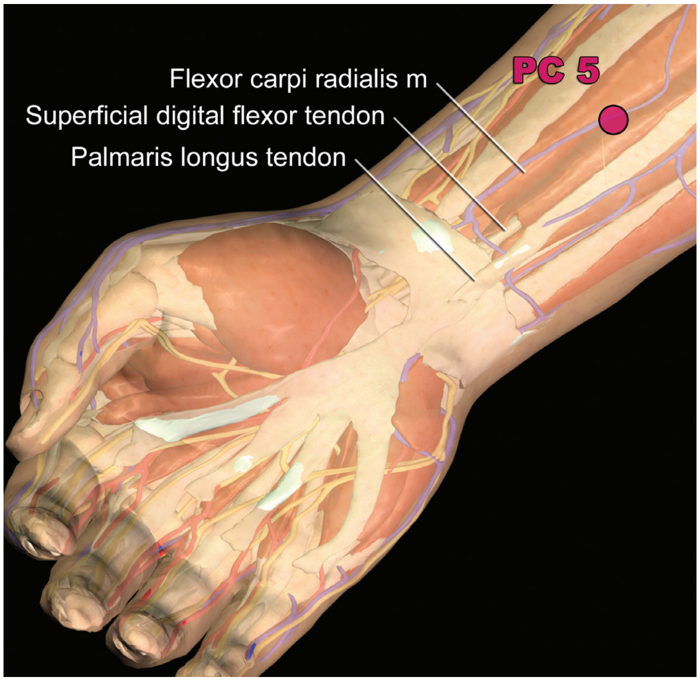


Figure 9-15. As the "messenger in the space between two sinews", the name "Intermediary Courier" for PC 5 refers to the point's location along the groove between the flexor carpi radialis muscle and the palmaris longus tendon.

- **Median nerve (C6-T1):** The median nerve in the PC 5-PC 6 region is responsible for issuing the mechanosensitive signals to the brain that stimulate cardiopulmonary modulatory reflexes through the rostral ventrolateral medulla. In addition, muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except the flexor carpi ulnaris and medial half of the flexor digitorum profundus muscle. The median nerve then innervates all of the thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Also supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), along with the radial aspect of the ring finger, as well as the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.
- **Anterior interosseous nerve:** Arises from the median nerve, a purely motor nerve that innervates the deep antebrachial muscles. Supplies the flexor digitorum profundus to the index and middle fingers, the flexor pollicis longus, and the pronator quadratus muscles. Also supplies the anterior surface of the interosseous membrane.

Clinical Relevance: Median nerve anatomy on the forearm varies eight ways.[7] As one example, the median nerve may divide in the proximal or middle third of the forearm and travel as a couple, split by a persistent median artery or muscle. It may then rejoin proximal to the transverse carpal ligament. Compression at any site of the median nerve, from root to destination, can cause abnormalities of sensation and function. “Double-crush” phenomenon refers to two sites of pressure producing problems for the nerve. As such, one should palpate the entire course of the nerve for evidence of entrapment.

Compression of the median nerve can be best understood by considering the course of the nerve as it travels from cubital fossa to wrist. First, the nerve passes between the two heads of the pronator teres muscle. It then courses deep to the fibrous arch formerly known as the “subliimis bridge”, created by the two heads of origin of the flexor digitorum superficialis muscle; these heads arise from the medial humeral epicondyle and the radius.[8]

The most common source of median nerve compression is carpal tunnel syndrome; that said, however, nerve dysfunction may arise from pressure elsewhere along its path. Space-occupying lesions in the carpal tunnel produce pain and paresthesias in the radial side of the palmar aspect of the hand. Problems typically worsen at night or following repetitive and forceful hand motion. Nonsurgical management of carpal tunnel syndrome and other median neuropathies should include acupuncture, massage, and/or laser therapy directed to both the source of compression and nearby sites. Proximal points can include PC 5.

Isolated anterior interosseous nerve compression may occur after repetitive movement involving flexion of the elbow and/or pronation of the forearm.[1] Injury of the anterior interosseous nerve manifests as weakness in interphalangeal joint flexion or paresis of the distal interphalangeal joints of the index and middle fingers.[9] Pain arises in the volar antebrachium; people with isolated anterior interosseous neuropathy cannot make the “ok” sign with the thumb and forefinger, making a pinching movement with these digits. Handwriting also becomes difficult.[10]

Compression of the anterior interosseous nerve occurs along the course of the PC channel and follows trauma, iatrogenic injury (dressings, slings, venipuncture), and elbow or shoulder arthroscopy. Anatomic sources of compression include: 1) the tendinous origin of the deep head of either the pronator teres or flexor digitorum superficialis to the middle finger; 2) a site of thrombosis of the ulnar collateral vessels crossing the anterior interosseous nerve; 3) accessory muscles or tendons of the flexor digitorum superficialis or the flexor pollicis longus (i.e., Gantzer’s muscle); 4) an aberrant radial artery; 5) tendinous portions of the palmaris longus or flexor carpi radialis brevis muscles, or 6) an enlarged bicipital bursa in the vicinity of PC 3.

Entrapment sites of the anterior interosseous and median nerves resemble one another because they pursue parallel trajectories. No matter which nerve becomes compressed, physical medicine can improve the symptoms by releasing the dysfunction at the heart of the entrapment.

Median nerve stimulation itself may prove therapeutic for a number of conditions. First and foremost, neuromodulation of the median nerve facilitates its recovery from the problems described above, wherein chronic pressure compromises nerve health. In addition, median nerve stimulation affords an array of homeostatic effects based on its neuromodulation of rostral ventrolateral medulla (RVLM) function. The RVLM affects cardiopulmonary physiology; neuromodulation through physical medicine modalities modulates cardiovascular excitatory responses.[11] Acupuncture points along the median nerve regulate blood pressure and protect against hypotension. Stimulation of PC 5 and PC 6 also alters cardiovascular function by acting on the cholinergic neurons in the nucleus ambiguus, likely by means of enkephalinergic pathways.[12]

This link between the median nerve, the RVLM, and the indications of PC 6 that pertain to cardiac activity has been highlighted by a study evaluating the predictive value of median nerve somatosensory evoked potentials for nonawakening from coma.[13] That is, adults who suffered hypoxic-ischemic encephalopathy and progressed to coma demonstrated absent somatosensory evoked potential responses from the median nerve. In other words, stimulation of the median nerve was unable to arouse the brain, likely due to the damage in the brainstem at the cardiopulmonary centers in the RVLM.

Median nerve stimulation also treats causalgia, otherwise known as complex regional pain syndrome type II (CRPS II).[14] It also reduces neuropathic pain in cases of median nerve damage following carpal tunnel surgery.[15]

Chronic regional pain disorders typically exhibit autonomic features such as vasomotor or sudomotor dysfunction. CRPS type I (reflex sympathetic dystrophy) produces: skin color changes, edema, abnormal sweating (sudomotor activity),

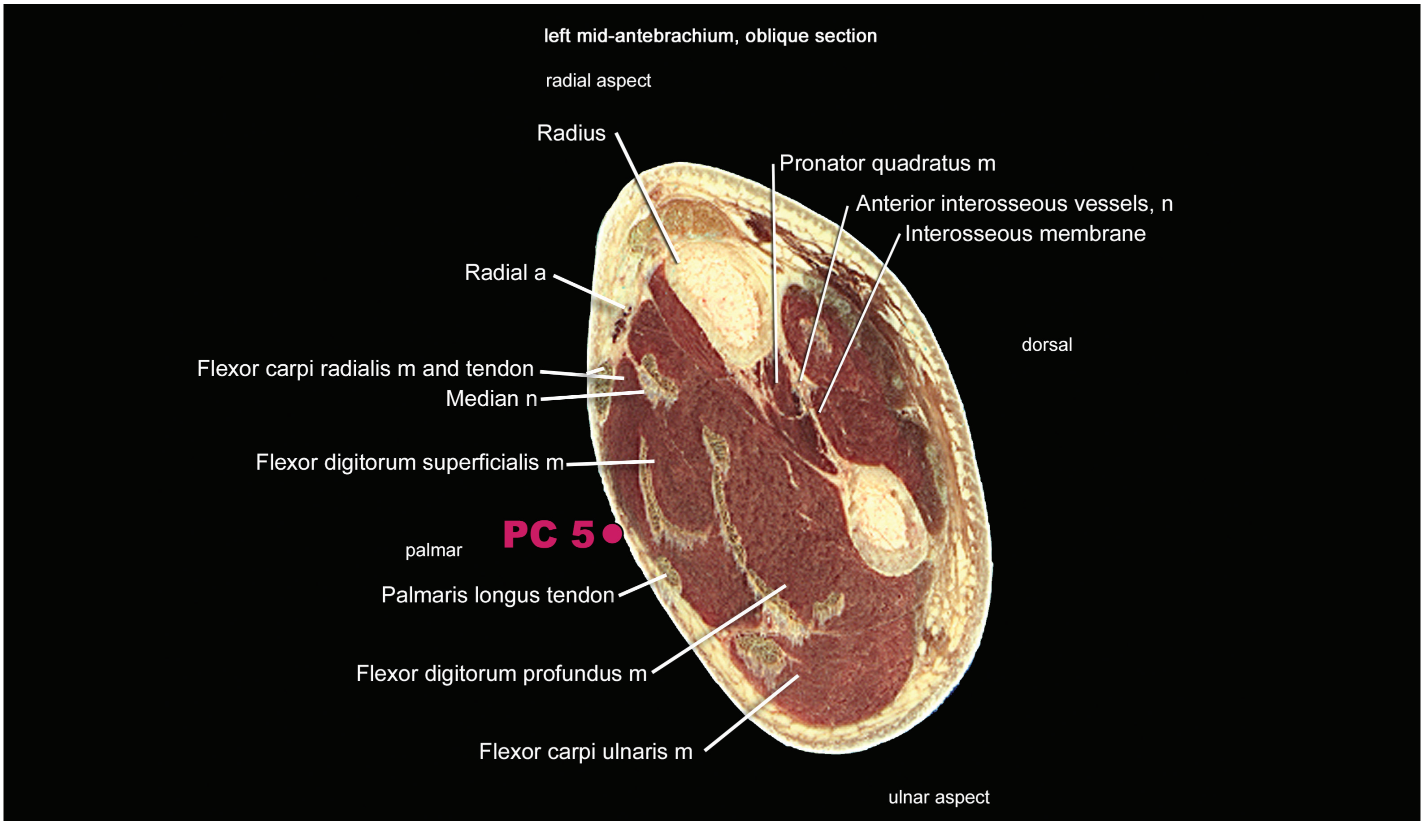

left mid-antebrachium, oblique section
radial aspect
Radius
Pronator quadratus m
Anterior interosseous vessels, n
Interosseous membrane
Radial a
dorsal
Flexor carpi radialis m and tendon
Median n
Flexor digitorum superficialis m
PC 5
palmar
Palmaris longus tendon
Flexor digitorum profundus m
Flexor carpi ulnaris m
ulnar aspect

Figure 9-16. Note the differences in depth one needs to treat in order to address myofascial dysfunction in the flexor digitorum superficialis, flexor digitorum profundus, and pronator quadratus muscles, all directly deep to PC 5.

regional pain, dysesthesia, temperature changes, and a history of trauma or a noxious event. CRPS type II adds a peripheral nerve lesion such as neuroma. Peripheral nerve stimulation provided by acupuncture and related techniques should precede implanted nerve stimulators or spinal cord stimulation, in that the non-invasive neuromodulation affords a safer and more comfortable method of fostering nerve repair and analgesia.

Vessels

- **Anterior interosseous artery and vein:** The larger partners of the posterior interosseous vessels, the anterior osseous vessels supply and drain the interosseous membrane and deep myofascia. Both vessels issue perforators to each other through the membrane; segmental vessels supply the periosteum of the radius and ulna. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that courses along the distal posterior portion of the interosseous membrane.
- **Median artery:** A branch of the anterior or common interosseous artery, the median artery arises from the proximal part of the interosseous artery and supplies the median nerve throughout its course along the forearm. In some individuals, the median arterial branch is sizeable and continues into the hand to join in the formation of the superficial palmar arch. When present, the median artery adds to the already crowded carpal canal and may cause compression of the median nerve, leading to carpal tunnel syndrome.
- **Median antebrachial vein:** Sometimes absent, the median antebrachial vein begins at the base of the dorsum of the thumb. It makes its way around the radial aspect of the wrist and moves proximally in the middle of the anterior aspect of the forearm. Its course runs between the cephalic and basilic veins. It occasionally divides into intermediate median cephalic and basilic veins, which drain into their respective veins. The median cubital vein often receives this median vein of the forearm, otherwise known as the median antebrachial vein.

Clinical Relevance: Extraneous fibrous bands and variant muscles occur with notable frequency in the antebrachium. Their oblique courses cross both nerves and vessels. Gantzer's muscle is also a well-known culprit inciting neurovascular compression, as noted above.

Indications and Potential Point Combinations

- **Acute disorders of cardiac and circulatory systems: angina pectoris, chest pain, tachycardia:** PC 5, PC 6, HT 3, ST 36, LR 3.
- **Pain in the arm, forearm, or middle finger:** The palmaris longus muscle trigger points radiate toward the palm (and PC 8). PC 5, PC 4, PC 6, and PC 7 all line up along the referred pain route. The flexor carpi radialis trigger point sends referred pain to the wrist in the vicinity of PC 7. PC 5, PC 6, and PC 7 plus local trigger points are indicated here. A trigger point in the radial head of the flexor digitorum superficialis muscle issues pain to the palmar aspect of the middle finger. For this pain pattern, needle PC 5, local trigger points, and web space (Baxie) points on either side of the middle digit.

Evidence-Based Applications

- Transcutaneous electrical nerve stimulation (TENS) applied to PC 5 and PC 6 **reduced the severity and incidence of hypotension** after spinal anesthesia in parturients undergoing Cesarean section.[1]
- Electroacupuncture from PC 5 to PC 6 **reduced the severity of hypotension** during anesthesia in patients undergoing liver transplantation, with no significant differences observed between the electroacupuncture group and those receiving norepinephrine as a vasoconstrictor.[17]
- Electroacupuncture at certain points such as PC 5 or PC 6 or LU 7 and LI 4, in addition to several others, may **improve exercise performance and post-exercise recovery.**[18]

References

1. Arai YCP, Kato N, Matsura M, et al. Transcutaneous electrical nerve stimulation at the PC-5 and PC-6 acupoints reduced the severity of hypotension after spinal anaesthesia in patients undergoing Caesarean section. *British Journal of Anaesthesia.* 2008;100(1):78-81.
2. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.
3. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.
4. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.
5. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
6. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
7. Koo JT and Szabo RM. Compression neuropathies of the median nerve. *Journal of the American Society for Surgery of the Hand.* 2004;4(5):156-175.
8. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther.* 2005;18:216-229.
9. Ulrich D, Piatkowski A, and Pallua N. Anterior interosseous nerve syndrome: retrospective analysis of 14 patients. *Arch Orthop Trauma Surg.* 2011;131:1561-1565.
10. Tagliafico A, Perez MM, Padua L, et al. Increased reflectivity and loss in bulk of the pronator quadratus muscle does not always indicate anterior interosseous neuropathy on ultrasound. *European Journal of Radiology.* 2013;82(3):526-529.
11. Zhou W, Hsiao I, Lin VWH, et al. Modulation of cardiovascular excitatory responses in rats by transcutaneous magnetic stimulation: role of the spinal cord. *J Appl Physiol.* 2006;100:926-932.
12. Guo Z-L, Li M, and Longhurst JC. Nucleus ambiguus cholinergic neurons activated by acupuncture: relation to encephalin. *Brain Research.* 2012;1442:25-35.
13. Robinson LR, Micklesen PJ, Tirschwell DL, et al. Predictive value of somatosensory evoked potentials for awakening from coma. *Crit Care Med.* 2003;31(3):960-967.
14. Jeon I-C, Kim M-S, and Kim S-H. Median nerve stimulation in a patient with complex regional pain syndrome type II. *J Korean Neurosurg Soc.* 2009;46:273-276.
15. Mirone G, Natale M, and Rotondo M. Peripheral median nerve stimulation for the treatment of iatrogenic complex regional pain syndrome (CRPS) type II after carpal tunnel surgery. *Journal of Clinical Neuroscience.* 2009;16:825-827.
16. Wright TW. Interosseous membrane of the forearm. *Journal of the American Society for Surgery of the Hand.* 2001;1(2):123-134.
17. Sahmeddini MA, Eghbal MH, Khosravi MB, et al. Electro-acupuncture stimulation at acupoints reduced the severity of hypotension during anesthesia in patients undergoing liver transplantation. *J Acupunct Meridian Stud.* 2012;5(1):11-14.
18. Urroz P, Colagiuri B, Smith CA, et al. Effect of acute acupuncture treatment on exercise performance and postexercise recovery: a systematic review. *The Journal of Alternative and Complementary Medicine.* 2013;19(1):9-16.

PC 6

Nei Guan "Inner Pass"

On the distal volar antebrachium, 2 cun proximal to the wrist crease (and PC 7), on the ulnar side of the flexor carpi radialis tendon, or between the tendons of the flexor carpi radialis and palmaris longus (when the latter is present).

Caution: The median nerve underlies this point. Needling the nerve will generate an electrical sensation. Do not traumatize the nerve through excessive stimulation.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central band spans the region of PC 4 and PC 5. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface.

The interosseous membrane provides longitudinal stability to the forearm.[54] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[55] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[56]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[57] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[58] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles and Tendons

- **Flexor digitorum superficialis muscle:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Flexor digitorum profundus muscle:** Flexes the distal phalanges of the fingers at the distal interphalangeal joints.
- **Palmaris longus tendon:** Tightens the palmar aponeurosis and flexes the hand at the wrist.

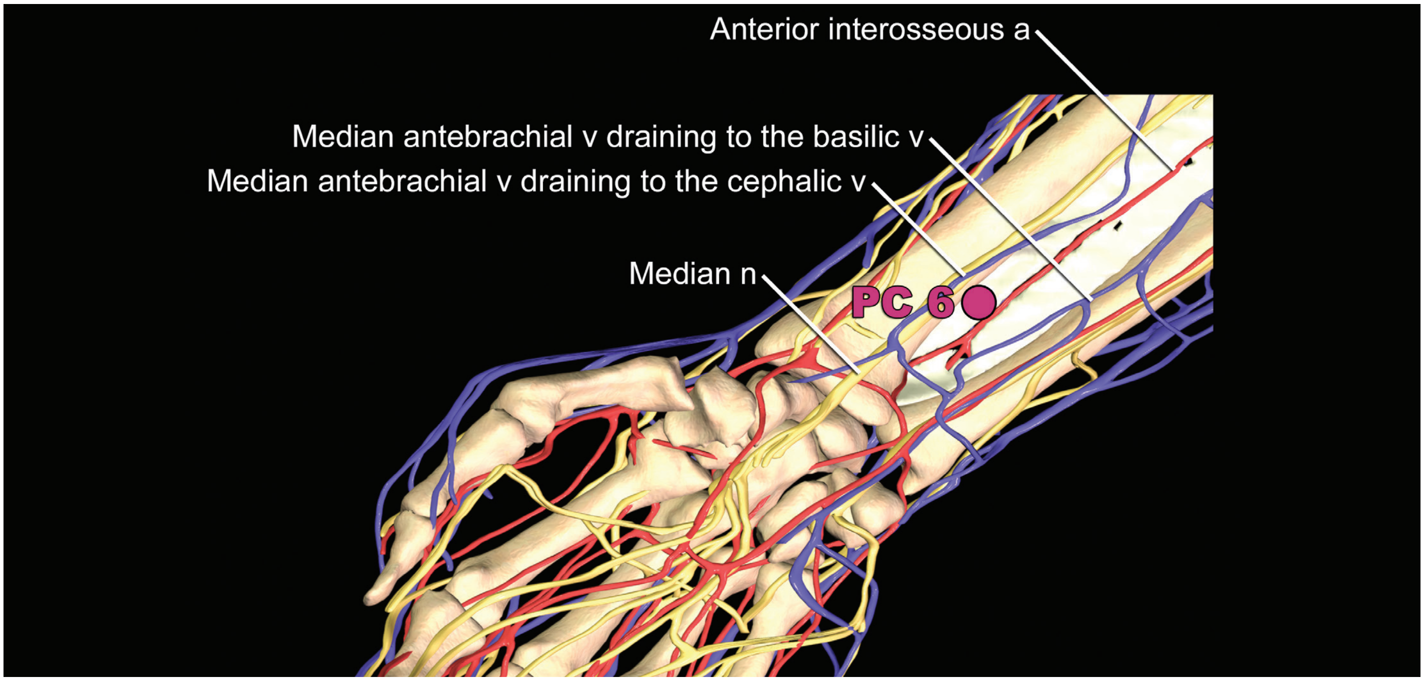

Anterior interosseous a
Median antebrachial v draining to the basilic v
Median antebrachial v draining to the cephalic v
Median n
PC 6

Figure 9-17. The name "Inner Pass" refers to the connection, or passage, through the interosseous membrane of the anterior interosseous vessels that then supply the dorsal, as well as the volar surfaces of the distal antebrachium. The penetration of the membrane by the anterior interosseous artery is evident in this image just distal to PC 6, where the dorsal branch disappears through the connective tissue. This fact reinforces the neurovascular basis of the acupuncture channels in that PC 6 serves as the "luo connecting point" between the PC and Triple Heater (TH) channels, evidenced by a vascular conduit bridging the two. Here, TH 5 sits atop PC 6, but on the dorsal surface. This link between the median nerve, the RVLM, and the indications of PC 6 that pertain to cardiac activity has been highlighted by a study evaluating the predictive value of median nerve somatosensory evoked potentials for nonawakening from coma.[79] That is, adults who suffered hypoxic-ischemic encephalopathy and progressed to coma demonstrated absent somatosensory evoked potential responses from the median nerve. In other words, stimulation of the median nerve was unable to arouse the brain, likely due to the damage in the brainstem at the cardiopulmonary centers in the RVLM.

- **Flexor carpi radialis muscle and tendon:** Flexes and abducts the hand at the wrist.
- **Pronator quadratus muscle:** Pronates the antebrachium, binds the radius and ulna.

Clinical Relevance: Trigger point pathology in the following muscles at or near PC 5 lead to their respective pain referral patterns:

- **Flexor digitorum superficialis and profundus:** Radial head of each muscle group refers pain to the palmar middle finger from PC 8 to PC 9.
- **Palmaris longus:** Pain from a palmaris longus trigger point just proximal to PC 4 sends pain along the PC channel to the palm between PC 8 and HT 8, where it centralizes.
- **Flexor carpi radialis:** Issues pain along the PC channel to the wrist, centered strongly over PC 7 and spilling toward LU 9. At times, extends to the palm near PC 8.

In addition, a myofascial trigger point in the medial head of the triceps can cause pain to travel from the elbow at PC 3-HT 3 where it localizes strongly. The pain pattern then extends down the PC/HT line to the ring finger and pinky.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm. A branch of the ulnar nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.
- **Median nerve (C6-T1):** The median nerve in the PC 5-PC 6 region is responsible for issuing the mechanosensitive signals to the brain that stimulate cardiopulmonary modulatory reflexes through the rostral ventrolateral medulla. In addition, muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis muscles), except the flexor carpi ulnaris and medial half of the flexor digitorum profundus muscle. The median nerve then innervates all of the thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Also supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), along with the radial aspect of the ring finger, as well as the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis.

The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

- **Anterior interosseous nerve:** Arises from the median nerve, a purely motor nerve that innervates the deep antebrachial muscles. Supplies the flexor digitorum profundus to the index and middle fingers, the flexor pollicis longus, and the pronator quadratus muscles. Also supplies the anterior surface of the interosseous membrane.

Clinical Relevance: Median nerve anatomy on the forearm varies eight ways.[59] As one example, the median nerve may divide in the proximal or middle third of the forearm and travel as a couple, split by a persistent median artery or muscle. It may then rejoin proximal to the transverse carpal ligament. Compression at any site of the median nerve, from root to destination, can cause abnormalities of sensation and function. “Double-crush” phenomenon refers to two sites of pressure producing problems for the nerve. As such, one should palpate the entire course of the nerve for evidence of entrapment.

Compression of the median nerve can be best understood by considering the course of the nerve as it travels from cubital fossa to wrist. First, the nerve passes between the two heads of the pronator teres muscle. It then courses deep to the fibrous arch formerly known as the “subliimis bridge”, created by the two heads of origin of the flexor digitorum superficialis muscle; these heads arise from the medial humeral epicondyle and the radius.[60]

The most common source of median nerve compression is carpal tunnel syndrome; that said, however, nerve dysfunction may arise from pressure elsewhere along its path. Space-occupying lesions in the carpal tunnel produce pain and paresthesias in the radial side of the palmar aspect of the hand. Problems typically worsen at night or following repetitive and forceful hand motion. Nonsurgical management of carpal tunnel syndrome and other median neuropathies should include acupuncture, massage, and/or laser therapy directed to both the source of compression and nearby sites. Proximal points can include PC 6.

Isolated anterior interosseous nerve compression may occur after repetitive movement involving flexion of the elbow and/or pronation of the forearm.[1] Injury of the anterior interosseous nerve manifests as weakness in interphalangeal joint flexion or paresis of the distal interphalangeal joints of the index and middle fingers.[61] Pain arises in the volar antebrachium; people with isolated anterior interosseous neuropathy cannot make the “ok” sign with the thumb and forefinger, making a pinching movement with these digits. Handwriting also becomes difficult.[62]

Compression of the anterior interosseous nerve occurs along the course of the PC channel and follows trauma, iatrogenic injury (dressings, slings, venipuncture), and elbow or shoulder arthroscopy. Anatomic sources of compression include: 1) the tendinous origin of the deep head of either the pronator teres or flexor digitorum superficialis to the middle finger; 2) a site of thrombosis of the ulnar collateral vessels crossing the anterior interosseous nerve; 3) accessory muscles or tendons of the flexor digitorum superficialis or the flexor pollicis longus (i.e., Gantzer’s muscle); 4) an aberrant radial artery; 5) tendinous portions of the palmaris longus or flexor carpi radialis brevis muscles, or 6) an enlarged bicipital bursa in the vicinity of PC 3.

Entrapment sites of the anterior interosseous and median nerves resemble one another because they pursue parallel trajectories. No matter which nerve becomes compressed, physical medicine can improve the symptoms by releasing the dysfunction at the heart of the entrapment.

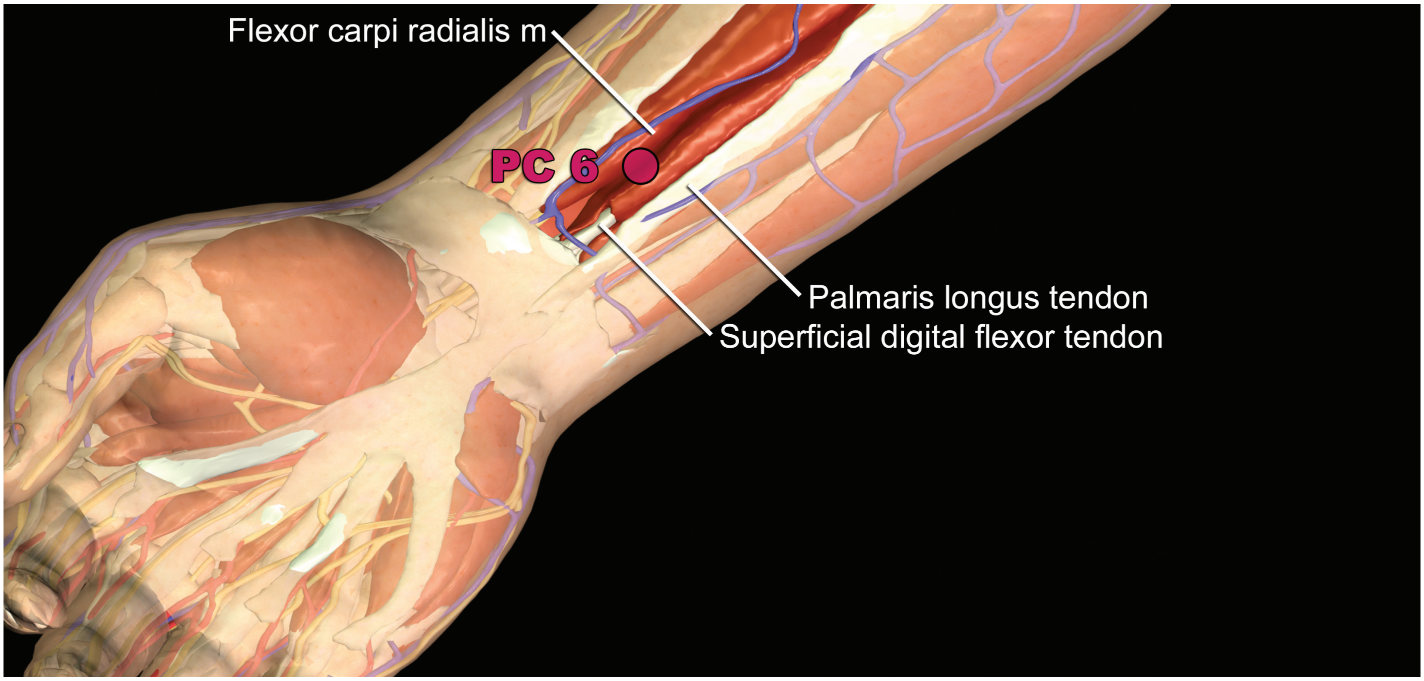


Figure 9-18. If the patient lacks a palmaris longus muscle, the radial aspect of the superficial digital flexor muscle serves as the ulnar border for the groove in which PC 6 sits. The flexor carpi radialis muscle continues to provide the radial border, as it has for PC 4 and PC 5.

Median nerve stimulation itself may prove therapeutic for a number of conditions. First and foremost, neuromodulation of the median nerve facilitates its recovery from the problems described above, wherein chronic pressure compromises nerve health. In addition, median nerve stimulation affords an array of homeostatic effects based on its neuromodulation of rostral ventrolateral medulla (RVLM) function. The RVLM affects cardiopulmonary physiology; neuromodulation through physical medicine modalities modulates cardiovascular excitatory responses.[63] Acupuncture points along the median nerve regulate blood pressure and protect against hypotension. Stimulation of PC 5 and PC 6 also alters cardiovascular function by acting on the cholinergic neurons in the nucleus ambiguus, likely by means of enkephalinergic pathways.[64]

Median nerve stimulation also treats causalgia, otherwise known as complex regional pain syndrome type II (CRPS II).[65] It also reduces neuropathic pain in cases of median nerve damage following carpal tunnel surgery.[66]

Chronic regional pain disorders typically exhibit autonomic features such as vasomotor or sudomotor dysfunction. CRPS type I (reflex sympathetic dystrophy) produces: skin color changes, edema, abnormal sweating (sudomotor activity), regional pain, dysesthesia, temperature changes, and a history of trauma or a noxious event. CRPS type II adds a peripheral nerve lesion such as neuroma. Peripheral nerve stimulation provided by acupuncture and related techniques should precede implanted nerve stimulators or spinal cord stimulation, in that the non-invasive neuromodulation affords a safer and more comfortable method of fostering nerve repair and analgesia.

Vessels

- **Anterior interosseous artery and vein:** The larger partners of the posterior interosseous vessels, the anterior osseous vessels supply and drain the interosseous membrane and deep myofascia. Both vessels issue perforators to each other through the membrane; segmental vessels supply the periosteum of the radius and ulna. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that courses along the distal posterior portion of the interosseous membrane.
- **Median artery:** A branch of the anterior or common interosseous artery, the median artery arises from the proximal part of the interosseous artery and supplies the median nerve throughout its course along the forearm. In some individuals, the median arterial branch is sizeable and continues into the hand to join in the formation of the superficial palmar arch. When present, the median artery adds to the already crowded carpal canal and may cause compression of the median nerve, leading to carpal tunnel syndrome.
- **Median antebrachial vein:** Sometimes absent, the median antebrachial vein begins at the base of the dorsum of the thumb. It makes its way around the radial aspect of the wrist and moves proximally in the middle of the anterior aspect of the forearm. Its course runs between the cephalic and basilic veins. It occasionally divides into intermediate median cephalic and basilic veins, which drain into their respective veins. The median cubital vein often receives this median vein of the forearm, otherwise known as the median antebrachial vein.

Clinical Relevance: Extraneous fibrous bands and variant muscles occur with notable frequency in the antebrachium. Their oblique courses cross both nerves and vessels. Gantzer's muscle is also a well-known culprit inciting neurovascular compression, as noted above.

Indications and Potential Point Combinations

- **Disorders of upper abdomen:** gastric and duodenal ulcers, nausea, vomiting: PC 6, ST 36, CV 12.
- **Emotional problems:** PC 6, SP 4, ST 36, GV 20.
- **Acupuncture analgesia for chest and upper abdominal surgery:** PC 6.
- **Carpal tunnel syndrome:** PC 6, PC 7, local trigger points. Also, target C5-C6 ventral cervical spinal nerve segments and facet joint points along with ST 36 to address central sensitization.[1]
- **Acute disorders of cardiac and circulatory systems such as angina pectoris, chest pain, arrhythmias, or tachycardia:** PC 5, PC 6, HT 3, ST 36, LR 3.
- **Pain in the arm, forearm, or middle finger:** The palmaris longus muscle trigger points radiate toward the palm (and PC 8). PC 6, PC 4, PC 5, and PC 7 all line up along the referred pain route. The flexor carpi radialis trigger point sends referred pain to the wrist in the vicinity of PC 7. PC 6, PC 5, and PC 7 plus local trigger points are indicated here. A trigger point in the radial head of the flexor digitorum superficialis muscle issues pain to the palmar aspect of the middle finger. For this pain pattern, needle PC 6, PC 5, local trigger points, and web space (Baxie) points on either side of the middle digit.
- **Nausea, vomiting:** PC 6, ST 36.

Evidence-Based Applications

- Acupuncture for carpal tunnel syndrome including PC 6 as one of the points was shown to be as effective as short-term low-dose prednisolone for mild-to-moderate **carpal tunnel syndrome.**[2]
- Acupuncture applied to PC 6 and PC 7 significantly improved nerve conduction velocity and symptoms in patients with **carpal tunnel syndrome.**[68]
- Prevents **postoperative nausea and vomiting** (double-blind RCT).[3]
- Acupressure at PC 6 has **anti-gagging effects in dental patients.**[4]
- Laser stimulation at PC 6 and CV 24 were each effective in controlling the **gagging reflex** in orthodontic patients.[69]
- Continuous, 24-hour acupressure on PC 6 as an adjunct to standard antiemetic medications for **post-myocardial infarction nausea and vomiting** significantly reduced its incidence after the first four hours.[5]
- Acupuncture stimulation of PC 6 activates the left superior frontal gyrus, the anterior cingulated gyrus, and the dorsomedial nucleus of the thalamus. It also modulates the following structures in the cerebellum: declive, nodulus, uvula of the vermis, quadrangular lobule, cerebellar tonsil, and the superior semilunar lobule. The modulation of activities in the cerebellar vestibular neuromatrix may also help explain the **antiemetic** effects of PC 6.[6]
- Transcutaneous electrical acupuncture point stimulation applied to PC 6 and CV 13 prevented **postoperative vomiting following pediatric tonsillectomy** as well as ondansetron did, but with fewer side effects.[7]
- Acupuncture with a small, indwelling needle at PC 6 effectively treated **acute vomiting** in children with gastroenteritis and pneumonia. *Klin Pediatr.* 2012;224:72-75.
- Electroacupuncture at PC 6 and ST 36 helps **control chemotherapy-induced emesis.**[8]
- Acupuncture at PC 6 was effective in treating **nausea and vomiting in early pregnancy.**[9]
- Acupressure at PC 6 was effective in relieving **morning sickness.**[10]
- A meta-analysis evaluating various means of stimulating PC 6 found that these nonpharmacologic techniques were equivalent to commonly used antiemetic drugs for the **prevention of postoperative nausea and vomiting.**[11]
- Acupuncture at PC 6 and CV 13 was as effective alternative to ondansetron for the prevention of **postoperative vomiting in children undergoing dental surgery with general anesthesia.**[12]
- Electroacupuncture at PC 6 significantly inhibited the rate of transient lower esophageal sphincter relaxations triggered by gastric distention. This suggests that electroacupuncture may help **gastroesophageal reflux disease** requires further study.[13]
- Electroacupuncture simultaneously at both PC 6 and ST 36 has a synergistic effect on **gastric myoelectrical activity.**[14]
- Transcutaneous electrical stimulation at PC 6 outperformed standard promotility medication in the treatment of **delayed gastric emptying** in critically ill patients, providing a convenient, non-invasive, safe, and inexpensive option for the prevention and treatment of malnutrition in critically ill individuals.[70]
- Acupuncture at ST 36, CV 12, and PC 6 served as an effective short- and medium-term treatment for **chronic idiopathic dyspepsia,** with fewer adverse effects and longer effectiveness than treatment with the prokinetic agent, domperidone.[15]
- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis.**[16]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully treated **sleep-related laryngospasm** with gastroesophageal reflux, refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[17]
- Central opioid pathways may be involved in **antiemetic effects.**[18]
- Acupuncture at PC 6 and ST 36 **lowered resting heart rate and CO_2 production.**[19]
- Acupuncture stimulation of LI 4 and PC 6 modulates heart rate variability differently under **fatigue or non-fatigue** states.[20]
- Electroacupuncture at ST 36 and PC 6 enhances **gastric motility** by affecting the migrating myoelectrical complex.[21]
- Acupuncture at PC 6 can improve left ventricular function temporarily in patients with **coronary artery disease.**[22,23]
- Electrical stimulation of the median nerve diminishes **regional myocardial ischemia** triggered by sympathetically mediated elevations in cardiac oxygen demand.[24]
- Acupuncture at PC 6 increased cardiac contraction in patients with **cardiomyopathy.**[25]

- Acupuncture at BL 14 and PC 6 caused bidirectional regulation of cardiac sympathetic and vagal nerve activities in a **cardioprotective** fashion.[26]
- Following **acute myocardial infarction,** patients receiving acupuncture at CV 14, CV 17, ST 36, PC 6, and SP 6 demonstrated the following changes: reduced blood viscosity and myocardial oxygen consumption, improved microcirculation and left ventricular function, improved collateral circulation, and reduced the area of infarction.[27]
- Electroacupuncture at PC 6, LU 2, and LU 7 may alleviate cardiac ischemia-reperfusion injury in adults undergoing **heart valve replacement.**[71]
- Acupuncture at PC 6 and HT 7 helps prevent **ventricular fibrillation secondary to myocardial** infarction in experimental rats.[28]
- Neural tracer investigation found central neural pathways from the heart and acupuncture points PC 6 and HT 7 in the middle cervical, stellate, and T4 sympathetic ganglia and the T2 to T6 spinal ganglia. Sites of overlap were also found in the brain and spinal cord, illustrating the interrelationship of PC 6, HT 7, and **autonomic regulation of heart function.**[29]
- Acupuncture at PC 6 demonstrated an **antiarrhythmic effect** in patients with both persistent and paroxysmal atrial fibrillation.[72]
- Electroacupuncture at PC 4 and PC 6 regulates blood pressure in cases of **hypotension and hemorrhagic shock.**[30,31,32,33]
- Acupuncture at ST 36, BL 15, BL 20, HT 5, and PC 6 reduced the number of attacks per week in **angina pectoris** patients and reduced ST-segment depression during exercise, possibly indicating protection of the myocardium from ischemia.[34]
- Electroacupuncture at PC 6 reduced the extent and severity of **myocardial injury** in a canine model after ligation of the coronary arteries.[35]
- Electroacupuncture at PC 6 and SP 4 significantly improved **recovery of cardiac and gastric electrical activities** after experimentally induced acute myocardial ischemia in rats, seemingly by up-regulating nitric oxide synthase expression in the myocardium as well as in the tissues of the gastric antrum and duodenum.[36]
- Manual acupuncture at PC 6 modulates **mean blood pressure and heart rate variability.**[37]
- Low level laser applied to PC 6 increased vagal activity and suppressed cardiac sympathetic nerve activity, potentially helping patients with **circadian rhythm challenges** due to taking jobs as night shift workers.[38]
- Laser stimulation of PC 6, ST 36, and LR 3 **modulated cardiovascular function** in anesthetized rats.[73]
- Acupuncture at PC 6 and ST 36 improved circadian rhythms of blood pressure in patients with **essential hypertension.**[74]
- Electroacupuncture at PC 6 improved **orthostatic tolerance** in healthy individuals by activating the sympathetic nervous system and improving cardiac function.[75]
- Acupuncture at LI 4, LR 3, and PC 6 inhibited sympathetic activation during **mental stress in advanced heart failure** patients.[39]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal hot flushes and sweating episodes.**[40]
- Acupuncture at PC 6, LR 3, SP 6, LI 4, LI 11, CV 2, CV 6, CV 12, and GV 20 effectively treated **premenstrual syndrome.**[76]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combination with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome,** thereby offering an alternative to pharmacologic induction of ovulation.[41]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL2 2, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[42]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[43]
- Acupuncture needling at PC 6 resulted in a significantly reduced level of **perfusion** at the tip of the middle finger immediately after needle insertion. This was followed, after one minute, by a marked increase in peripheral perfusion.[44]
- Acupuncture at PC 6, BL 56, and GV 6 exhibited higher norepinephrine concentration in the skin and greater 3H-NE release than did stimulation of sham points. Nitric oxide (NO), an important messenger molecule, appears to be responsible for inducing these changes, acting like a neurotransmitter itself with **diverse functions** in certain circumstances.[45]
- Acupuncture stimulation of GV 14 caused hypothermia via a decrease in metabolic rate, an increase in cutaneous circulation on the back, and perspiration. In contrast, acupuncture stimulation of PC 6 or ST 36 produced a slight hyperthermia, putatively due to a decrease in **cutaneous circulation.**[46]
- Acupuncture at SP 6 produced a strong **vasoconstriction** in the ipsilateral leg and a slight vasoconstriction in the contralateral leg with no change in the arms. Stimulation of ST 36 produced a superficial vasoconstriction in the skin of both legs but no change in the arms. Stimulation of PC 6 or LI 11 caused ipsilateral vasoconstriction in the arms only. This information suggests a topographical representation in the neural segments responsible for the change in sympathetic activity.[47]
- Acupuncture at LU 7, LI 4, LI 11, ST 40, PC 3, and PC 6 resulted in immediate improvement in forced expiratory volume in 1 second (FEV1) in **asthma patients.**[48]
- Acupuncture-like transcutaneous nerve stimulation at SP 6, ST 36, LI 4, and CV 24 improves whole saliva production in patients with **radiation-induced xerostomia** in head-and-neck cancer patients treated with radical radiotherapy.[49]
- Acupuncture at LI 4 and PC 6 effectively treated acute postoperative pain in a patient with **pregnancy-induced thrombocytopenia.**[50]
- Acupuncture at LI 4 and PC 6 **increased pain threshold and pain tolerance** in the skin over the thyroid.[51]
- “Magnitopuncture” at PC 6 and GV 14 reduced the effects of **driving fatigue.**[52]

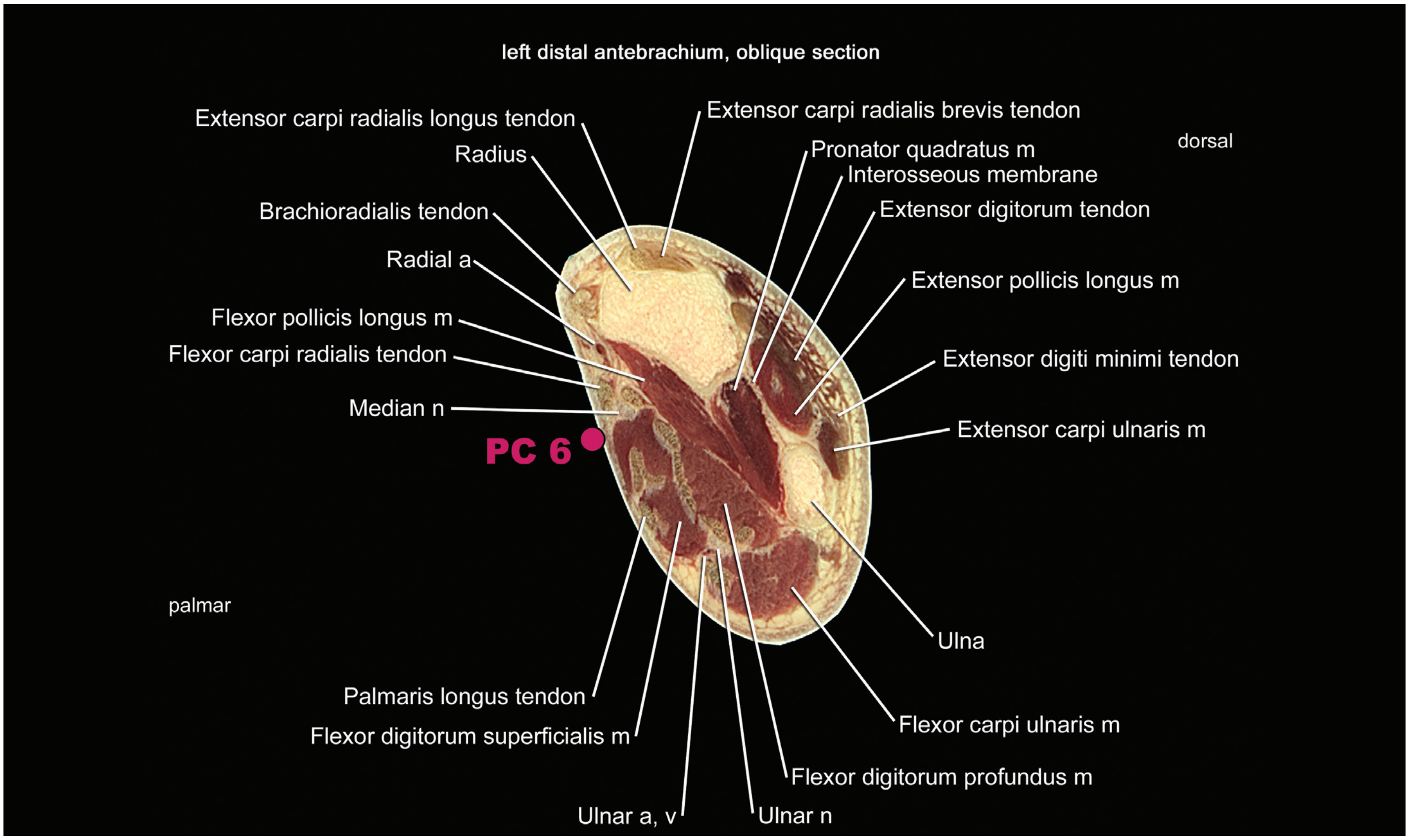

left distal antebrachium, oblique section
Extensor carpi radialis longus tendon
Extensor carpi radialis brevis tendon
Radius
Pronator quadratus m
dorsal
Interosseous membrane
Brachioradialis tendon
Extensor digitorum tendon
Radial a
Extensor pollicis longus m
Flexor pollicis longus m
Flexor carpi radialis tendon
Extensor digiti minimi tendon
Median n
Extensor carpi ulnaris m
PC 6
palmar
Ulna
Palmaris longus tendon
Flexor carpi ulnaris m
Flexor digitorum superficialis m
Flexor digitorum profundus m
Ulnar a, v
Ulnar n

Figure 9-19. Note the proximity of the median nerve to PC 6 in this cross section. Median nerve trauma through over-vigorous needling could injure the nerve and invoke a transient neuropraxia.

- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in prophylaxis of **migraine** compared to flunarizine.[53]
- Electroacupuncture from PC 5 to PC 6 **reduced the severity of hypotension** during anesthesia in patients undergoing liver transplantation, with no significant differences observed between the electroacupuncture group and those receiving norepinephrine as a vasoconstrictor.[77]
- Electroacupuncture at certain points such as PC 5 or PC 6 or LU 7 and LI 4, in addition to several others, may **improve exercise performance and post-exercise recovery.**[78]

References

1. Fernandez-de-las-Penas, de la Llave-Rincon AI, Fernandez-Camero, et al. Bilateral widespread mechanical pain sensitivity in carpal tunnel syndrome: evidence of central processing in unilateral neuropathy. *Brain*. 2009;132(Pt 6):1472-1479.
2. Yang CP, Hsieh CL, Wang NH, et al. Acupuncture in patients with carpal tunnel syndrome: a randomized controlled trial. *Clin J Pain*. 2009;25(4):327-333.
3. Al-Sadi M, Newman B, and Julious SA. Acupuncture in the prevention of postoperative nausea and vomiting. *Anaesthesia*. 1997;52:658-661.
4. Lu DP, Lu GP, and Reed JF. Acupuncture/acupressure to treat gagging dental patients: a clinical study of anti-gagging effects. *General Dentistry*. 2000;July/August: 446-452.
5. Dent HE, Dewhurst NG, Mills SY, and Willoughby M. Continuous PC 6 wristband acupressure for relief of nausea and vomiting associated with acute myocardial infarction: a partially randomized, placebo-controlled trial. *Complementary Therapies in Medicine*. 2003;11:72-77.
6. Yoo S-S, Teh E-K, Blinder RA, and Jolesz FA. Modulation of cerebellar activities by acupuncture stimulation: evidence from fMRI study. *NeuroImage*. 2004;22:932-940.
7. Kabalak AA, Akcay M, Akcay F, and Gogus N. Transcutaneous electrical acupoint stimulation versus ondansetron in the prevention of postoperative vomiting following pediatric tonsillectomy. *Journal of Alternative and Complementary Medicine*. 2005;11(3):407-413.
8. Shen J, Wenger N, Glaspy J, Hays RD, Albert PS, Choi C, and Chekelle PG. Electroacupuncture for control of myeloablative chemotherapy-induced emesis. A randomized controlled trial. *JAMA*. 2000;284:2755-2761.
9. Smith C, Crowther C, and Beilby J. Acupuncture to treat nausea and vomiting in early pregnancy: a randomized controlled trial. *Birth*. 2002;29(1):1-9.
10. De Aloysio D and Penacchioni P. Morning sickness control in early pregnancy by Neiguan point acupressure. *Obstetrics & Gynecology*. 1992;80:852-854.
11. Lee A and Done ML. The use of nonpharmacologic techniques to prevent postoperative nausea and vomiting: a meta-analysis. *Anesth Analg*. 1999;88:1362-1369.
12. Somri M, Vaida SJ, Sabo E, Yassain G, Gankin I, and Gaitini LA. Acupuncture versus ondansetron in the prevention of postoperative vomiting. A study of children undergoing dental surgery. *Anaesthesia*. 2001;56:927-932.
13. Zou D, Chen WH, Iwakiri K, Rigda R, Tippett M, and Holloway RH. Inhibition of transient lower esophageal sphincter relaxations by electrical acupoint stimulation. *AJP-GI*. 2005;289:197-201.
14. Shiotani A, Tatewaki M, Hoshino E, and Takahashi T. Effects of electroacupuncture on gastric myoelectrical activity in healthy humans. *Neurogastroenterol Motil*. 2004;16:293-298.
15. Cittadini M, Marmori F, Diacinti D, and Walker JI. Randomized trial of acupuncture compared with prokinetic drugs and sham acupuncture for chronic idiopathic dyspepsia. *Medical Acupuncture*. 14(2). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol14_2/article2.html.
16. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine*. 2004;24(3):163-165.
17. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci*. 2003;326(2):107-109.
18. Tatewaki M, Strickland C, Fukuda H, Tsuchida D, Hoshino E, Pappas TN, Takahashi T. Effects of acupuncture on vasopressin-induced emesis in conscious dogs. *Am J Phsyiol Regul Integr Comp Physiol*. 2005;288:R401-R408.
19. Lin J-G, Ho S-J, and Lin J-C. Effect of acupuncture on cardiopulmonary function. *Chinese Medical Journal*. 1996;109(6):482-485.
20. Li Z, Want C, Mak AFT, and Chow DHK. Effects of acupuncture on heart rate variability in normal subjects under fatigue and non-fatigue state. *Eur J Appl Physiol*. 2005;94:633-640.
21. Qian L, Peters LJ, and Chen JDZ. Effects of electroacupuncture on gastric migrating myoelectrical complex in dogs. *Digestive Diseases and Sciences*. 1999;44(1):56-62.
22. Ho F-M, Huang P-J, Lo H-M, Lee F-K, Chern T-H, Chiu T-W, and Liau C-S. Effect of acupuncture at Nei-Kuan on left ventricular function in patients with coronary artery disease. *American Journal of Chinese Medicine*. 1999;27(2):149-156.
23. Chen S. Improvement of left heart function in CHD patients by needling Neiguan. *Inter-*

national Journal of Clinical Acupuncture. 1997;9(2):121-124.

24. Li P, Pitsillides KF, Rendig SV, Pan H-L, and Longhurst JC. Reversal of reflex-induced myocardial ischemia by median nerve stimulation. A feline model of electroacupuncture. *Circulation*. 1998;97:1186-1194.

25. Chen S, Bao S, Chang P, Zang D, Lu H, Yu G, Zheng D, Wu J, Qian D, and Huang M. Preliminary investigation on the effect of acupuncture of Neiguan (P.6) and Shaofu (H.8) on cardiac function of idiopathic cardiomyopathy. *Journal of Traditional Chinese Medicine*. 1983;3(2):113-120.

26. Shi X, Zhao Y, Want X, and Duan D. Research on the action of acupuncture on human cardiac autonomic nerve. *Acupuncture Research*. 2992;27(1):68-70.

27. Zhu B, Bi L, Liang S, Pang L, Wang S, Liu J, Jiang A, Li C, Ye Z, Yang H, Chen Z, Wang K, Bian S, Guo X, and Hong H. Effect of acupuncture on left ventricular function, microcirculation, blood rheology and cyclicnucleotides in patients with acute myocardial infarction. *Journal of Traditional Chinese Medicine.* 1989;9(1):63-68.

28. Guan X, Zhang J, Shi B, Chen Y, and Ouyang X. Acupuncture in prevention of ventricular fibrillation secondary to myocardial infarction: animal experiment to explore its mechanism. *International Journal of Clinical Acupuncture*. 1993;4(3):235-242.

29. Jang I, Cho K, Moon S, Ko C, Lee B, Ko B, and Lee C. A study on the central neural pathway of the heart, Nei-Kuan (EH-6) and Shen-Men (He-7) with neural tracer in rats. *American Journal of Chinese Medicine*. 2003;31(4):591-609.

30. Yin S, Cao Y, and Zhang J. Treatment of primary hypotension by electroacupuncture at Neiguan and Gongsun. *Journal of Traditional Chinese Medicine*. 2004;24(3):193.

31. Song X, Tang Z, Hou Z, and Zhu S. An experimental study on acupuncture anti-hemorrhagic shock. *Journal of Traditional Chinese Medicine*. 1993;13(3):207-210.

32. Syuu Y, Matsubara H, Kiyooka T, Hosogi S, Mohri S, Araki J, Ohe T, and Saga H. Cardiovascular beneficial effects of electroacupuncture at Neiguan (PC-6) acupoint in anesthetized open-chest dog. *Japanese Journal of Physiology*. 2001;51:231-238.

33. Syuu Y, Matsubara H, Hosogi S, and Suga H. Pressor effect of electroacupuncture on hemorrhagic hypotension. *Am J Physiol Regul Integr Comp Physiol.* 2003;285:R1446-R1452.

34. Richter A, Herlitz J, and Hialmarson A. Effect of acupuncture in patients with angina pectoris. *European Heart Journal*. 1991;12:175-178.

35. Meng J. The effects of acupuncture in treatment of coronary heart diseases. *Journal of Traditional Chinese Medicine.* 2004;24(1):16-19.

36. Want S-B, Chen S-P, Gao Y-H et al. Effects of electroacupuncture on cardiac and gastric activities in acute myocardial ischemia rats. *World J Gastroenterol*. 2008;14(42):6496-6502.

37. Chang S, Chao W-L, Chiang M-J, et al. Effects of acupuncture at Neiguan (PC 6) of the Pericardial meridian on blood pressure and heart rate variability. *Chinese Journal of Physiology*. 2008;51(3):167-177.

38. Wu J-H, Chen H-Y, Chang Y-J, et al. Study of autonomic nervous activity of night shift workers treated with laser acupuncture. *Photomedicine and Laser Surgery*. 2009;27(2):273-279.

39. Middlekauff HR, Hui K, Yu JL, Hamilton MA, Fonarow GC, Moriguchi J, Maclellan WR, and Hage A. Acupuncture inhibits sympathetic activation during mental stress in advanced heart failure patients. *Journal of Cardiac Failure*. 2002;8(6):399-406.

40. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society*. 1995;2(1):3-12.

41. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand*. 2000;79:180-188.

42. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.

43. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.

44. Litscher G, Wang L, Huber E, and Nilsson G. Changed skin blood perfusion in the fingertip following acupuncture needle introduction as evaluated by laser Doppler perfusion imaging. *Lasers Med Sci*. 2002;17:19-25.

45. Chen J-X, Ibe BO, Ma S-X. Nitric oxide modulation of norepinephrine production in acupuncture points. *Life Sciences*. 2006;79:2157-2164.

46. Lin M-T, Liu G-G, Soong J-J, Chern Y-F, and Wu K-M. Effects of stimulation of acupuncture loci Ta-Chuei (Go-14), Nei-Kuan (EH-6) and Tsu-San-Li (St-36) on thermoregulatory function of normal adults. *Am J Chin Med*. 1979;7(4):324-332.

47. Lin M-T, Chandra A, and Chen-Yen S-M. Effects of needle stimulation of acupuncture loci Nei-Kuan (EH-6), Tsu-San-Li (St-36), San-Yin-Chiao (Sp-6) and Chu-Chih (LI-11) on cutaneous temperature and pain threshold in normal adults. *Am J Chin Med*. 1982;9(4):305-314.

48. Chu K-A, Wu Y-C, Lin M-H, and Wang H-C. Acupuncture resulting in immediate bronchodilating response in asthma patients. *J Chin Med Assoc*. 2005;68(12):591-594.

49. Wong RKW, Jones GW, Sagar SM, Babjak A-F, and Whelan T. A Phase I-II study in the use of acupuncture-like transcutaneous nerve stimulation in the treatment of radiation-induced xerostomia in head-and-neck cancer patients treated with radical radiotherapy. *Int J Radiation Oncology Biol Phys*. 2003;57(2):472-480.

50. Oomman S, Liu D, and Cummings M. Acupuncture for acute postoperative pain relief in a patient with pregnancy-induced thrombocytopenia – a case report. *Acupuncture in Medicine*. 2005;23(2):83-85.

51. Stacher G, Wancura I, Bauer P, Lahoda R, and Schulze D. Effect of acupuncture on pain threshold and pain tolerance determined by electrical stimulation of the skin: a controlled study. *American Journal of Chinese Medicine*. 1975;3(2):143-149.

52. Li Z, Jiao K, Chen M, and Wang C. Reducing the effects of driving fatigue with magnitopuncture stimulation. *Accident Analysis and Prevention*. 2004;36:501-505.

53. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache*. 2002;42:855-861.

54. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg*. 2005;9(1):29-34.

55. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main*. 2007;26(6):255-277.

56. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther*. 2006;19:137-145.

57. Green JB and Zelouf DS. Forearm instability. *J Hand Surg*. 2009;34A:953-961.

58. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg*. 2009;34A:953-961.

59. Koo JT and Szabo RM. Compression neuropathies of the median nerve. *Journal of the American Society for Surgery of the Hand*. 2004;4(5):156-175.

60. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther*. 2005;18:216-229.

61. Ulrich D, Piatkowski A, and Pallua N. Anterior interosseous nerve syndrome: retrospective analysis of 14 patients. *Arch Orthop Trauma Surg*. 2011;131:1561-1565.

62. Tagliafico A, Perez MM, Padua L, et al. Increased reflectivity and loss in bulk of the pronator quadratus muscle does not always indicate anterior interosseous neuropathy on ultrasound. *European Journal of Radiology*. 2013;82(3):526-529.

63. Zhou W, Hsiao I, Lin VWH, et al. Modulation of cardiovascular excitatory responses in rats by transcutaneous magnetic stimulation: role of the spinal cord. *J Appl Physiol*. 2006;100:926-932.

64. Guo Z-L, Li M, and Longhurst JC. Nucleus ambiguus cholinergic neurons activated by acupuncture: relation to encephalin. *Brain Research*. 2012;1442:25-35.

65. Jeon I-C, Kim M-S, and Kim S-H. Median nerve stimulation in a patient with complex regional pain syndrome type II. *J Korean Neurosurg Soc*. 2009;46:273-276.

66. Mirone G, Natale M, and Rotondo M. Peripheral median nerve stimulation for the treatment of iatrogenic complex regional pain syndrome (CRPS) type II after carpal tunnel surgery. *Journal of Clinical Neuroscience*. 2009;16:825-827.

67. Wright TW. Interosseous membrane of the forearm. *Journal of the American Society for Surgery of the Hand*. 2001;1(2):123-134.

68. Khosrawi S, Moghtaden A, and Haghighat S. Acupuncture in treatment of carpal tunnel syndrome: a randomized controlled trial study. *J Res Med Sci*. 2012;17(1):1-7.

69. Sari E and Sari T. The role of acupuncture in the treatment of orthodontic patients with a gagging reflex: a pilot study. *Br Dent J*. 2010;208(10):E19.

70. Pfab F, Winhard M, Nowak-Machen M, et al. Acupuncture in critically ill patients improves delayed gastric emptying: a randomized controlled trial. *Anesth Analg*. 2011;112(1):150-155.

71. Yang L, Yang J, Wang Q, et al. Cardioprotective effects of electroacupuncture pretreatment on patients undergoing heart valve replacement surgery: a randomized controlled trial. *Ann Thorac Surg*. 2010;89:781-786.

72. Lombardi F, Belletti S, Battezzati PM, et al. Acupuncture for paroxysmal and persistent atrial fibrillation: an effective non-pharmacological tool? *World J Cardiol*. 2012;4(3):60-65.

73. Friedemann T, Shen X, Bereiter-Hahn J, et al. Regulation of the cardiovascular function by CO_2 laser stimulation in anesthetized rats. *Lasers Med Sci*. 2012;27(2):469-477.

74. Kim HM, Cho SY, Park SU, et al. Can acupuncture affect the circadian rhythm of blood pressure? A randomized, double-blind, controlled trial. *J Altern Complement Med*. 2012;18(10):918-923.

75. Sun J, Sang H, Yang C, et al. Electroacupuncture improves orthostatic tolerance in healthy individuals via improving cardiac function and activating the sympathetic system. *Europace*. 2013;15(1):127-134.

76. Anil A, Peker T, Goktas T, et al. Importance of acupuncture on premenstrual syndrome. *Clin Exp Obstet Gynecol*. 2012;39(2):209-213.

77. Sahmeddini MA, Eghbal MH, Khosravi MB, et al. Electro-acupuncture stimulation at acupoints reduced the severity of hypotension during anesthesia in patients undergoing liver transplantation. *J Acupunct Meridian Stud*. 2012;5(1):11-14.

78. Urroz P, Colagiuri B, Smith CA, et al. Effect of acute acupuncture treatment on exercise performance and postexercise recovery: a systematic review. *The Journal of Alternative and Complementary Medicine*. 2013;19(1):9-16.

79. Robinson LR, Micklesen PJ, Tirschwell DL, et al. Predictive value of somatosensory evoked potentials for awakening from coma. *Crit Care Med*. 2003;31(3):960-967.

PC 7

Da Ling "Great Mound"

On the volar aspect of the wrist, along the distal crease, on the ulnar side of the flexor carpi radialis tendon. If the palmaris longus tendon exists, PC 7 lies between it and the flexor carpi radialis tendon. Level with HT 7.

Caution: The median nerve is superficial and close to this point.[1] Needling the nerve can generate an electrical sensation. Do not traumatize the nerve through excessive stimulation.

Connective Tissues

- **Flexor retinaculum (includes the transverse carpal ligament):** Holds the flexor tendons in place. The deep part of the flexor retinaculum, called the transverse carpal ligament, attaches to the hook of the hamate and the tubercle of the trapezium bone.[5] The median nerve travels deep to the transverse carpal ligament on the radial aspect of the tunnel. While Figure 9-22 elucidates the anatomical relationships in cross section at PC 7, this is an oblique section, which changes the appearance of structures traversing this level. Nevertheless, Figure 9-22 does reveal the tight packing of tunnel contents.

The carpal tunnel, existing in two distinct parts, narrows in its distal portion, described as that section between the hamulus, or hook, of the hamate bone and the tubercle of the trapezium. The transverse carpal ligament thickens and tenses in this zone, whereas it thins and slackens at the proximal portion, between the pisiform bone and scaphoid tubercle. This allows contents inhabiting the proximal tunnel to expand. Severe or chronic carpal tunnel syndrome constricts the median nerve to such an extent that it acquires an "hour glass deformity" through the narrow zone. The palmar wrist crease

The distal tunnel contains nine tendons, including the flexor pollicis longus and superficial and deep digital flexors for each of the four fingers, making for a crowded channel coursing beneath the transverse carpal ligament. The flexor carpi radialis tendon occupies its own osteofibrous tunnel.

Fibers from thenar and hypothenar muscle fascia join and blend with dorsal fascia of the palmaris brevis muscle to create a fascial plane superficial to the transverse carpal ligament.[6] Preserving this connective tissue bridge, should surgery prove to be necessary, maintains pinch strength.

Clinical Relevance: Entrapment likely results from the narrowness of the distal carpal tunnel, combined with the thickness and tension of the transverse carpal ligament in this section, impacting the tunnel's contents. Thus, releasing restrictions with acupuncture and related techniques can reduce the pain and numbness that accompanies carpal tunnel syndrome.

The location of PC 7 at the palmar wrist crease places the point at the proximal border of the transverse carpal ligament, where more space exists for tunnel contents, in contrast to the distal region. Thus, treatment for carpal tunnel constriction should follow the course of the PC line to free the tissue of the narrow part, between PC 7 and PC 8. Consider, too, the location of PC 7 between the flexor carpi radialis and the tunnel. This places the point atop the transverse carpal ligament, where it bridges from the palmar fascia to the trapezium.

Tendons

- **Flexor digitorum superficialis tendon:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Flexor digitorum profundus tendon:** Flexes the distal phalanges

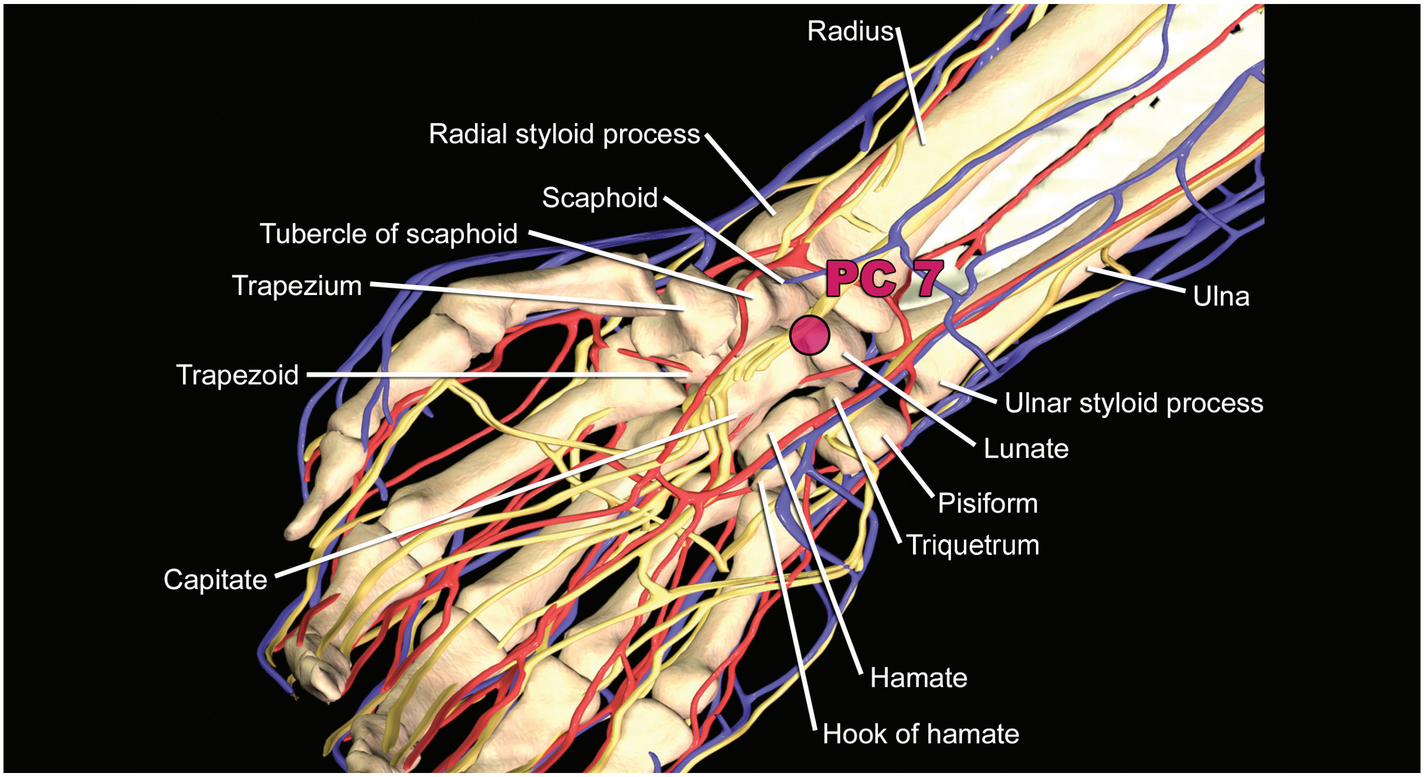


Figure 9-20. The proximity of the median nerve to PC 7 explains its pre-eminence in acupuncture approaches for carpal tunnel syndrome.

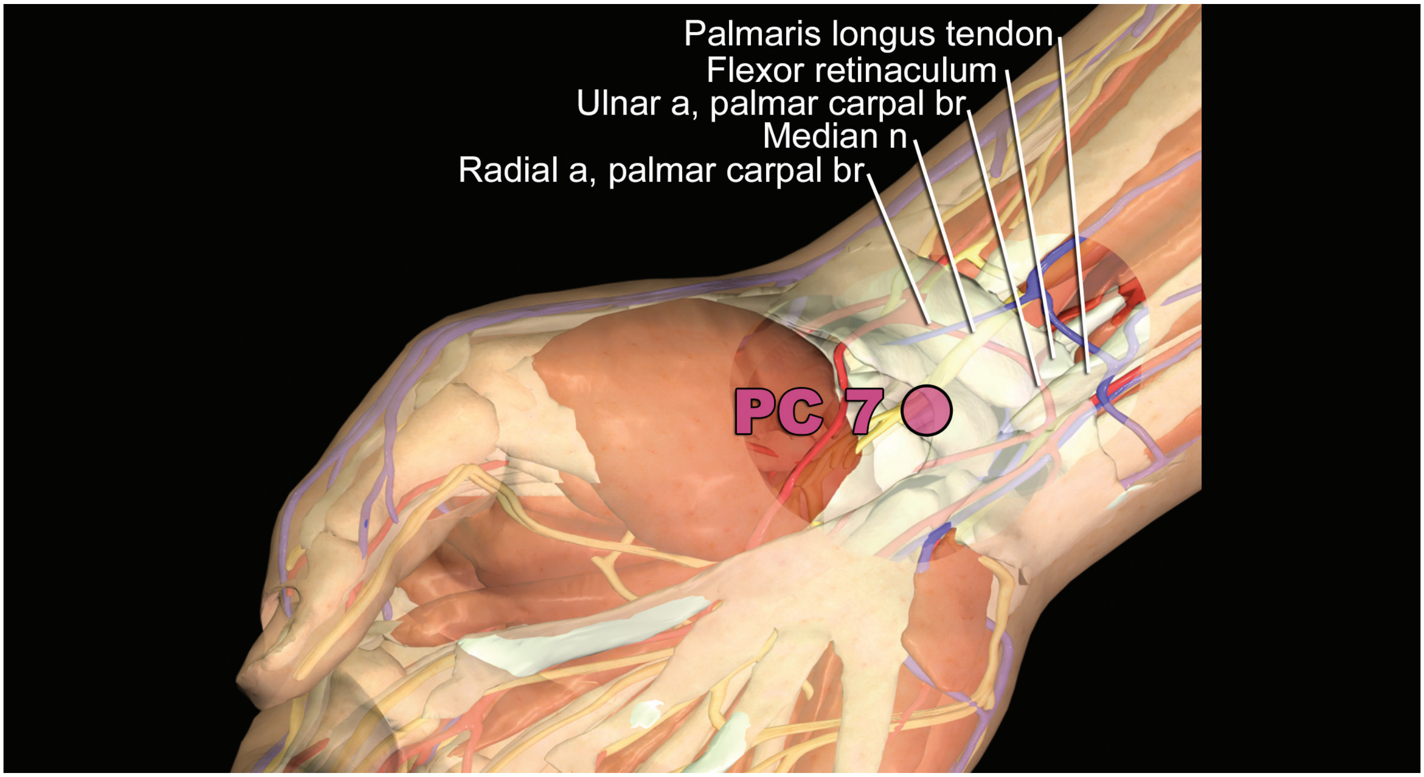


Figure 9-21. This semi-transparent muscle layer illustrates the neurovascular anatomy relevant to PC 7, namely the median nerve and the communicating branches between the radial and ulnar arteries. Dynamic wrist motion changes the position of neurovascular and tendinous structures within the carpal tunnel, arguing for employing appropriate therapeutic exercises and manual therapy treatments to maintain free mobility of these structures to avoid compression and sidestep surgery.[25]

of the fingers at the distal interphalangeal joints.

- **Palmaris longus tendon:** Tightens the palmar aponeurosis and flexes the hand at the wrist.
- **Flexor carpi radialis tendon:** Flexes and abducts the hand at the wrist. The flexor carpi radialis tendon sits outside the carpal tunnel, separated from it by a deep portion of the transverse carpal ligament.[7]

Clinical Relevance: Trigger point pathology in the following muscles at or near PC points on the proximal forearm lead to their respective pain referral patterns, which may follow tendons traveling toward the wrist:

- **Flexor digitorum superficialis and profundus:** Radial head of each muscle group refers pain to the palmar middle finger from PC 8 to PC 9.
- **Palmaris longus:** Pain from a palmaris longus trigger point just proximal to PC 4 sends pain along the PC channel to the palm between PC 8 and HT 8, where it centralizes.
- **Flexor carpi radialis:** Issues pain along the PC channel to the wrist, centered strongly over PC 7 and spilling toward LU 9. At times, extends to the palm near PC 8.

In addition, a myofascial trigger point in the medial head of the triceps can cause pain to travel from the elbow at PC 3-HT 3 where it localizes strongly. The pain pattern then extends down the PC/HT line to the ring finger and pinky.

Patients with anomalous muscles, tendons, or fibrous bands linking structures together, accentuate median nerve compression.[8]

Note how, as Figure 9-21 reveals, the palmaris longus tendon expands at the level of PC 7 into the fascia of the thenar eminence. This distal fascial feature along the superficial flexor surface of the thoracic limb joins the tendon to the palmar aponeurosis. The myofascial continuum expressed in acupuncture as the PC channel thereby extends from the pectoralis major muscle (PC 1) to the medial intermuscular septum of the brachium (PC 2), over the cubital fossa to the flexor digitorum superficialis and palmaris longus. This final connection to the palmar aponeurosis brings the connective tissue out toward the fingers.

Traction along the axis of the palmaris longus tendon pulls upon the palmar and thenar fasciae. Releasing this region with manual therapy or stretching may alleviate stiffness and the neurovascular compression it can cause. The propagation of impulse along fascial planes with acupuncture can induce channel effects from distal thoracic limb to the upper chest, where the PC line began.

Nerves

- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm. A branch of the ulnar nerve.
- **Lateral antebrachial cutaneous nerve, from the musculocutaneous nerve (C6, C7):** Supplies the radial volar aspect of the forearm, and a portion of the dorsal radial aspect of the distal forearm.
- **Median nerve (C6-T1):** Muscular branches supply the pronator teres and pronator quadratus muscles and all of the forearm flexors (including the flexor carpi radialis, the palmaris longus,

and the flexor digitorum superficialis muscles), except the flexor carpi ulnaris and medial half of the flexor digitorum profundus muscle. The median nerve innervates all of the thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Also supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), along with the radial aspect of the ring finger, as well as the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

The median nerve enters the carpal tunnel midway between the radius and ulna or slightly radial of midline. Its position within the tunnel shifts in accordance with hand movement. Anatomical variations of the median nerve include accessory branches including nerve duplications. The thenar branch of the median nerve most often separates distal to the transverse carpal ligament, but it may instead perforate the flexor retinaculum through its own tunnel.[9]

- **Anterior interosseous nerve:** Arises from the median nerve. Supplies the flexor digitorum profundus, the flexor pollicis longus, and the pronator quadratus muscles. Also supplies the anterior surface of the interosseous membrane.

Clinical Relevance: Proximal to the wrist, the median nerve sits deep within the volar antebrachium, sandwiched between the superficial and deep digital flexor muscles. Between PC 6 and PC 7, the nerve curves around the lateral aspect of the superficial digital flexor to rest atop or adjacent to the tendon bundle at the wrist (see Figure 9-22). The nerve then enters the carpal tunnel, risking entrapment, except for its superficial palmar nerve branch. This cutaneous branch of the median nerve circumvents the carpal tunnel and thus sidesteps the problem.

Isolated anterior interosseous nerve compression may occur after repetitive movement involving flexion of the elbow and/or pronation of the forearm.[1] Injury of the anterior interosseous nerve manifests as weakness in interphalangeal joint flexion or paresis of the distal interphalangeal joints of the index and middle fingers.[10] Pain arises in the volar antebrachium; people with isolated anterior interosseous neuropathy cannot make the “ok” sign with the thumb and forefinger, making a pinching movement with these digits. Handwriting also becomes difficult.[11]

Compression of the anterior interosseous nerve occurs along the course of the PC channel and follows trauma, iatrogenic injury (dressings, slings, venipuncture), and elbow or shoulder arthroscopy. Anatomic sources of compression include: 1) the tendinous origin of the deep head of either the pronator teres or flexor digitorum superficialis to the middle finger; 2) a site of thrombosis of the ulnar collateral vessels crossing the anterior interosseous nerve; 3) accessory muscles or tendons of the flexor digitorum superficialis or the flexor pollicis longus (i.e., Gantzer’s muscle); 4) an aberrant radial artery; 5) tendinous portions of the palmaris longus or flexor carpi radialis brevis muscles, or 6) an enlarged bicipital bursa in the vicinity of PC 3.

Entrapment sites of the anterior interosseous and median nerves resemble one another because they pursue parallel trajectories. No matter which nerve becomes compressed, physical medicine can improve the symptoms by releasing the dysfunction at the heart of the entrapment.

Median nerve stimulation itself may prove therapeutic for a number of conditions. First and foremost, neuromodulation of the median nerve facilitates its recovery from the problems described above, wherein chronic pressure compromises nerve health. In addition, median nerve stimulation affords an array of homeostatic effects based on its neuromodulation of rostral ventrolateral medulla (RVLM) function. The RVLM affects cardiopulmonary physiology; neuromodulation through physical medicine modalities modulates cardiovascular excitatory responses.[12] Acupuncture points along the median nerve regulate blood pressure and protect against hypotension. Stimulation of PC 5 and PC 6 also alters cardiovascular function by acting on the cholinergic neurons in the nucleus ambiguus, likely by means of enkephalinergic pathways.[13]

Median nerve stimulation also treats causalgia, otherwise known as complex regional pain syndrome type II (CRPS II).[14] It also reduces neuropathic pain in cases of median nerve damage following carpal tunnel surgery.[15]

Chronic regional pain disorders typically exhibit autonomic features such as vasomotor or sudomotor dysfunction. CRPS type I (reflex sympathetic dystrophy) produces: skin color changes, edema, abnormal sweating (sudomotor activity), regional pain, dysesthesia, temperature changes, and a history of trauma or a noxious event. CRPS type II adds a peripheral nerve lesion such as neuroma. Peripheral nerve stimulation provided by acupuncture and related techniques should precede implanted nerve stimulators or spinal cord stimulation, in that the non-invasive neuromodulation affords a safer and more comfortable method of fostering nerve repair and analgesia.

Vessels

- **Anastomosis between palmar carpal branches of radial and ulnar arteries:** The carpal arterial arch joins the radial and ulnar arteries.
- **Superficial venous palmar arch:** Joins tributaries of the basilic and cephalic veins.

Clinical Relevance: Superficial and deep vascular networks supply the flexor retinaculum at the wrist.[16] The superficial network arises from branches of the ulnar artery. The deep network forms from branches of the palmar superficial arch. Vessels traversing the wrist at the level of PC 7 are at risk of iatrogenic damage during carpal tunnel surgery. Anatomic variations of the ulnar artery place the vessel at heightened risk of injury during transverse carpal ligament resection.[17] Acupuncture, laser therapy, and manual treatment of the region may aid in patient recovery by benefiting local circulation.

Up to one quarter of patients undergoing surgical carpal tunnel release experience complications and/or treatment failure.[18] Causes of complications include hematoma, skin necrosis, iatrogenic injuries intraoperatively, and infection. Incomplete decom-

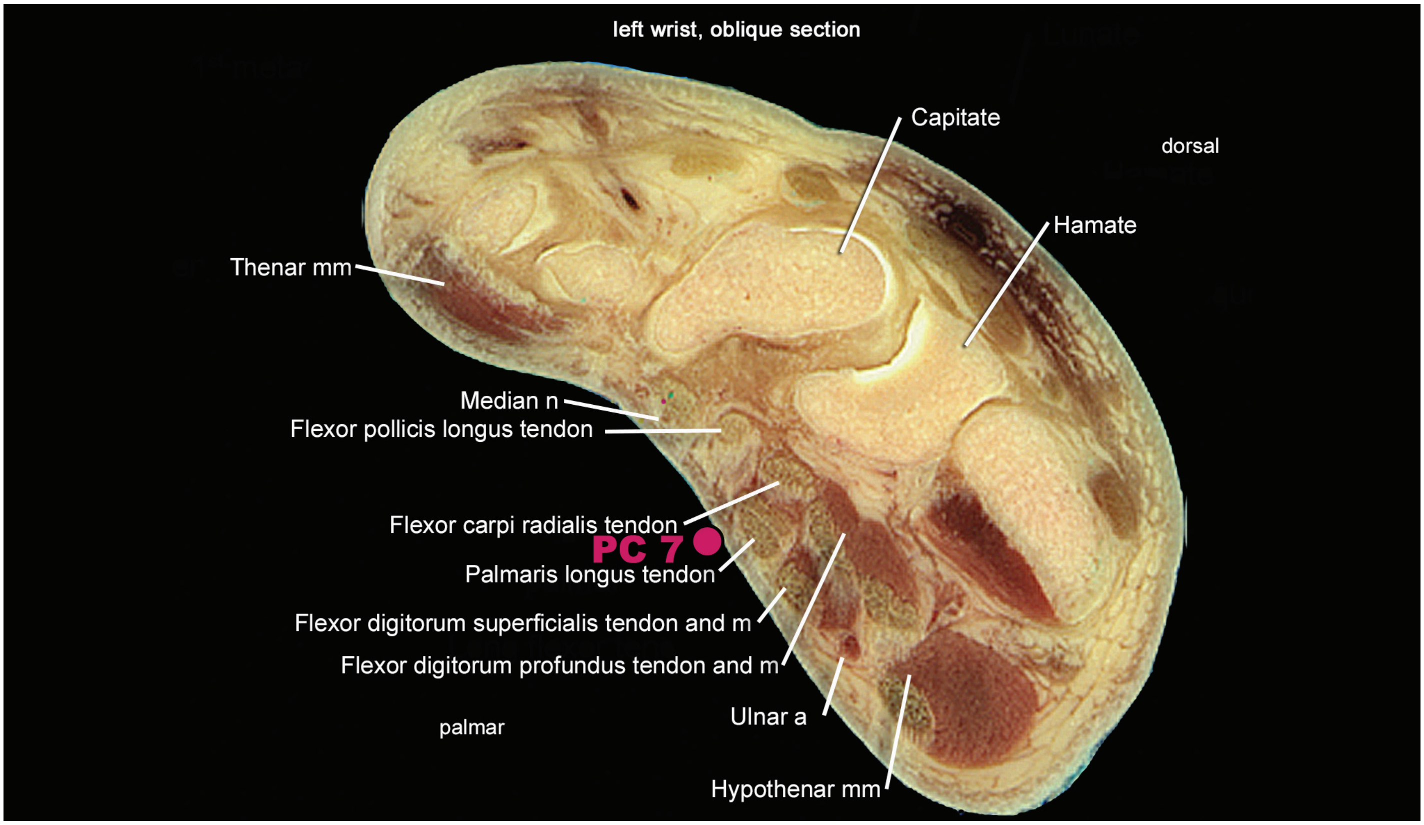

left wrist, oblique section
Capitate
dorsal
Hamate
Thenar mm
Median n
Flexor pollicis longus tendon
Flexor carpi radialis tendon
PC 7
Palmaris longus tendon
Flexor digitorum superficialis tendon and m
Flexor digitorum profundus tendon and m
Ulnar a
palmar
Hypothenar mm

Figure 9-22. The descriptive name for PC 7, "Great Mound", connotes the way in which the thenar and hypothenar eminences mound at the heel of the hand.

pression can cause persistent problems, as can intraneural or perineural scarring. If conservative treatment for carpal tunnel syndrome with physical medicine maneuvers fails and surgery seems to be the only remaining option, acupuncture and laser therapy should strongly be considered to limit the amount of necrosis and circulatory compromise following tunnel release. These approaches also aid in accelerating the resolution of neuropathic pain and sensory dysfunction.

Indications and Potential Point Combinations

- **Local wrist pain:** Identify the source of pain; if palmar and tender at PC 7, consider trigger point in the flexor carpi radialis or pronator teres (treat PC 7 and LU 9).Trigger point in the palmaris longus muscle radiates to the palm; treat palmaris longus trigger point, PC 6, PC 7, PC 8 (if tolerated). For radial wrist pain, consider PC 7, LU 9, LU 10, and LI 4 for opponens pollicis trigger.
- **Carpal tunnel syndrome:** PC 7, PC 6, LU 9, HT 7. Rule out other sources of median nerve entrapment. Consider laser therapy and massage to PC 8.
- **Anxiety or depression:** PC 7, CV 17, ST 36.
- **Insomnia:** PC 7, TH 5, HT 7, HT 3, GV 20, LR 3, ST 36, CV 4.[19]
- **Heel Pain:** PC 7, local points tender to palpation and involved in nerve entrapment referring to the heel.[20]

Evidence-Based Applications

- Laser at PC 7, TENS at TH 4/PC 7, laser at Ting points on the hand, and laser at LU 9, HT 7, HT 8, PC 8, and Baxie significantly reduced pain in patients suffering from **carpal tunnel syndrome.** Patients' scores on the McGill Pain Questionnaire decreased significantly, as did median nerve sensory latency and Phalen and Tinel signs.[2]
- Patients with **chronic neck pain** who received electrical stimulation at acupuncture points on the wrist, including PC 7, experienced significant improvements over sham treatment with no adverse effects.[3]
- Acupuncture at PC 7 and PC 6 produced significantly better improvement in symptoms as well as distal motor and sensory latencies for patients with **carpal tunnel syndrome** than did oral steroid medication. These results continued through the 1- year follow-up period.[21]
- Acupuncture applied to PC 6 and PC 7 significantly improved nerve conduction velocity and symptoms in patients with **carpal tunnel syndrome.**[22]
- Acupuncture at PC 7, TH 4, TH 5, and Baxie, along with moxibustion at LI 11 and Tuina (Chinese massage) to the wrist, reduced symptoms and improved function in patients with **carpal tunnel syndrome.**[23]
- Electroacupuncture at 15 Hz at PC 7 increased **dopamine** release in the striatum of rats, while the same stimulation at HT 7, LU 9, TH 5, and LI 5 did not.[4]
- Acupuncture needling of PC 7 reduced reported morning pain in patients with suspected **plantar fasciitis** significantly more than needling did when applied to LI 4.[24]

References

1. Southworth SR and Hartwig RH. Foreign body in the median nerve: a complication of acupuncture. *Journal of Hand Surgery (British Volume).* 1990;15B:111-112.

2. Naeser MA, Hahn K-AK, Lieberman BE, and Branco KF. Carpal tunnel syndrome pain treated with low-level laser and microamperes transcutaneous electrical nerve stimulation: a controlled study. *Arch Phys Med Rehabil.* 2002;83:978-988.

3. Chan DKC, Johnson MI, Sun KO, et al. A randomized, sham-controlled trial using a wrist-ankle acustimulation device. *Clin J Pain.* 2009;25(4):320-325.

4. Shen E-Y and Lai Y-J. The efficacy of frequency-specific acupuncture stimulation on extracellular dopamine concentration in striatum – a rat model study. *Neuroscience Letters.* 2007;415:179-184.

5. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther.* 2005;18:216-229.

6. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.

7. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.

8. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.

9. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.

10. Ulrich D, Piatkowski A, and Pallua N. Anterior interosseous nerve syndrome: retrospective analysis of 14 patients. *Arch Orthop Trauma Surg.* 2011;131:1561-1565.

11. Tagliafico A, Perez MM, Padua L, et al. Increased reflectivity and loss in bulk of the pronator quadratus muscle does not always indicate anterior interosseous neuropathy on ultrasound. *European Journal of Radiology.* 2013;82(3):526-529.

12. Zhou W, Hsiao I, Lin VWH, et al. Modulation of cardiovascular excitatory responses in rats by transcutaneous magnetic stimulation: role of the spinal cord. *J Appl Physiol.* 2006;100:926-932.

13. Guo Z-L, Li M, and Longhurst JC. Nucleus ambiguus cholinergic neurons activated by acupuncture: relation to encephalin. *Brain Research.* 2012;1442:25-35.

14. Jeon I-C, Kim M-S, and Kim S-H. Median nerve stimulation in a patient with complex regional pain syndrome type II. *J Korean Neurosurg Soc.* 2009;46:273-276.

15. Mirone G, Natale M, and Rotondo M. Peripheral median nerve stimulation for the treatment of iatrogenic complex regional pain syndrome (CRPS) type II after carpal tunnel surgery. *Journal of Clinical Neuroscience.* 2009;16:825-827.

16. Zbrodowski A and Gajisin S. The blood supply of the flexor retinaculum. *J Hand Surg Br.* 1988;13(1):35-39.

17. Kwon JY, Kim JY, Hong JT, et al. Position change of the neurovascular structures around the carpal tunnel with dynamic wrist motion. *J Korean Neurosurg Soc.* 2011;50:377-380.

18. Neuhaus V, Christoforou D, Cheriyan T, et al. Evaluation and treatment of failed carpal tunnel release. *Orthop Clin North Am.* 2012;43(4):439-447.

19. Ren Y. 86 cases of insomnia treated by double point needling – daling through to waiguan. *J Tradit Chin Med.* 1985;5(1):22.

20. Clark RJ and Tighe M. The effectiveness of acupuncture for plantar heel pain: a systematic review. *Acupunct Med.* 2012;30(4):298-306.

21. Yang C-P, Wang N-H, Li T-C, et al. A randomized clinical trial of acupuncture versus oral steroids for carpal tunnel syndrome: a long-term follow-up. *J Pain.* 2011;12(2):272-279.

22. Khosrawi S, Moghtaden A, and Haghighat S. Acupuncture in treatment of carpal tunnel syndrome: a randomized controlled trial study. *J Res Med Sci.* 2012;17(1):1-7.

23. Cai D-F. Warm-needling plus Tuina relaxing for the treatment of carpal tunnel syndrome. *Journal of Traditional Chinese Medicine.* 2010;30(1):23-24.

24. Zhang SP, Yip T-P, and Li Q-S. Acupuncture treatment for plantar fasciitis: a randomized control led trial with six months follow-up.

25. Kwon JY, Kim JY, Hong JT, et al. Position change of the neurovascular structures around the carpal tunnel with dynamic wrist motion. *J Korean Neurosurg Soc.* 2011;50:377-380.

PC 8

Lao Gong "Palace of Toil"

On the palm of the hand, between the 2nd and 3rd metacarpal bones, in a depression on the radial aspect of the third metacarpal bone. Can be found where the tip of the middle finger touches the palm when a tight fist is made.

Fascia

- **Palmar aponeurosis:** The strong palmar aponeurosis constitutes the deep fascia over the palm. It covers and protects the nerves and vessels; it also maintains the transverse arch of the transverse carpal ligaments. Its distal fibers function as a pulley on the flexor tendons. It assists in forming a cup with the hand by means of its attachments to the metacarpal bones.

The palmar aponeurosis joins the palmaris longus tendon at the level of the distal transverse wrist crease,[3] or PC 7. The palmaris longus, a thin, highly variable, accessory muscle of the forearm, helps tense the palmar aponeurosis, contributing to wrist flexion.[1] The palmaris longus influences the longitudinal orientation of fibers in the superficial layer of the palmar aponeurosis through the tension it places on the fascia.

Clinical Relevance: Tension along the palmaris longus tendon influences fiber direction in the palmar aponeurosis, causing a more regularly arranged longitudinal orientation.[4] This may explain why the presence of the palmaris longus tendon correlates with increased risk of developing Dupuytren's disease.

Muscles and Tendons

- **Flexor digitorum superficialis tendon:** Flexes the middle phalanges of the fingers at the proximal interphalangeal joints.
- **Flexor digitorum profundus tendon:** Flexes the distal phalanges of the fingers at the distal interphalangeal joints.
- **2nd lumbrical muscle:** The four small lumbrical muscles originate from the deep digital flexor tendons. Flexes the digit at the metacarpophalangeal joint and extend the interphalangeal joint. The lumbrical muscles of the hand contribute indirectly to interphalangeal joint extension by regulating flexion force of the deep digital flexor.[5]
- **1st palmar interosseous muscle:** Adducts the digits toward the axial line. Assists the lumbrical muscles in extending the interphalangeal joints and flexing the metacarpophalangeal joints.
- **2nd dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.

Clinical Relevance: Trigger point pathology in the following muscles at or near PC points on the proximal forearm lead to their respective pain referral patterns, which may follow tendons traveling toward the wrist:

  - **Flexor digitorum superficialis and profundus:** Radial head of each muscle group refers pain to the palmar middle finger from PC 8 to PC 9.
  - **Palmaris longus:** Pain from a palmaris longus trigger point just proximal to PC 4 sends pain along the PC channel to the palm between PC 8 and HT 8, where it centralizes.
  - **Flexor carpi radialis:** Issues pain along the PC channel to the wrist, centered strongly over PC 7 and spilling toward LU 9. At times, extends to the palm near PC 8.

In addition, a myofascial trigger point in the medial head of the triceps can cause pain to travel from the elbow at PC 3-HT 3 where it localizes strongly. The pain pattern then extends down the PC/HT line to the ring finger and pinky.

Patients with anomalous muscles, tendons, or fibrous bands linking structures together, accentuate median nerve compression.[6]

Note how, as Figure 9-23 reveals, the palmaris longus tendon adjoins the palmar aponeurosis and extends to PC 8, linking the line from pectoralis muscle to the palm, thereby creating the connective tissue component of the PC channel.

Traction along the axis of the palmaris longus tendon creates lines of force in both the palmar and thenar fasciae. Thus, releasing these connective tissue elements with massage, acupuncture, laser therapy, or stretching may alleviate neurovascular compression and stiffness of the wrist or hand.

The lumbrical muscles work in concert with the interosseous muscles to perform finely coordinated movements of the fingers.[7] They assist in regulating flexion and extension of the intrinsic and extrinsic muscles attaching to the fingers. Consequently, myofascial restriction can compromise dexterity and strength in the hand. The palm contains abundant sensory nerve endings; as such, patients will tolerate massage and laser therapy at PC 8 more readily than acupuncture needling.

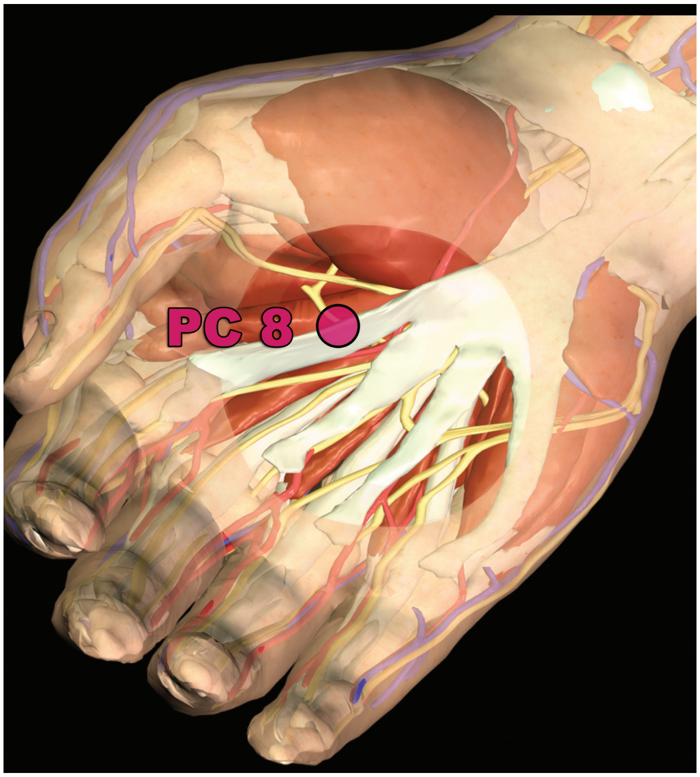


Figure 9-23. PC 8, the "Palace of Toil", falls on the "palace of toil" in the hand, i.e., the palm. An alternate descriptive name for PC 8 is "Labour Palace", also self-explanatory.

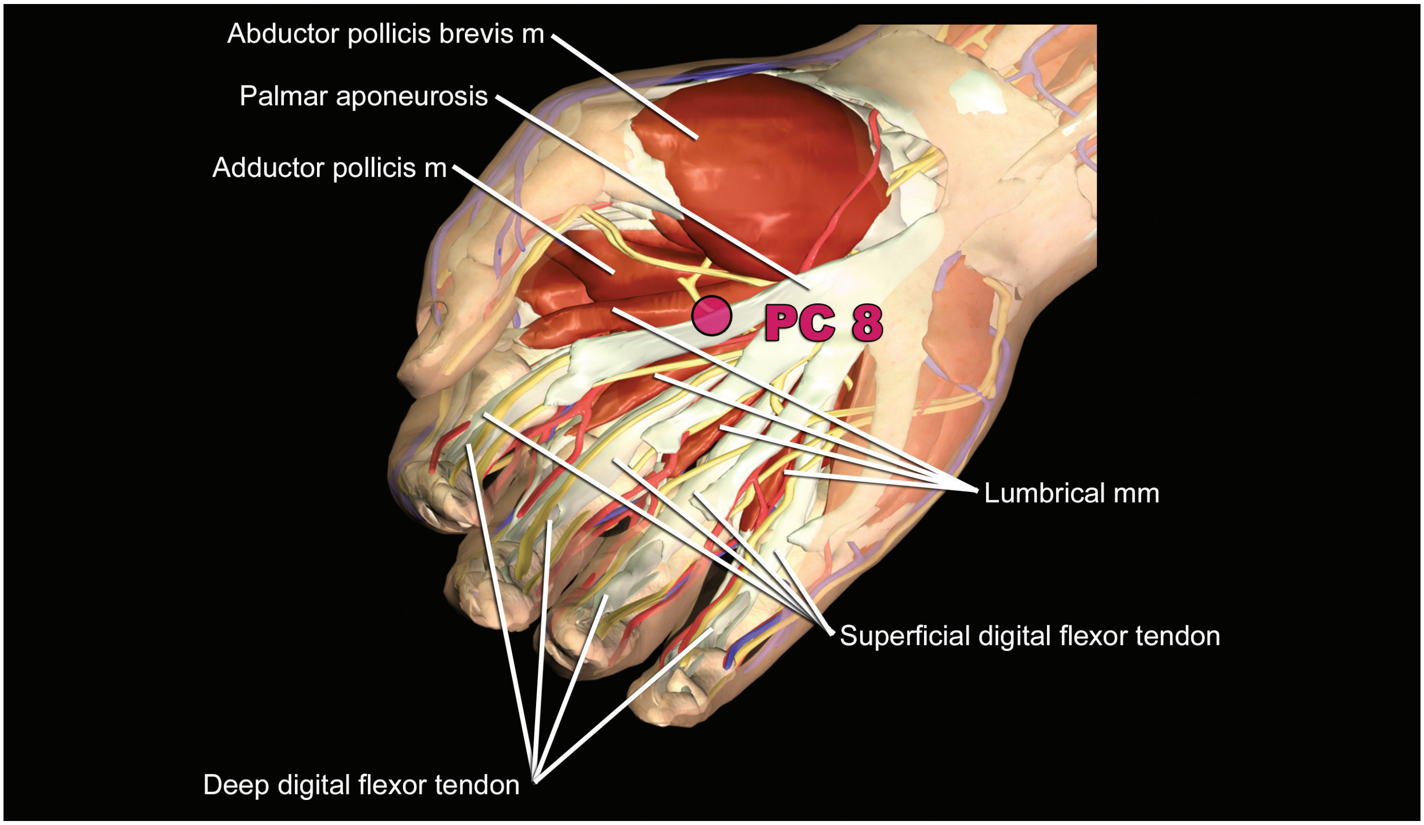

Abductor pollicis brevis m
Palmar aponeurosis
Adductor pollicis m
PC 8
Lumbrical mm
Superficial digital flexor tendon
Deep digital flexor tendon

Figure 9-24. The deforming, fibrotic condition of the palmar fascia known as "Dupuytren's contracture" arises as a result of fibroblast proliferation, possibly related to a sustained relative ischemia in the region.[13] Acupuncture stimulation at PC 8 could improve local blood flow. Thus, it may impact pathogenesis of the disease. Dry needling, massage, and laser therapy may relax tension on the palmaris longus muscle that would otherwise worsen the contracture. Excessive and sustained tension on the palmar aponeurosis reorganizes the cytoarchitecture of the palmar aponeurosis, potentially predisposing patients to Dupuytren's contracture.

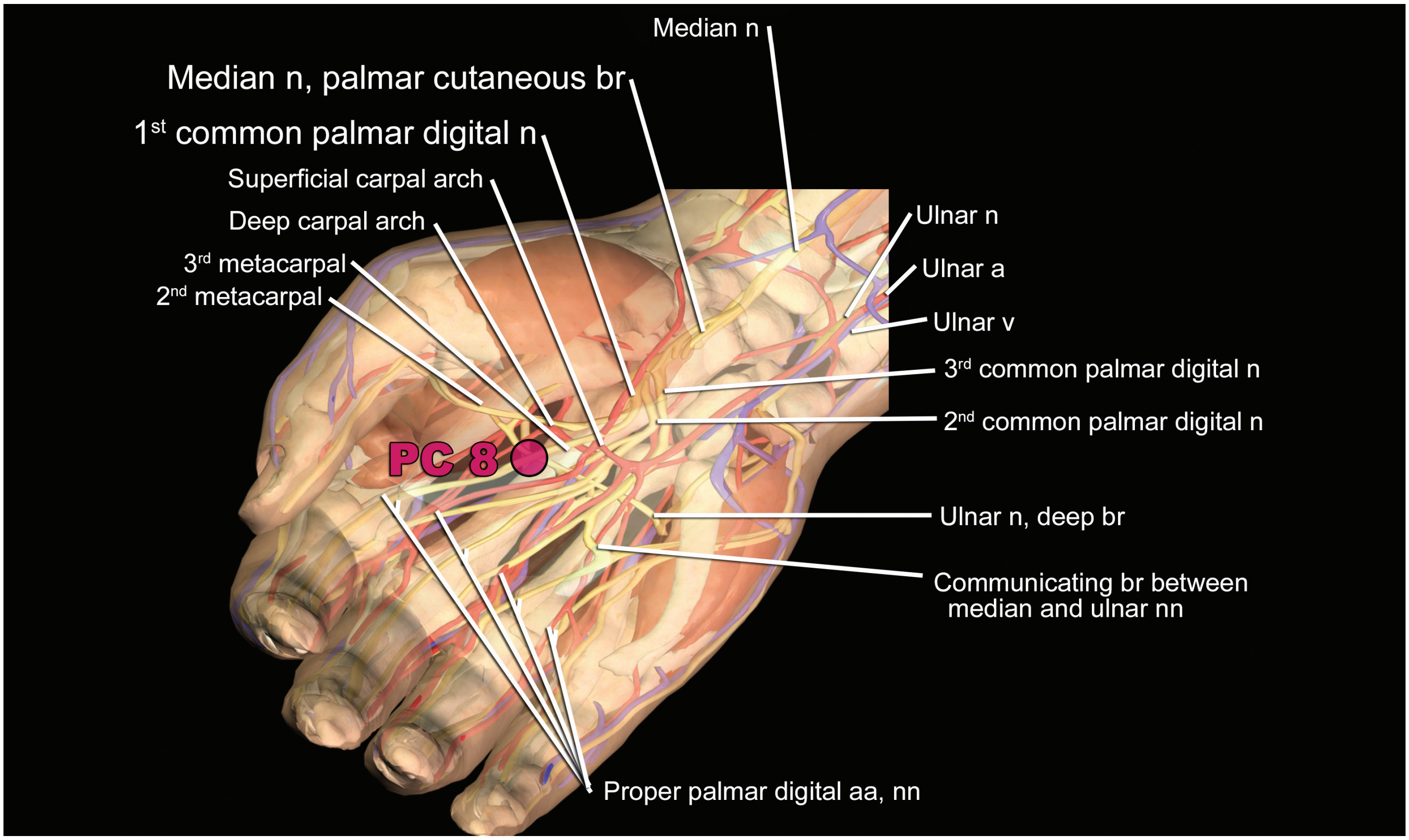

Median n
Median n, palmar cutaneous br
1st common palmar digital n
Superficial carpal arch
Deep carpal arch
3rd metacarpal
2nd metacarpal
Ulnar n
Ulnar a
Ulnar v
3rd common palmar digital n
2nd common palmar digital n
PC 8
Ulnar n, deep br
Communicating br between median and ulnar nn
Proper palmar digital aa, nn

Figure 9-25. The clinical application of PC 8 pertaining to sympathetic arousal arise from stimulation of the nervi vasorum associated with the double arterial arch system, shown here.

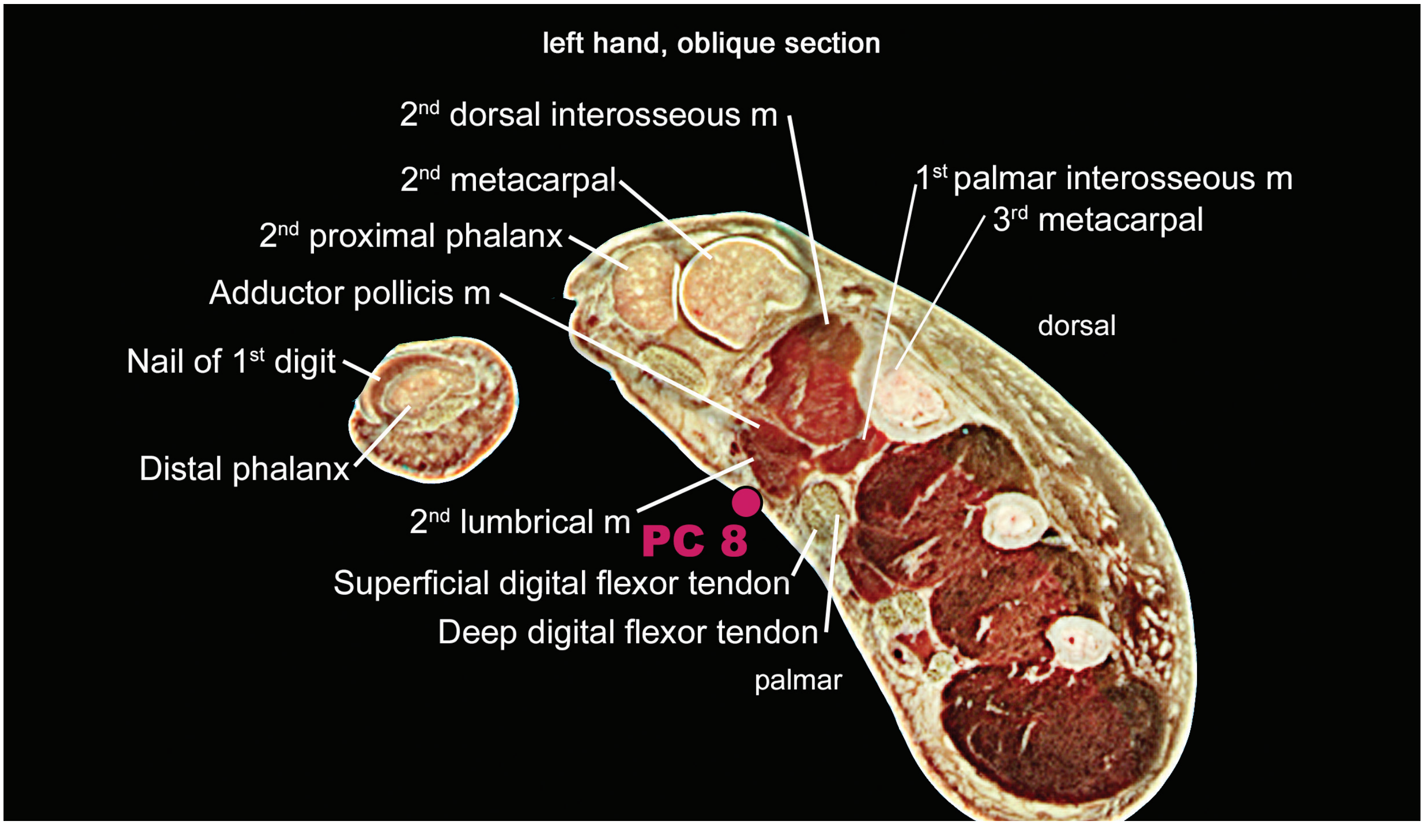

left hand, oblique section
2nd dorsal interosseous m
2nd metacarpal
2nd proximal phalanx
Adductor pollicis m
Nail of 1st digit
Distal phalanx
2nd lumbrical m
PC 8
Superficial digital flexor tendon
Deep digital flexor tendon
palmar
1st palmar interosseous m
3rd metacarpal
dorsal

Figure 9-26. This cross section exposes the relationship between PC 8 and the adductor pollicis muscle. Trigger points in the adductor pollicis muscle may respond to PC 8 needling or acupressure (given the sensitivity of the palm).

Nerves

- **Median nerve (C6-T1):** The median nerve innervates all of the thenar muscles except for the adductor pollicis and deep head of the flexor pollicis brevis. Also supplies the lumbrical muscles for digits II and III, and provides sensation to the skin of the palmar and distal dorsal aspects of the radial three digits (thumb, forefinger, and middle finger), along with the radial aspect of the ring finger, as well as the adjacent palmar areas. Four branches arise from the median nerve: the recurrent (thenar), lateral, medial, and palmar cutaneous. The recurrent branch supplies the abductor pollicis brevis, the opponens pollicis, and the superficial head of the flexor pollicis brevis. The lateral branch supplies the 1st lumbrical, the palmar skin, and the skin on the distal dorsal aspects of the thumb and radial half of the index finger. The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. The palmar cutaneous branch supplies the skin of the central palmar region.

Clinical Relevance: PC 8 serves as a useful distal point in cases of more proximal median nerve entrapment. In the distal antebrachium, the median nerve occupied a deep position along the volar antebrachium, sandwiched between the superficial and deep digital flexor muscles. Between PC 6 and PC 7, the nerve curved around the lateral aspect of the superficial digital flexor to rest atop the tendon bundle at the wrist (see Figure 9-25). The median nerve travels through the carpal tunnel, at risk of entrapment, except for its superficial palmar nerve branch, which may circumvent the tunnel.

The recurrent branch of the median nerve is susceptible to entrapment where it pierces the transverse carpal ligament or wraps around the distal aspect of the ligament. Branches of the median nerve that supply the index, middle, and ring fiber pass between metacarpal heads through metacarpal tunnels.[8] Activities involving digital extension at the metacarpophalangeal joints can compress the digital nerves against deep transverse metacarpal ligaments. Vibrating tools such as jackhammers may damage these nerves through repeated, blunt trauma.

Vessels

- **Superficial palmar arterial arch:** The direct continuation of the ulnar artery. Meets the radial artery on the radial aspect of the hand.
- **Common palmar digital artery:** Arises from the superficial palmar arch. Courses toward the web between the digits, where it branches into the proper palmar digital arteries. These arteries give off dorsal branches that supply the nail beds.

Clinical Relevance: Ischemic events affecting the palm (including PC 8 and HT 8) may require incorporation of lumbrical muscles into replantation or revascularization flaps.[9] Arteries supplying the lumbrical muscles originate directly from the superficial palmar arch or the common palmar digital artery. The 2nd lumbrical muscle, beneath PC 8, receives blood supply mainly from the superficial palmar arterial arch, the 1st common palmar digital artery, and the 3rd palmar metacarpal artery. As it can prove difficult or impossible to repair minute vessels supplying the lumbrical and interosseous muscles at certain areas of their supply chain, injuries to the vasculature of the hand, whether traumatic or iatrogenic, may compromise muscular health and, consequently, function.[10]

Furthermore, variations in arterial arch anatomy lead to vascular damage during surgical harvesting of radial arteries as an arterial bypass conduit.[11] Physical medicine maneuvers support repair of vessel recovery and regrowth.

Indications and Potential Point Combinations

- **Paresis or paralysis of the thoracic limb:** PC 8, Baxie points (in the web spaces between the fingers), LI 4, and neuroanatomically appropriate points based on nature of neurologic compromise.
- **Superficial prickling pain in the forearm radiating to the palm:** PC 8, PC 7, trigger point in the palmaris longus muscle, which may occur in the vicinity of PC 4 or at other locations along the palmaris longus muscle and tendon.
- **Dupuytren's contracture:** PC 8, PC 7, trigger point in the palmaris longus muscle (in the vicinity of PC 4), or elsewhere along the palmaris longus muscle and tendon.[2]
- **Sympathetic activation, mania, high fever:** PC 8, LR 3, GV 14, GV 20, KI 1.
- **"Weeder's thumb", or trigger points in the adductor and opponens pollicis muscle:** PC 8, LI 5, and LI 4 (to treat the adductor pollicis muscle and its radiation pattern) and/or LU 10 and LU 9 (for opponens pollicis trigger point and referred pain pattern).

Evidence-Based Applications

- Transcutaneous electrical acupuncture point stimulation from LI 4 to PC 8 and PC 6 to TH 5 reduced the urge to smoke in **addicted cigarette smokers.**[12]

References

1. Stecco C, Lancerotto L, Porzionato A, et al. The palmaris longus muscle and its relations with the antebrachial fascia and the palmar aponeurosis. *Clinical Anatomy.* 2009;22:221-229.
2. Stecco C, Lancerotto L, Porzionato A, et al. The palmaris longus muscle and its relations with the antebrachial fascia and the palmar aponeurosis. *Clinical Anatomy.* 2009;22:221-229.
3. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.
4. Stecco, Lancerotto L, Porzionato A, et al. The palmaris longus muscle and its relations with the antebrachial fascia and the palmar aponeurosis. *Clinical Anatomy.* 2009;22:221-229.
5. Bilge O, Pinar Y, Ozer MA, et al. The vascular anatomy of the lumbrical muscles in the hand. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2007;60:1120-1126.
6. Rotman MB and Donovan JP. Practical anatomy of the carpal tunnel. *Hand Clin.* 2002;18(2):219-230.
7. Zbrodowski A, Mariethoz E, Benarkiewicz M, et al. The blood supply of the lumbrical muscles. *Journal of Hand Surgery (British and European Volume).* 1998;23B:384-388.
8. Pratt N. Anatomy of nerve entrapment sites in the upper quarter. *J Hand Ther.* 2005;18:216-229.
9. Bilge O, Pinar Y, Ozer MA, et al. The vascular anatomy of the lumbrical muscles in the hand. *Journal of Plastic, Reconstrutive & Aesthetic Surgery.* 2007;60:1120-1126.
10. Weinzweig N, Starker I, Sharzer LA, et al. Revisitation of the vascular anatomy of the lumbrical and interosseous muscles. *Plast Reconstr Surg.* 1997;99(3):785-790;
11. Loukas M, Holdman D, and Holdman S. Anatomical variations of the superficial and deep palmar arches. *Folia Morphol.* 2005;64(2):78-83.
12. Lambert C, Berlin I, Lee T-L, et al. A standardized transcutaneous electric acupoint stimulation for relieving tobacco urges in dependent smokers. *Evidence-Based Complementary and Alternative Medicine.* 2011;Article ID 195714.
13. Murrell GAC. An insight into Dupuytren's contracture. *Annals of the Royal College of Surgeons of England.* 1992;74:156-161.

PC 9

Zhong Chong “Middle Rushing”, “Central Rush”, “Central Hub”, “Central Surge”

On the radial nail angle of the 3rd digit, the width of a Chinese leek leaf from the corner of the nail. (Some sources locate the point at the center of the tip of the middle finger.)

Nerves

- **Median nerve (C6-T1):** The medial branch supplies the 2nd lumbrical and the skin of the palmar and distal dorsal aspects of the adjacent aspects of the 2nd, 3rd, and 4th digits. (Supplies the radial aspect of the dorsal tip of the ring finger.) Distal branches of the proper palmar digital nerve from the median nerve provide sensation and sympathetic input to the middle finger.
- **Note about fingertip nerve supply:** The highly sensate fingertip contains sensory end organs between the volar digital skin and the nail that allows for accurate prehension of small objects. The proper palmar digital nerve accompanies its arterial companion on the ventral ulnar and radial aspects of the fingers. Proximal to the base of the nail fold, the nerve divides and sends branches into the pulp of the finger as well as to the nail bed. These nerve fibers provide only part of the sensory supply to the nail bed. Additional sensation is supported by structures known as “glomus bodies”, identified as intertwining clusters of fine vessels and nerves. Glomus bodies modulate blood flow to the fingertip by controlling fine vessel diameter. The close proximity of glomus bodies to the nail allows for thermal transfer, similar to the heat exchange that takes place when one places a hand against a window pane. Too, the finger’s tip serves as a temperature regulator, highlighting the indications of Ting points such as PC 9 for heat stroke and fever.

Clinical Relevance: This point treats distal middle finger numbness or nerve damage. It can intensely activate autonomic reflexes influencing attention and arousal as well as heat distribution. It also accentuates autonomic reflexes to the cardiopulmonary centers via brainstem circuits that reflex between the median nerve and the rostral ventrolateral medulla.

Vessels

- **Dorsal branches of proper palmar digital artery of the radial side of the 3rd digit:** Arise from the proper palmar digital arteries, which in turn arise from the superficial palmar arterial arch, which comes from the ulnar artery.

Clinical Relevance: The rich arteriovenous supply of the distal finger offers opportunities to induce profound autonomic shifts in hemodynamics and alertness, seemingly disproportionate to the vessels’ sizes in this region.

Indications and Potential Point Combinations

- **Hypotension, syncope:** PC 9, LI 5.
- **Pain in middle finger, palmar aspect from trigger point(s) in the flexor digitorum muscles affecting the middle finger:** PC 9, Baxie (web space points) on either side of middle finger, trigger point in the radial head of the flexor digitorum superficialis and profundus at about PC 4.
- **Pain in middle finger, dorsal aspect from trigger point(s) in the extensor digitorum muscle extending the middle finger:** PC 9, Baxie (web space points) on either side of middle finger, trigger point in the extensor digitorum muscle in the vicinity of TH 9, TH 4, TH 5.
- **Post-stroke coma:** PC 9, PC 8, GV 20, GV 16, LI 4, ST 36.
- **High-fever neurologic complications:** PC 9, PC 8, PC 6, GV 20, LR 3.

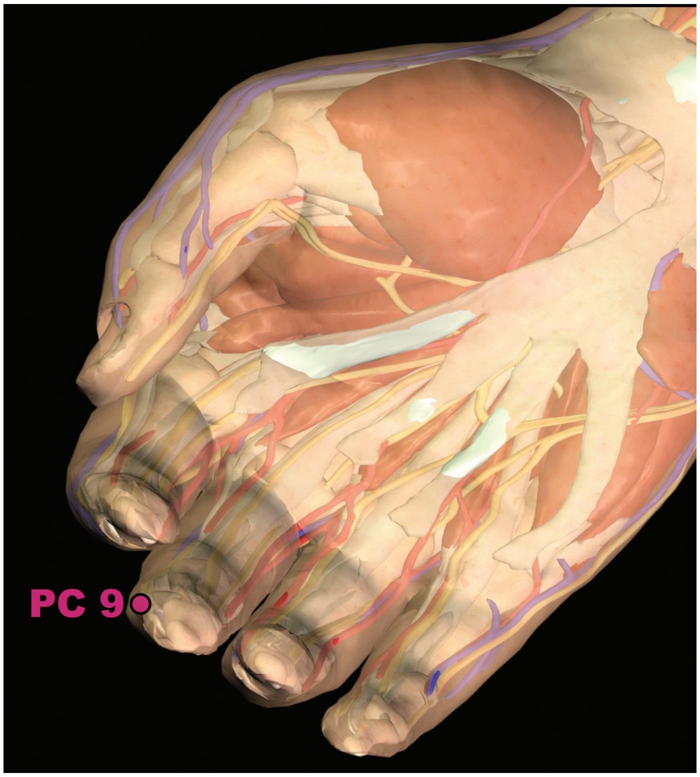


Figure 9-27. TThe centrality of the middle finger and the turbulence of blood flow from the arterial to the venous system provide insight into the names for PC 9 such as “Middle Rushing” and “Central Surge”.

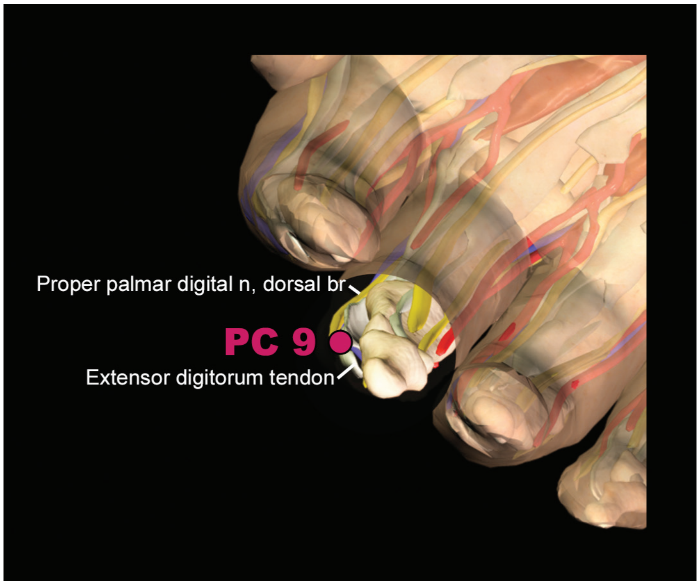

Proper palmar digital n, dorsal br
PC 9
Extensor digitorum tendon

Figure 9-28. PC 9 takes the channel to the dorsal surface and thus relates to extensor, rather than flexor, tendons. The middle finger extensor tendon inserts onto the dorsal surface of the distal phalanx of the middle finger, near PC 9.

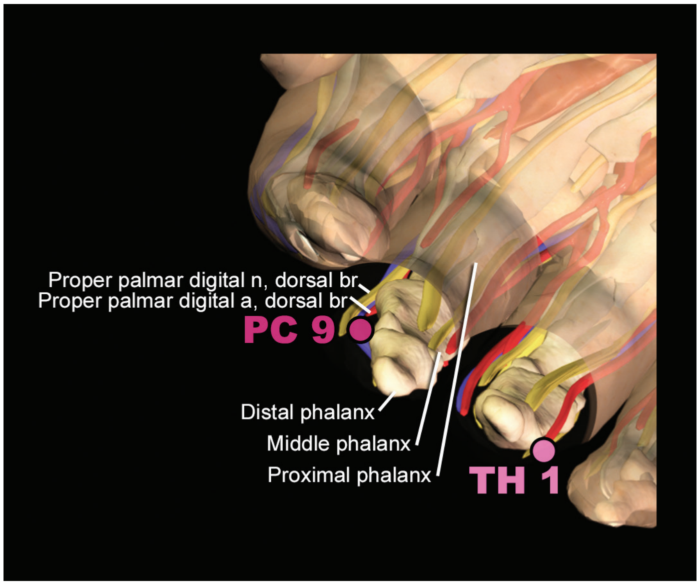
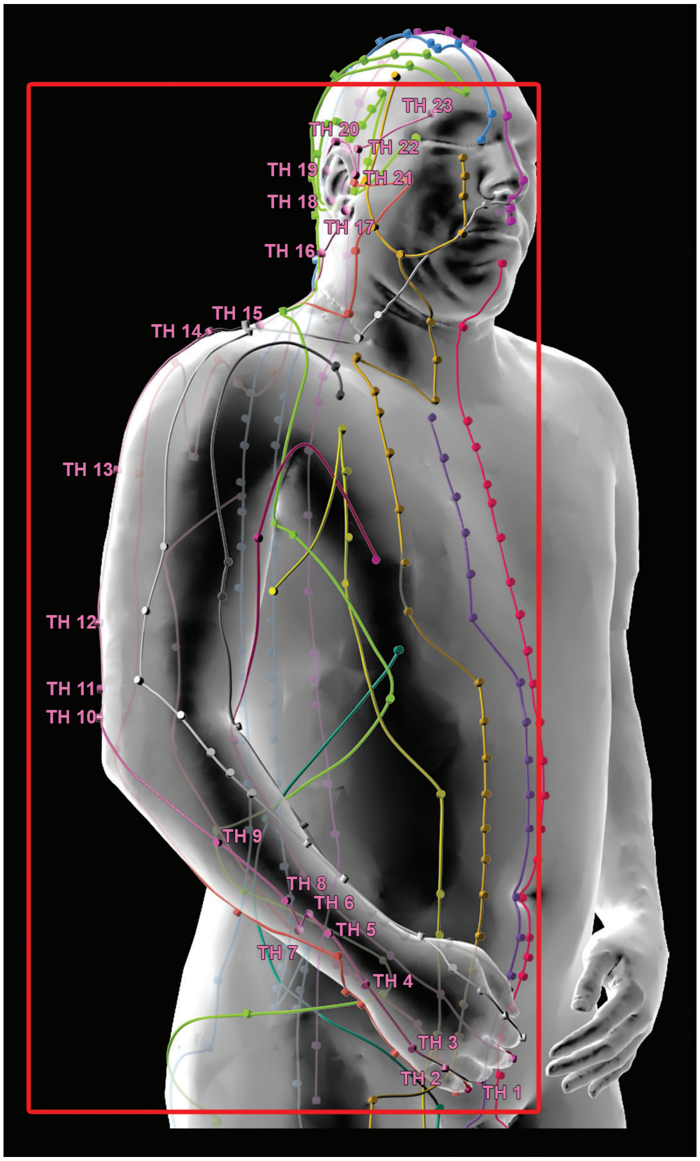
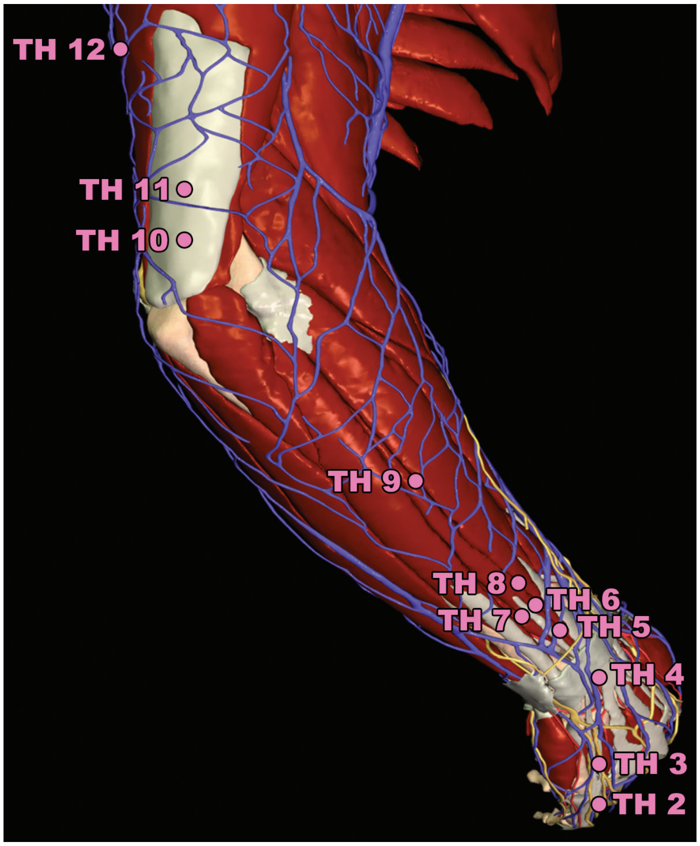

Proper palmar digital n, dorsal br
Proper palmar digital a, dorsal br
PC 9
Distal phalanx
Middle phalanx
Proximal phalanx
TH 1

Figure 9-29. The neurovascular correlates for PC 9, like the other Ting, or most distal points of channels that land on the fingers and toes are the dorsal branches of the proper palmar/plantar digital arteries and their accompanying nerves. 4 In the cases of LU 11, LI 1, and PC 9, the nerve supply originates in the median nerve. This depiction compares the neurovascular supply of PC 9 (in its standard location) to TH 1, the start of the next channel. Whereas PC 9 carries median nerve innervation, TH 1 derives its sensory supply from the ulnar nerve.

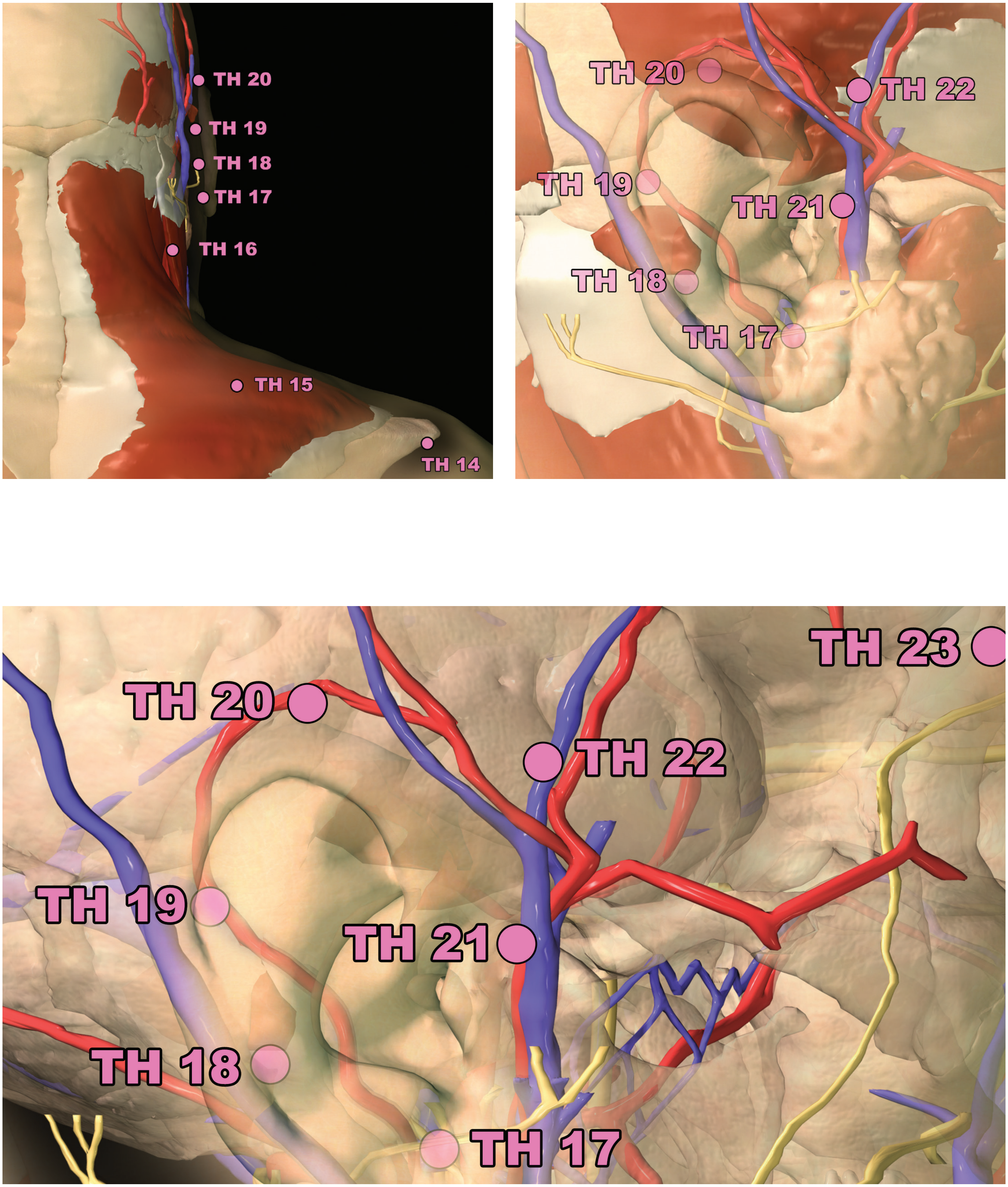
Channel 10:: The Triple Heater (TH)


TH 23
TH 20
TH 22
TH 19
TH 21
TH 18
TH 17
TH 16
TH 15
TH 14
TH 13
TH 12
TH 11
TH 10
TH 9
TH 8
TH 6
TH 5
TH 7
TH 4
TH 3
TH 2
TH 1

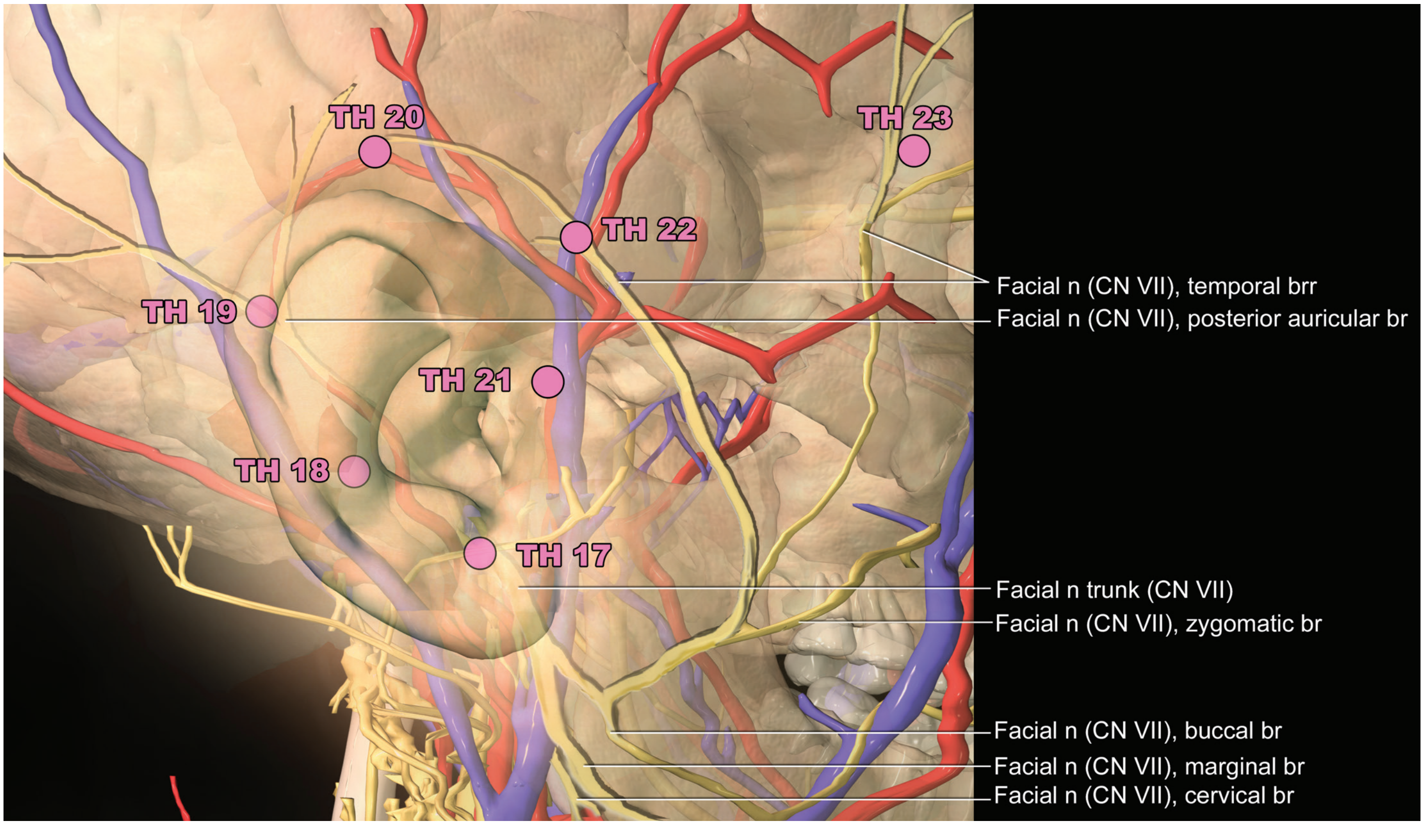
The TH channel begins on the ulnar aspect of the ring finger. It wends its way between the 4th and 5th metacarpals, then sinks into the interosseous groove between radius and ulna. Proximal to the elbow, the TH line journeys over the dorsal brachium to the acromion process. It ascends to the mastoid process, encircles the ear, and arches over the temporal region to the lateral eyebrow, where it ends at TH 23.


TH 12
TH 11
TH 10
TH 9
TH 8
TH 6
TH 7
TH 5
TH 4
TH 3
TH 2

Muscles along the TH channel extend the pinky, ring finger, carpus, elbow, shoulder, and neck. They move the ear, the temporomandibular joint, and the eyebrow. These muscles work in concert when a musician plays a violin, resting the rostral mandible on the chinrest, supporting the instrument with the shoulder, holding the elbow in partial extension, and placing the fingers on the strings. One listens for good intonation with the ear and watches the conductor or reads music with the eye. Actions of the extensors on the right hand arm, and shoulder move the bow and bear responsibility for tone quality, dynamics, rhythm, and much of the timbre. The line these muscles describe (TH channel) appear in the following two images.


TH 20
TH 19
TH 18
TH 17
TH 16
TH 15
TH 14
TH 20
TH 22
TH 19
TH 21
TH 18
TH 17
TH 23
TH 20
TH 22
TH 19
TH 21
TH 18
TH 17

The vascular basis of the TH channel becomes visible here, as does the relationship between TH 22 and the temporal lobe of the brain, as well as TH 19 and the sigmoid sinus.


TH 20
TH 23
TH 22
Facial n (CN VII), temporal brr
TH 19
Facial n (CN VII), posterior auricular br
TH 21
TH 18
TH 17
Facial n trunk (CN VII)
Facial n (CN VII), zygomatic br
Facial n (CN VII), buccal br
Facial n (CN VII), marginal br
Facial n (CN VII), cervical br

The TH channel on the head illustrates the close association between the facial nerve and the TH line, from stylomastoid foramen (TH 17) to the eyebrow (TH 23).

TH 1

Guan Chong "Rushing Pass", "Passage Hub", "Impetuous Pass"

Located on the ulnar aspect of the 4th digit, level with the base of the nail, the width of a Chinese leek leaf from the corner of the nail. In other words, TH 1 resides at the nail angle of the ulnar aspect of the 4th ring finger.

Nerves

- **Dorsal branches of proper palmar digital nerve:** Arise from the ulnar nerve (C8-T1). The dorsal branches of the proper palmar digital nerves supply branches to the dorsum of the tip of the little finger and nail bed, and the ulnar aspect of the ring finger.

Clinical Relevance: Stimulation of TH 1 activates the C8/T1 spinal cord segments, where the sympathetic cell column in the spinal cord begins. As the most distal point on the TH channel, TH 1 receives the richest autonomic innervation per unit area of any TH point on the thoracic limb. Initial sympathetic activation may induce a reflex parasympathetic response.[2]

Vessels

- **Dorsal branches of proper palmar digital artery of the ulnar side of the 4th digit:** The dorsum of the fingertip receives arterial blood supply from the dorsal branch of the proper palmar digital artery which arises from the superficial palmar arterial arch. The distal (ting) points on each channel that begins or end on a digit signify locations where vessels from either side of the finger form anastomotic branches across the dorsum.[1] The dorsal branch of the proper palmar digital artery provides vascularization to the flexor and extensor tendons as well as the interphalangeal joint and skin of the fingertip.

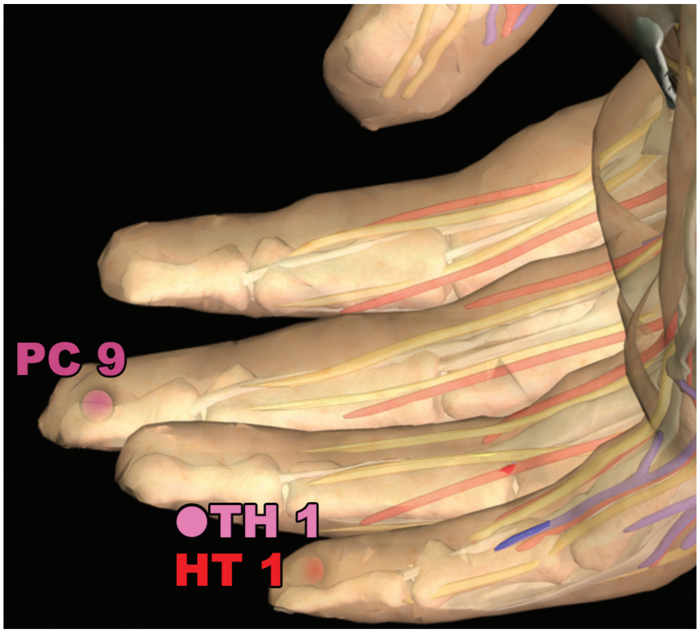


Figure 10-1. The term "Passage Hub" describes the location of TH 1 as a distal point between two other significant sites: PC 9 ("Central Hub" or "Central Surge") and HT 9 ("Lesser Surge").

Clinical Relevance: Autonomic fibers from the ulnar nerve become the nervi vasorum of arterioles at TH 1. These afferents connect to autonomic centers in the brain and spinal cord that regulate autonomic tone. Sympathetic fibers stimulated by needling TH 1 may inspire a reflex parasympathetic response.[3]

Indications and Potential Point Combinations

- **Forearm pain:** Search for trigger points along the ulnar aspect of the ring finger's digital extensor muscle. TH 1, TH 9, LI 10, local trigger points.
- **Syncope:** TH 1 is one of several Ting points on the fingers known to arouse the sympathetic nervous system. At least initially, they offset vagovagal reactions. After several minutes, parasympathetic activity may follow.[4]

References

1. Endo T, Kojima T, and Hirase Y. Vascular anatomy of the finger dorsum and a new idea for coverage of the finger pulp defect that restores sensation. *J Hand Surg.* 1992;17A:927-932.
2. Choi W, Lee S, Cho S, et al. Differential autonomic response to acupuncture at Wood and Metal at Five-Shu acupoints. *J Alt Complement Med.* 2012;18(10):959-964.
3. Choi W, Lee S, Cho S, et al. Differential autonomic response to acupuncture at Wood and Metal at Five-Shu acupoints. *J Alt Complement Med.* 2012;18(10):959-964.
4. Choi W, Lee S, Cho S, et al. Differential autonomic response to acupuncture at Wood and Metal at Five-Shu acupoints. *J Alt Complement Med.* 2012;18(10):959-964.

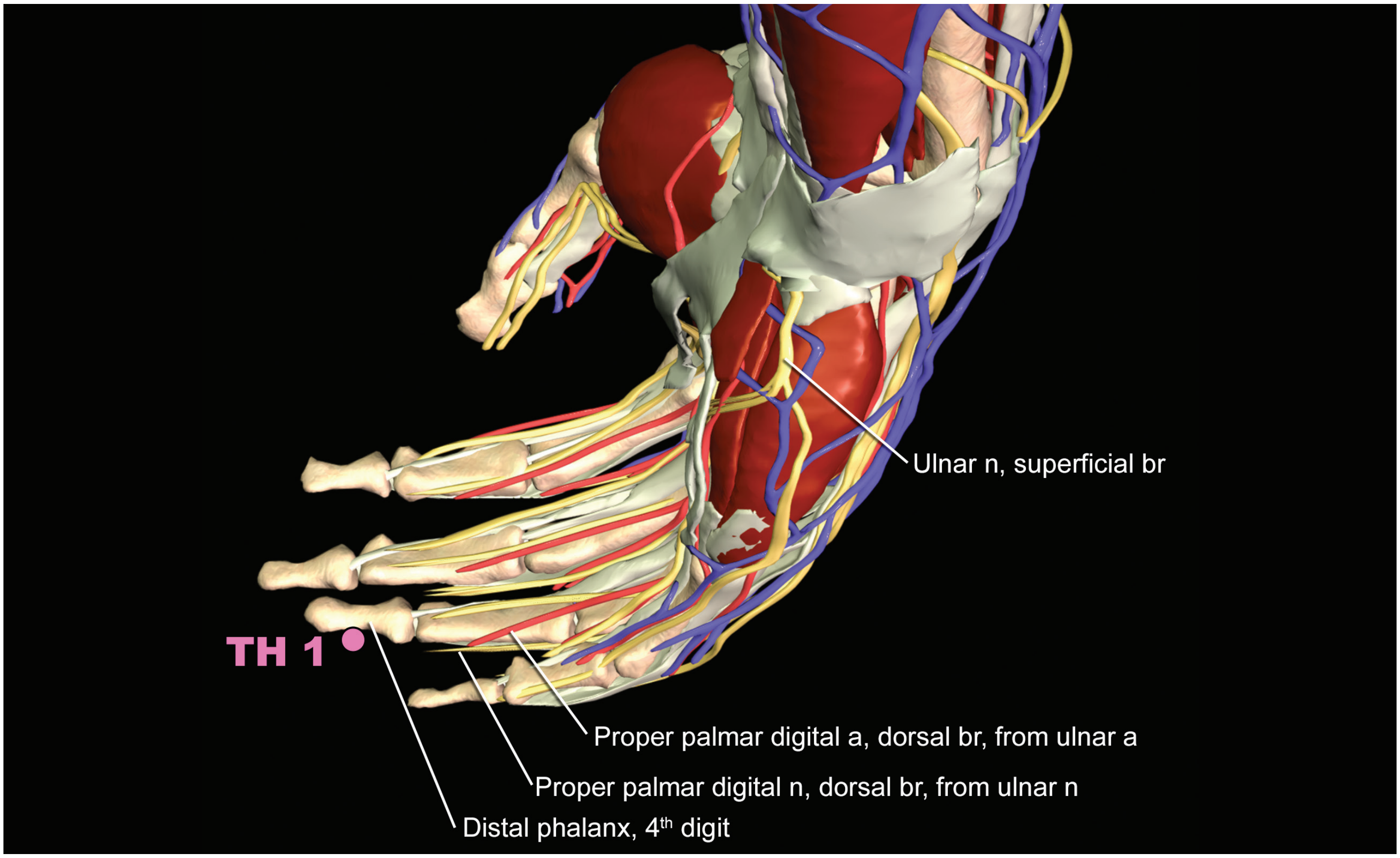

Ulnar n, superficial br
TH 1
Proper palmar digital a, dorsal br, from ulnar a
Proper palmar digital n, dorsal br, from ulnar n
Distal phalanx, 4th digit

Figure 10-2. Trigger points in proximal ring-finger extensor muscle occur in the vicinity of TH 9 and LI 10. They issue pain along the TH line to the ring finger toward TH 1.

TH 2

Ye Men "Fluid Gate" or "Humor Gate"

On the dorsum of the hand, distal to the 4th and 5th metacarpophalangeal joints, approximately 0.5 cun proximal to the web margin, at the dorsal/palmar skin junction. Can be found at the proximal end of the crease formed by the web space when the hand makes a loose fist.

Tendons

- **4th lumbrical tendon**: Flexes the digit at the metacarpophalangeal joint and extend the interphalangeal joint.
- **3rd palmar interosseous tendon:** Adducts the digits toward the axial line. Assists the lumbrical muscles in extending the interphalangeal joints and flexing the metacarpophalangeal joints.
- **4th dorsal interosseous tendon:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.

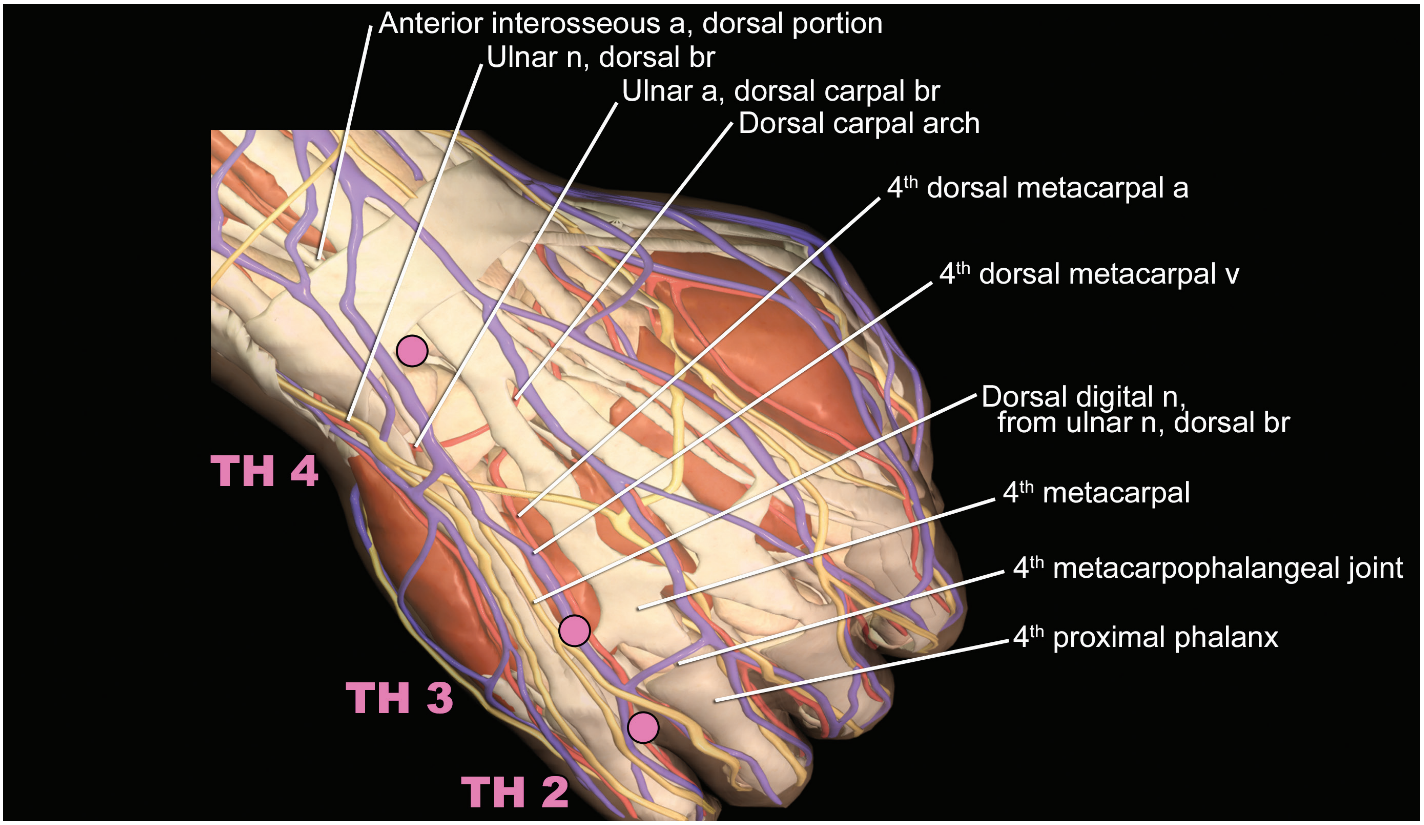
Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 2 may cause difficult or painful ring or little finger movement. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints.

Pain at TH 2 may manifest from local or proximal trigger point pathology. A trigger point in the ring finger extensor near TH 9 typically refers pain to the region around TH 2, connecting a line from TH 2 to LI 11. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to TH 2. Because of the multiplicity of causes of perceived pain in this region, a complete myofascial palpation exam should elucidate myriad contributors to ulnar hand pain.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[1] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

Nerves

- **Common palmar digital branches of the superficial branch of the ulnar nerve:** Supply sympathetic motor innervation to the palmar and dorsal skin of the little finger and ulnar half of the ring finger.



Anterior interosseous a, dorsal portion
Ulnar n, dorsal br
Ulnar a, dorsal carpal br
Dorsal carpal arch
4th dorsal metacarpal a
4th dorsal metacarpal v
Dorsal digital n, from ulnar n, dorsal br
4th metacarpal
4th metacarpophalangeal joint
4th proximal phalanx
TH 4
TH 3
TH 2

Figure 10-3. The web space placement of TH 2 overlaps with one of the Baxie points' locations, which exist in the four web spaces on each hand. The term "Baxie" connotes the eight "evils" that were thought to enter at these sites and cause pain. The branching neurovasculature here makes it ideal for modulating nerve signals and blood flow to the two ulnar–innervated fingers. The branching metacarpal nerve forms a target for somatic afferent stimulation designed to recover motor and sensory nerve communication between the spinal cord and hand, as in the cases of peripheral nerve injury, cervical disk disease, and cerebrovascular accident. A Chinese needling technique connecting TH 2 to TH 3 has been advocated for disorders manifesting on the head and neck along the TH channel.[2] However, threading a needle from one point to another may prove to be unacceptably invasive and risky for patients considering the modern medical and legal environments.

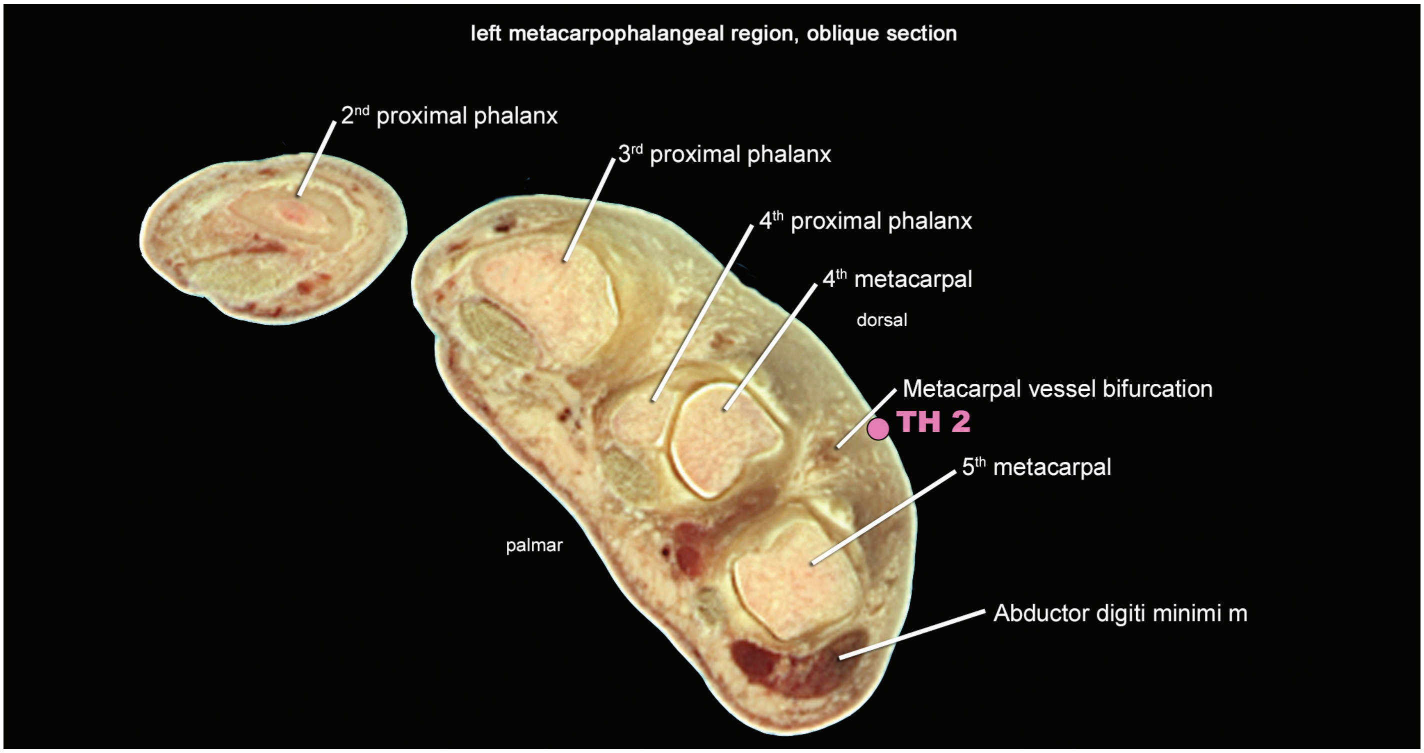


Figure 10-4. TH 2, also named "Fluid Gate" or "Humor Gate", provides a passageway of blood to the fingers, explaining the reference to liquid and the humors it contains as it courses through the body. This image demonstrates how the bifurcation of the vasculature at this point, mirrors that of the nervous system into digital branches.

- **Dorsal digital nerves:** Supplies the ulnar aspect of the ring finger, derived from the ulnar nerve.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: TH 2 coincides with the division of the fourth metacarpal nerve into two digital branches. As such, this point serves as a distal site for neuromodulation of problems related to hand and finger discomfort affecting the ulnar side of the hand and wrist.

Vessels

- **Dorsal metacarpal artery:** Arises from the dorsal carpal arch and receives contributions from the superficial palmar arch via perforating branches.
- **Dorsal digital arteries:** The dorsal metacarpal artery divides into two dorsal digital arteries at the metacarpophalangeal region.
- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health.

Indications and Potential Point Combinations

- **Fever with nausea and sore throat:** TH 2, PC 6, CV 22.
- **Earache:** TH 2, TH 20, TH 21, GB 20.
- **Stiffness or pain in the hand:** TH 2, explore extensor digitorum bundle to the ring finger at about TH 9, TH 4.
- **Compromised nerve function of the thoracic limb or hand:** TH 2, Baxie, specific points related neuroanatomically to the peripheral nerve and spinal cord segments involved in the dysfunction.

References

1. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 2012;20(1):94-101.
2. Zhu XM and Liu XQ. Clinical application of the penetrating needling technique from Yemen (TE 2) to Zhongzhu (TH 3). *Zhongguo Zhen Jiu.* 2012;32(3):264-266.

TH 3

Zhong Zhu "Central Islet"

On the dorsum of the hand, in a depression just proximal to the 4th and 5th metacarpophalangeal joints. Locate the point with the hand making a loose fist. This point, along with the prominences of the 4th and 5th metacarpophalangeal joints creates an equilateral triangle.

Muscles

- **4th lumbrical muscle:** Flexes the digit at the metacarpophalangeal joint and extends the interphalangeal joint.
- **3rd palmar interosseous muscle**: Adducts the digits toward the axial line. Assists the lumbrical muscles in extending the interphalangeal joints and flexing the metacarpophalangeal joints.
- **4th dorsal interosseous muscle:** Abducts digits from the axial line. Acts with the lumbrical muscles to extend the interphalangeal joints and to flex the metacarpophalangeal joints.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 3 may cause difficult or painful ring or little finger movement. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 3 may manifest from local or proximal trigger point pathology. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 3 and on toward TH 2, with pain also referred proximad to LI 11. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line at TH 3 and TH 2. Because of the multiplicity of causes of perceived pain in this region, a complete myofascial palpation exam should elucidate myriad contributors to ulnar hand pain.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[4] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

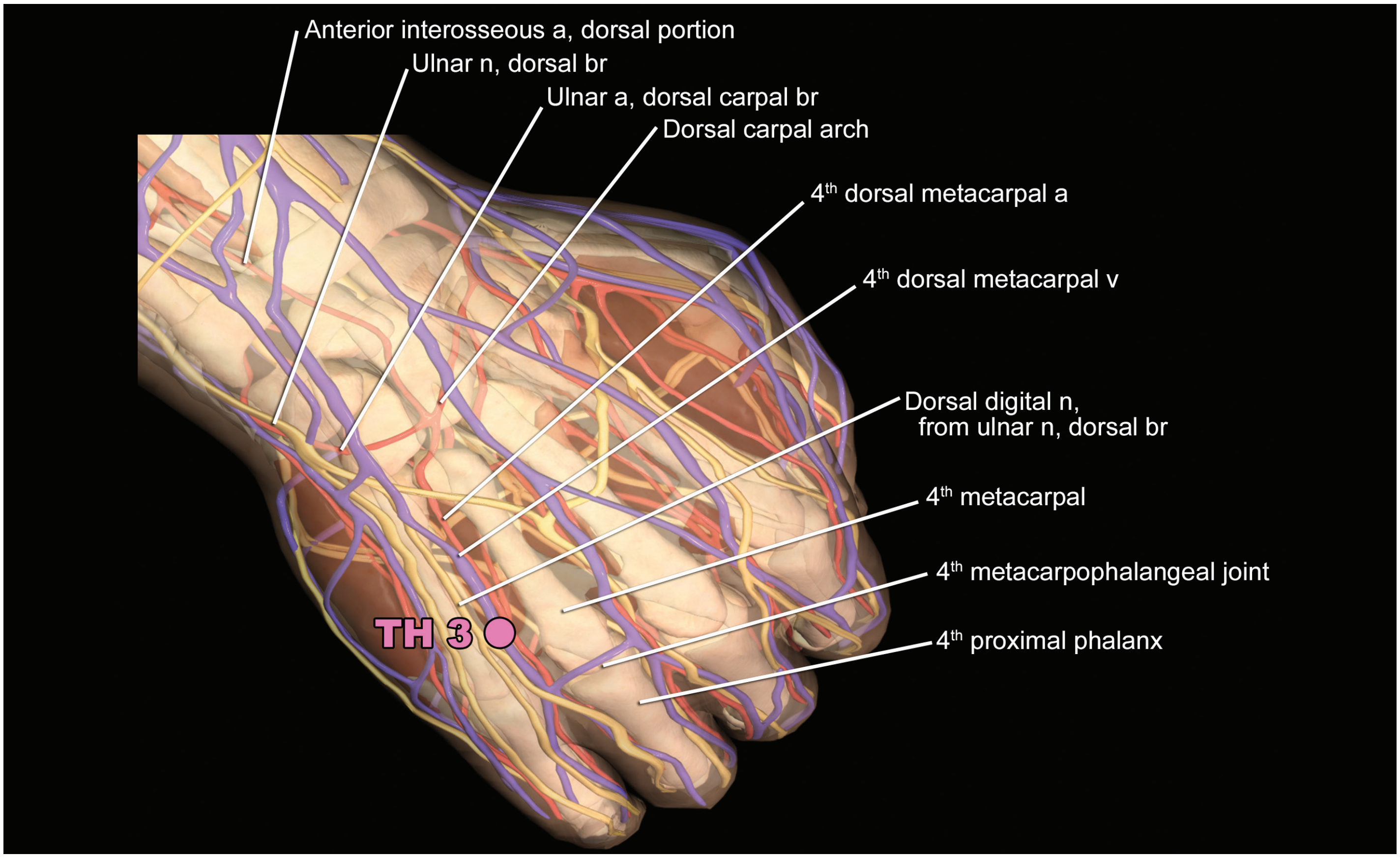

Anterior interosseous a, dorsal portion
Ulnar n, dorsal br
Ulnar a, dorsal carpal br
Dorsal carpal arch
4th dorsal metacarpal a
4th dorsal metacarpal v
Dorsal digital n, from ulnar n, dorsal br
4th metacarpal
4th metacarpophalangeal joint
4th proximal phalanx
TH 3

Figure 10-5. The Chinese name for TH 3 means "Central Islet" interposed between TH 2 ("Humor Gate") and TH 4 ("Yang Pool") maintains the reference to bodily fluid. This point sits in a shallow depression just proximal to the web space between the 4th and 5th metacarpophalangeal joints, made visible with a clenched fist. TH 2, in conjunction with the metacarpophalangeal joints of the 4th and 5th digits, form the angles of an equilateral triangle.

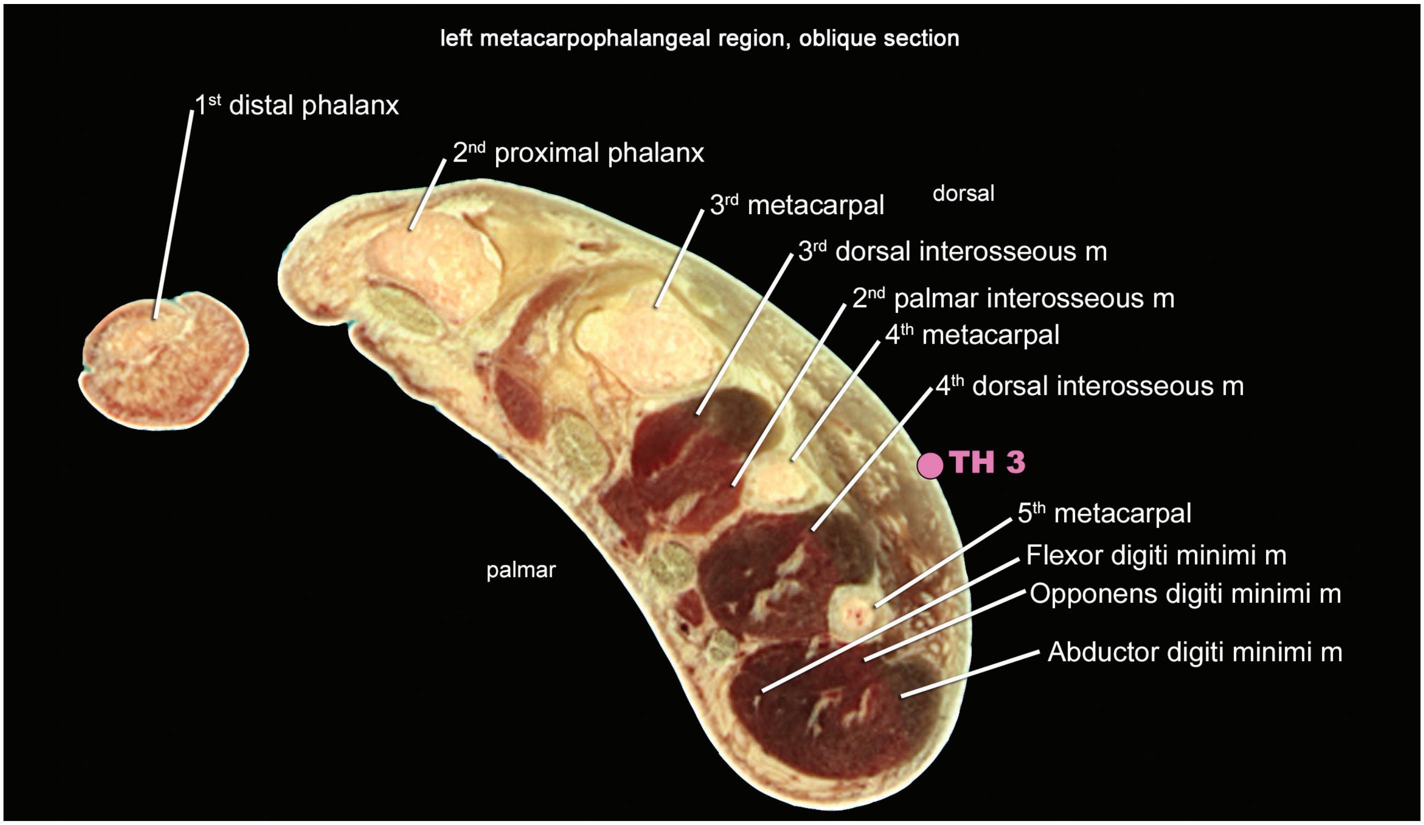


Figure 10-6. Trigger points in the 4th dorsal interosseous muscle appearing here deep to TH 3 may account for local and/or radiating pain to the digit. A trigger point in the ring finger extensor portion of the extensor digitorum muscle (at about LI 10 or TH 9) issues pain toward or through this site on its way to TH 2 and the ring finger.

Nerves

- **Common palmar digital branches of the superficial branch of the ulnar nerve:** Supply sympathetic motor innervation to the palmar and dorsal skin of the little finger and ulnar half of the ring finger.
- **Dorsal digital nerves:** Supplies the ulnar aspect of the ring finger, derived from the ulnar nerve.
- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

Clinical Relevance: Needling of TH 3 produces an increase in sympathetic nervous system activity, given its rich afferent sensory supply.[5] This serves to awaken the brain to its presence in the hand, thereby facilitating communication between the central nervous system and the distal extremity, which would aid in the recovery of hand function in patients following brain or spinal cord injury. In addition, neuromodulation of the sensory and motor nerves supplying the extensors of the hand should improve coordination and proprioception for patients with myofascial dysfunction following trauma or overuse.

Vessels

- **Dorsal metacarpal artery:** Arises from the dorsal carpal arch and receives contributions from the superficial palmar arch via perforating branches.
- **Dorsal digital arteries:** The dorsal metacarpal artery divides into two dorsal digital arteries at the metacarpophalangeal region.
- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health.

Indications and Potential Point Combinations

- **Temporal headache:** TH 3, GB 34, GB 21, local headache trigger points.

- **Sudden deafness:**[1,6] TH 3, GB 2, TH 17, LI 4, and GB 43.
- **Tinnitus:** Assess for upper cervical and temporomandibular somatic dysfunction and treat accordingly. TH 3, TH 21, SI 19, Taiyang.
- **Pain in elbow and upper arm:** TH 3; check for trigger points in the ring finger extensor portion of the extensor digitorum muscle and treat accordingly (TH 9, LI 10 vicinity)
- **Paralysis of upper extremities:** TH 3, Bafeng (web space) points, PC 8, PC 6, LI 4, identify interrupted source of neural input and treat accordingly (e.g., affected spinal cord segments and peripheral nerves).
- **Post-stroke hand dysfunction:**[7] TH 3, TH 5
- **Pain in neck and shoulders:** TH 3,TH 5, GB 21, GB 20, BL 10.
- **Central vestibular disorder:** TH 3, GB 34, ST 36.[8]

Evidence-Based Applications

- Acupuncture stimulation of TH 3 excited cortices of the bilateral frontal and temporal lobes, the cerebellum, and occipital lobes, affecting **areas of the brain that process acoustic, visual, and somatomotor function.**[2]
- Electroacupuncture at GB 2, TH 17, LI 4, GB 43, and TH 3 significantly improved hearing in patients with **sudden deafness** with better results than medication.[3]

References

1. Qian X. Experience in the clinical application of Zhongzhu (TE 3). *Journal of Traditional Chinese Medicine*. 2004;24(4):282-283.
2. Tian LF, Zhou C, Chen M, et al. (Chinese). Study of the relationship between the acupoints of Zhongzhu (TE 30, Yanglingquan (GB 34) and their corresponding cortical areas with the functional MRI. *Zhongguo Zhen Jiu*. 2009;29(7):561-564.
3. Luo TH, Zhou J, Huang YS, et al. (Chinese). Observation on therapeutic effect of electroacupuncture for treatment of sudden hearing loss. *Zhongguo Zhen Jiu*. 2009;29(3):185-187.
4. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. I*EEE Transactions on Neural Systems and Rehabilitation Engineering*. 2012;20(1):94-101.
5. Choi W, Lee S, Cho S, et al. Differential autonomic response to acupuncture at Wood and Metal of Five-Shu acupoints. *J Alt Complement Med*. 2012;18(10):959-964.
6. Luo RH, Zhou J, Huang YS, et al. Observation on therapeutic effect of electroacupuncture for treatment of sudden hearing loss. *Zhongguo Zhen Jiu*. 2009;29(3):185-187.
7. Cheng XK, Wang ZM, Sun L, et al. Post-stroke hand dysfunction treated with acupuncture at Zhongzhu (TE 3) and Waiguan (TE 5).
8. Tian LF, Zhou C, Chen M, et al. (Chinese). Study of the relationship between the acupoints of Zhongzhu (TE 30, Yanglingquan (GB 34) and their corresponding cortical areas with the functional MRI. *Zhongguo Zhen Jiu*. 2009;29(7):561-564.

TH 4

Yang Chi "Yang Pool"

On the dorsum of the wrist, at the junction of the ulna and carpal bones, in a depression between the tendons of the extensor digitorum and the extensor digiti minimi muscles. TH 4 can be found by starting at TH 3 and following the groove between the 4th and 5th metacarpal bones to the depression at the wrist. Ask the patient to move the digits in extension as though playing a piano while palpating to differentiate between the ring and little finger extensor tendons.

Connective Tissues

- **Dorsal radiocarpal ligament:** Originates from the dorsal margin of the distal radius. Extends in distal and oblique direction toward the ulnar aspect of the wrist. Fibers attach to the lunate bone and lunotriquetral interosseous ligament. The dorsal radiocarpal ligament and dorsal intercarpal ligaments form a "V" configuration. They function in alliance as a dorsal radioscaphoid ligament that varies its length by means of changing the angle of the "V".[3] The lateral "V" configuration allows normal carpal kinematic activity while, at the same time, stabilizing the dorsum of the wrist by means of its attachment to the scaphoid through wrist range of motion.4 The dorsal radiocarpal and intercarpal ligaments increases in length and tension with ulnar flexion of the wrist, as observed during a dart-throwing motion. Note the relative positions of the carpal bones available for viewing in Figure 10-8.

Clinical Relevance: This ligament of the wrist joint strengthens the fibrous capsule of the wrist. Equally if not more importantly, mechanoreceptors supply signals about joint perturbations to the central nervous system. Studies on wrist ligament-muscular reactions reveal that early-onset responses may serve to protect the joint while later reflexes may follow supraspinal reactions issued to stabilize the wrist joint.[1] This supraspinal control appears to involve dynamic fine-tuning of the corticospinal system during motor preparation in consideration of regulating afferent and efferent neural traffic.[2]

Tears, elongation, or strains of the dorsal radiocarpal ligament may negatively impact wrist stabilization and pronation. Laser therapy may aid in the restoration of ligamentous support on the dorsum of the wrist. It has shown value for problems associated with treatment of the transverse carpal ligament on the flexor surface.[5] While the latter application likely involved pain and functional changes related to neurovascular elements, laser therapy has shown value in improving connective tissue health related to ligaments of the knee.[6]

Tendons

- **Extensor digitorum tendon:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor digiti minimi tendon:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 4 may cause limited ring or little finger extension.

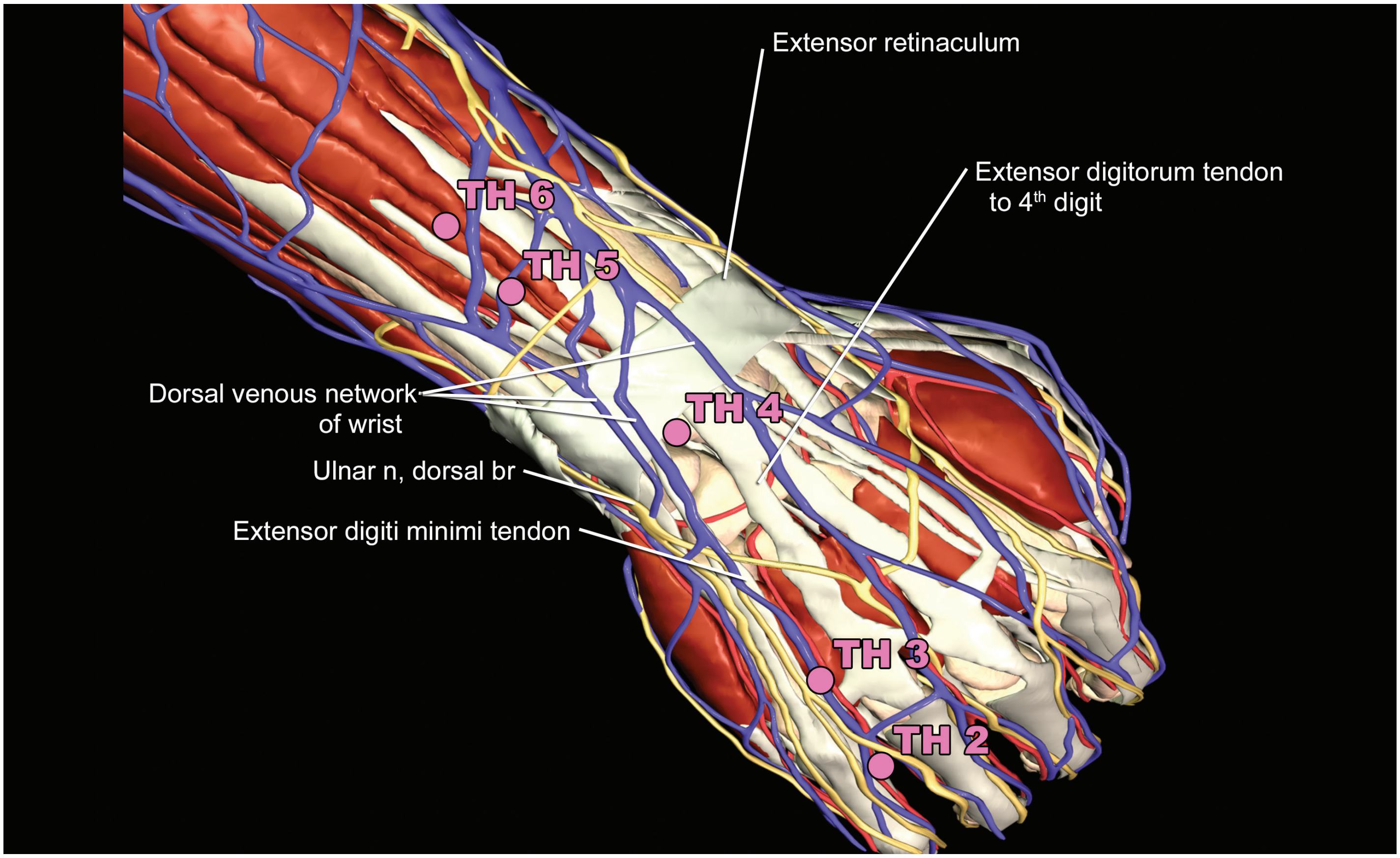

Extensor retinaculum
Extensor digitorum tendon to 4th digit
TH 6
TH 5
Dorsal venous network of wrist
TH 4
Ulnar n, dorsal br
Extensor digiti minimi tendon
TH 3
TH 2

Figure 10-7. TH 4 lives between the tendons of the extensor digitorum to the ring finger and the extensor digiti minimi tendon, as shown in this image.

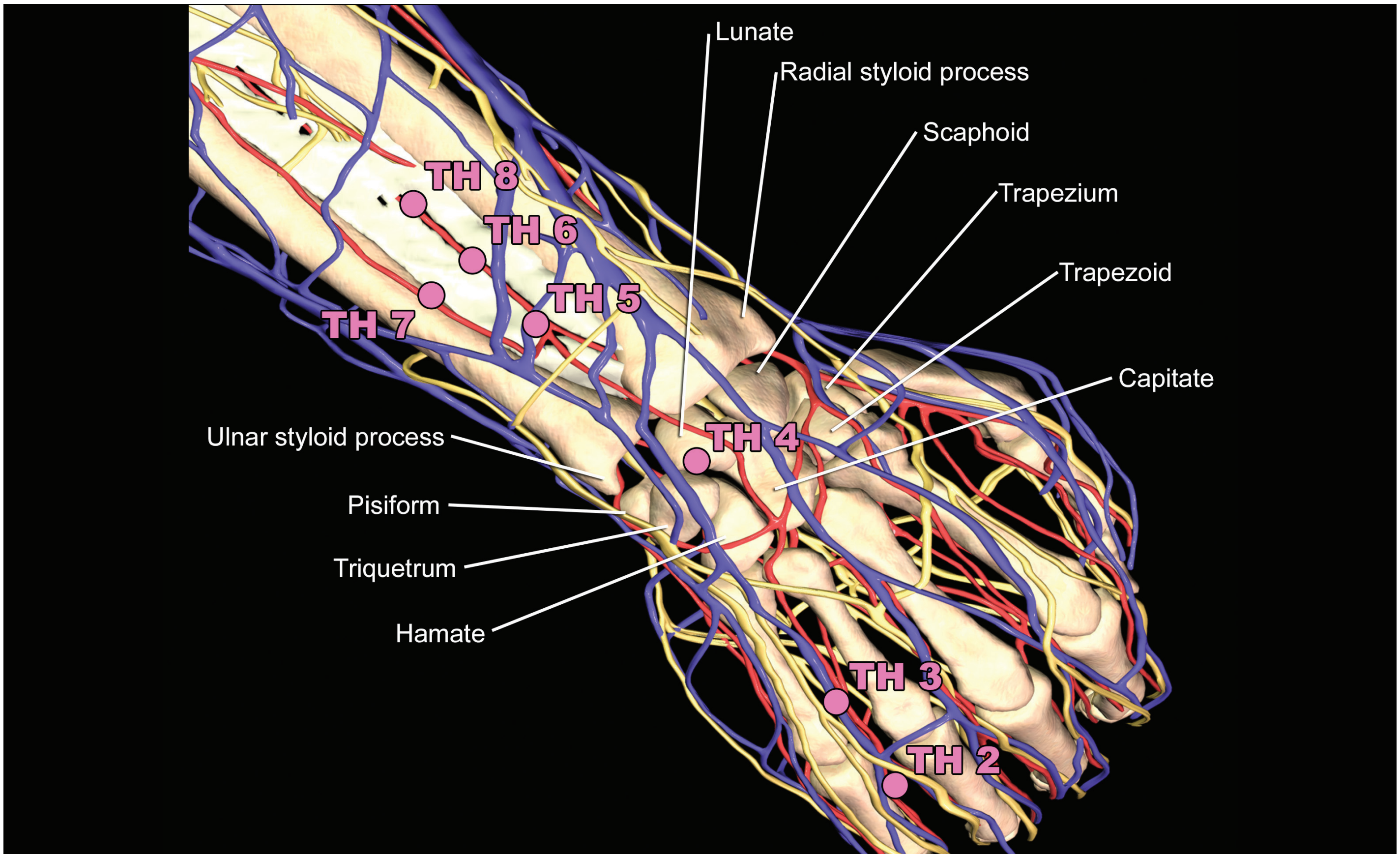


Figure 10-8. The depression forming the "Yang Pool" of TH 4 constitutes a cleft between the lunate and triquetral bones and the two diverging tendons. This pool occurs on the dorsum of the wrist, considered the "Yang" surface in Chinese medicine.

Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 4 may manifest from local or proximal trigger point pathology. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 4 and on toward TH 2, with pain also referred proximad to LI 11. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line at TH 4. Because of the multiplicity of causes of perceived pain in this region, a complete myofascial palpation exam should elucidate myriad contributors to ulnar hand pain.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[7] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

The term "trigger finger" ("stenosing tenosynovitis") ordinarily applies to flexor tendon triggering, confirmed by finding a sudden extension of the involved finger at the proximal interphalangeal joint when the flexor tendon passes through the A1, or first annular, pulley near the head of the metacarpal bone. This leads to a palpable "triggering" or snap on the palmar aspect of the metacarpophalangeal joint. The extensor digiti minimi may develop a trigger phenomenon as well, manifesting as painful radial subluxation of the tendon over the metacarpal head. Some patients report hearing a "click" and feeling pain at the site of the 5th extensor retinaculum in conjunction with finger flexion.[8] The site of the snapping occurs just ulnar to TH 2 and TH 3 (at the metacarpophalangeal joint). While release of the extensor retinaculum constitutes one approach, physical medicine measures involving acupuncture and related techniques offer an alternative, conservative, intervention that may obviate more invasive interventions.

Nerves

- **Ulnar nerve (C8-T1):** The ulnar nerve supplies most of the intrinsic hand muscles (i.e., the hypothenar, interosseous, adductor pollicis, deep head of the flexor pollicis brevis, and the medial (IV and V) lumbrical muscles. It provides sensation to the palmar and distal dorsal aspects of the ulnar 1.5 digits (i.e., the little and the ulnar half of the ring finger) and adjacent palmar region. It gives off four branches: the palmar cutaneous, dorsal, superficial, and deep. The palmar cutaneous branch supplies the skin at overlying the carpal bones on the ulnar side of the wrist. The dorsal branch supplies the skin on the ulnar aspect of the dorsal hand and the proximal parts of the little and medial ring finger. The superficial branch supplies the palmaris brevis muscle, the skin of the palmar and distal dorsal aspects of the little finger and the ulnar side of the ring finger, and the proximal palm. The deep branch supplies the hypothenar muscles (i.e., the abductor, flexor, and opponens digiti minimi), the IV and V lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.

- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles.

Clinical Relevance: Fractures of the thoracic limb can injure peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[9] Displacement of bone after high-energy trauma induces nerve traction with acute deficits. Iatrogenic entrapment following fracture reduction places compressive forces on nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and functional restoration.

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[10]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[11]

Vessels

- **Dorsal venous network:** Formed by the three dorsal metacarpal veins, which in turn arise from the dorsal digital veins. This portion of the dorsal venous network drains into the cephalic vein.

- **Dorsal carpal branch of the ulnar artery:** Arises from the ulnar artery at the wrist. Anastomoses with branches of the radial artery, thereby providing collateral circulation for the wrist joint via dorsal and palmar carpal arches.

- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.

- **Anterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that courses along the distal posterior portion of the interosseous membrane.

- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health.

Hematomata or aneurysms of vessels in the extensor surface groove between radius and ulna may compress the posterior interosseous nerve.[12]

Indications and Potential Point Combinations

- **Pain in wrist:** Identify source of pain (arthrodial, referred myofascial, neuropathic, etc.) For pain on the dorsal wrist, TH 4, TH 5, and trigger points responsible for referred pain, if present. These triggers may include TH 9/LI 10 region over the middle and ring finger extensors or a trigger point in the extensor indicis muscle at TH 5 that strongly refers pain to the central dorsal wrist.

- **Arm or shoulder pain:** Trigger points in the long head of the triceps muscle may refer pain to the wrist near TH 4. Palpate for trigger points in the triceps; consider TH 11, TH 12.

- **Tonsillitis, pharyngitis:** TH 4, TH 21, CV 23, CV 22.

- **Trigger finger:** LI 11, LI 10, LI 4, TH 5, TH 4.[13]

Evidence-Based Applications

- Treatment of **"snapping" finger** was addressed by bilateral acupuncture at TH 4, TH 5, LI 4, LI 10, and LI 11.[14]

- The "up-down cross" method of stimulating the contralateral opposite limb calls for TH 4 for the treatment of **ankle sprain.**[15,16] According to this approach, PC 7 qualifies as an alternate point for the treatment of ankle sprain and instability. See Figure 10-9 to identify their relationship to one another at the wrist.

- Thoracic limb spasticity following **stroke** with TH 4, TH 10, LI 15, PC 7, LU 5, and HT 1, along with contralateral scalp acupuncture.[17]

References

1. Hagert E, Persson JKE, Werner M, et al. Evidence of wrist proprioceptive reflexes elicited after stimulation of the scapholunate interosseous ligament. *Journal of Hand Surgery*. 2009;34A(4):642-651.
2. Meziane HB, Spieser L, Pailhous J, et al. Corticospinal control of wrist muscles during expectation of a motor perturbation: A transcranial magnetic stimulation study. *Behavioural Brain Research*. 2009;198:459-465.
3. Viegas SF, Yamaguchi S, Boyd NL, et al. The dorsal ligaments of the wrist: anatomy, mechanical properties, and function. *J Hand Surg*. 1999;24A:456-458.
4. Tang JB, Gu XK, Xu J, et al. In vivo length changes of carpal ligaments of the wrist during dart-throwing motion. *J Hand Surg*. 2011;36A:284-290.
5. Chang WD, Wu JH, Jiang JA, et al. Carpal tunnel syndrome treated with a diode laser: a controlled treatment of the transverse carpal ligament. *Photomed Laser Surg*. 2008;26(6):551-557.
6. Delbari A, Bayat M, and Bayat M. Effect of low-level laser therapy on healing of medial collateral ligament injuries in rats: an ultrastructural study. *Photomed Laser Surg*. 2007;25(3):191-196.
7. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and*

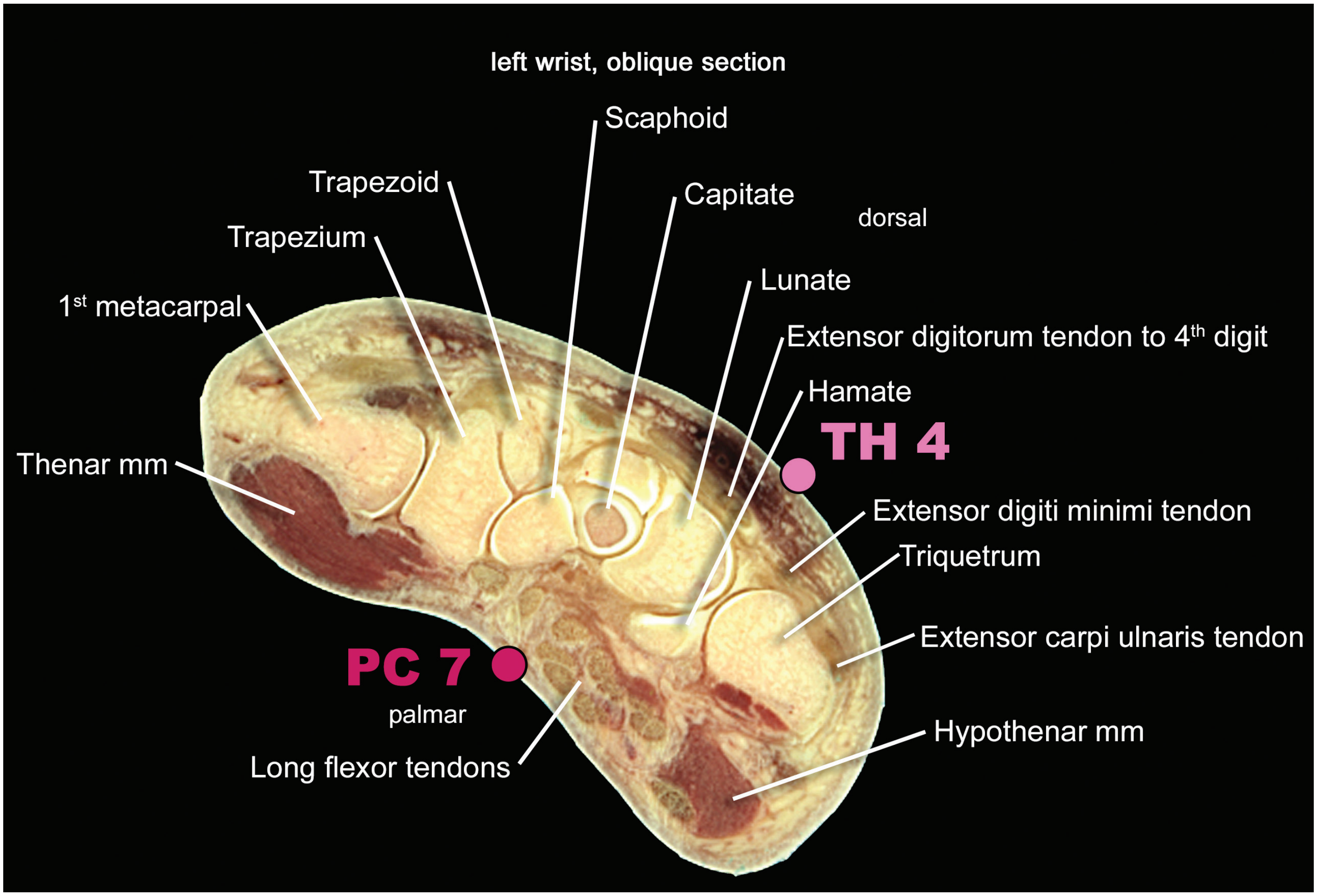

left wrist, oblique section
Scaphoid
Trapezoid
Capitate
dorsal
Trapezium
Lunate
1st metacarpal
Extensor digitorum tendon to 4th digit
Hamate
TH 4
Thenar mm
Extensor digiti minimi tendon
Triquetrum
Extensor carpi ulnaris tendon
PC 7
palmar
Hypothenar mm
Long flexor tendons

Figure 10-9. This cross section of the "Yang Pool", or TH 4, reveals the snug location of the point between two digital extensor tendons.

Rehabilitation Engineering. 2012;20(1):94-101.

8. Park SE, Kim YY, Ji JH, et al. Double triggering of extensor digiti minimi: a case report. *Arch Orthop Trauma Surg.* 2013;133(3):429-432.

9. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.

10. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.

11. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.

12. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. *J Vasc Surg.* 2003;38:617-619.

13. Arichi S, Arichi H, and Toda S. Acupuncture and rehabilitation effect of acupuncture on normal side to snapping finger. *Am J Chin Med.* 1983;11(1-4):137-142.

14. Arichi S, Arichi H, and Toda S. Acupuncture and rehabilitation effect of acupuncture on normal side to snapping finger. *Am J Chin Med.* 1983;11(1-4):137-142.

15. Li C, Lu WH, and Xu JY. Selection point by up-down cross method for ankle sprain. *Zhongguo Zhen Jiu.* 2011;31(10):918.

16. Mou ZX. Treatment of 31 cases of acute ankle sprain by puncturing yangchi. *J Tradit Chin Med.* 1987;7(1):71.

17. Zhang ZM, Feng CL, Pi ZK, et al. Observation on clinical therapeutic effect of acupuncture on upper limb spasticity in the patient of poststroke. *Zhongguo Zhen Jiu.* 2008;28(4):257-260.

TH 5

Wai Guan "Outer Pass"

On the dorsal distal antebrachium, 2 cun proximal to the dorsal wrist crease and TH 4, on the line connecting TH 4 and the tip of the olecranon.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface, in conjunction with a dorsal branch of the anterior interosseous vessels.

The interosseous membrane provides longitudinal stability to the forearm.[11] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[12] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[13]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[14] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[15] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles and Tendons

- **Extensor digitorum tendon:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor digiti minimi tendon:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.
- **Extensor indicis muscle:** Extends the index finger. Helps extend the entire hand.
- **Extensor pollicis longus muscle:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 5 may cause limited ring or little finger extension.

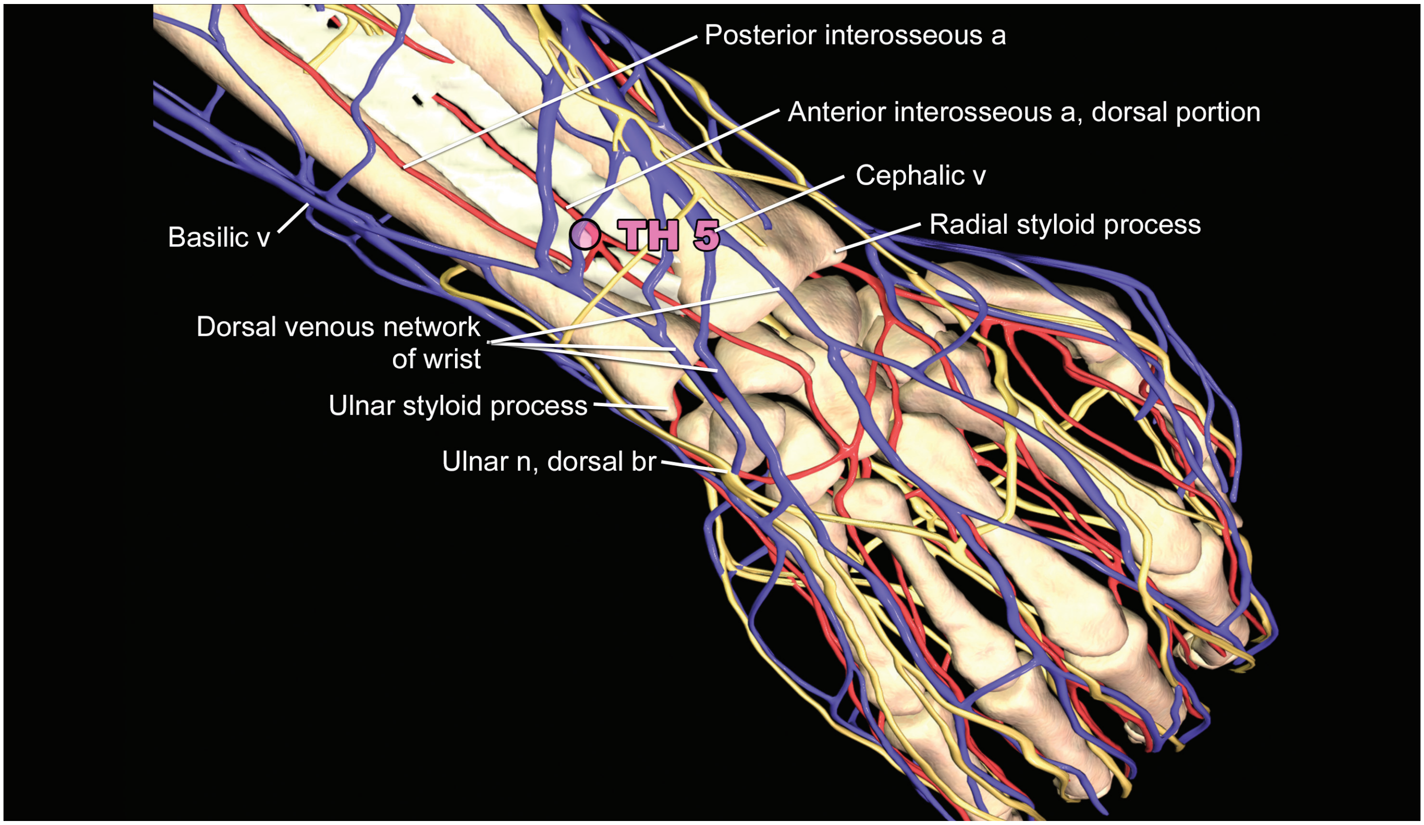


Figure 10-10. TH 5, the "Outer Pass" supplies the dorsal, or Yang, surface of the distal antebrachium, serving as an "outer" counterpart to PC 6, called the "Inner Pass". Both relate anatomically to the passage of the anterior interosseous vessels from the volar to the dorsal surface. This vascular link between the TH and PC lines explains its status as a "Luo", or "connecting" point in Chinese medicine.

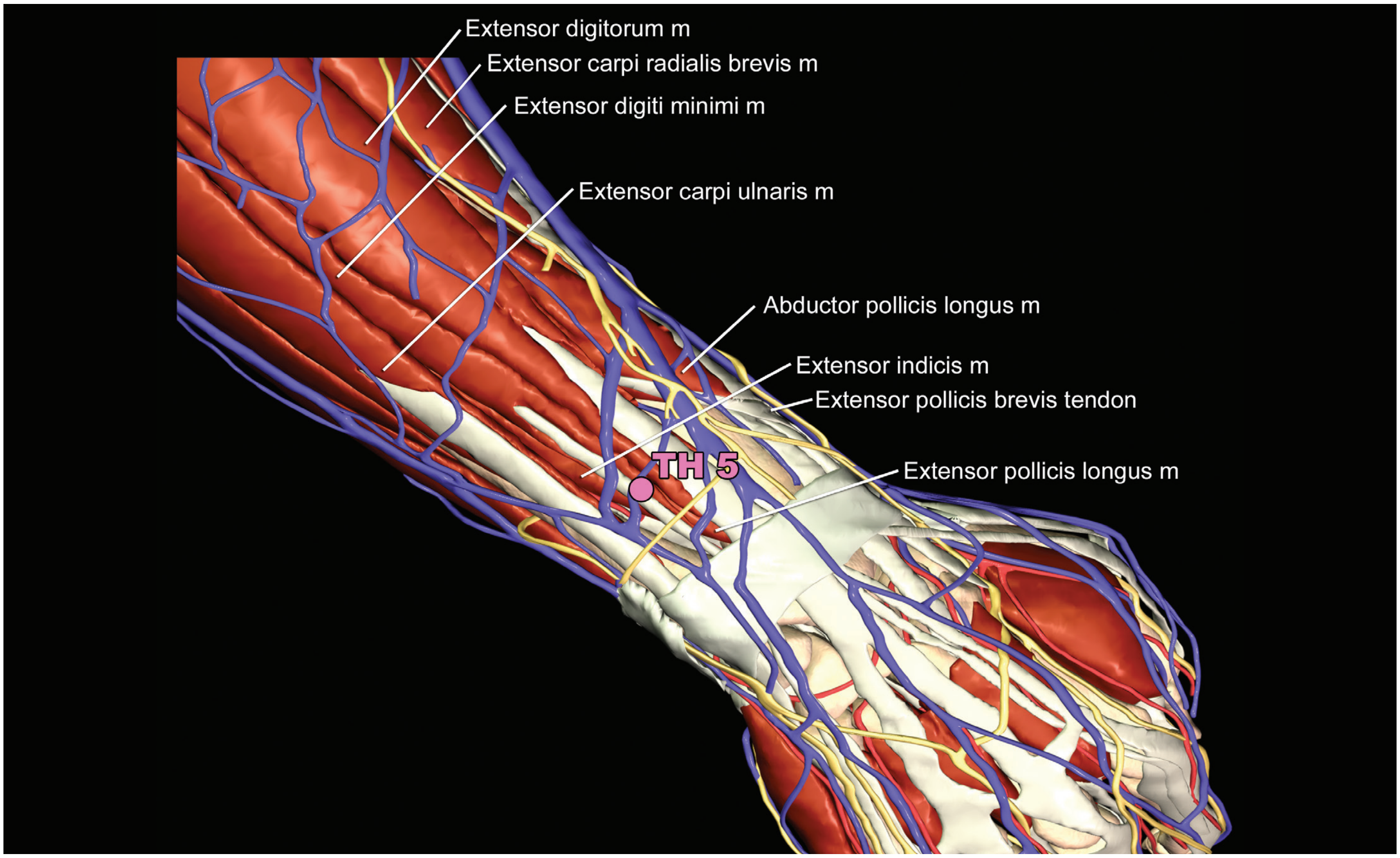

Extensor digitorum m
Extensor carpi radialis brevis m
Extensor digiti minimi m
Extensor carpi ulnaris m
Abductor pollicis longus m
Extensor indicis m
Extensor pollicis brevis tendon
TH 5
Extensor pollicis longus m

Figure 10-11. The analgesic effects of TH 5 stimulation for patients with wrist pain stems at least in part from its relationship to the trigger point in the extensor indicis muscle, shown here. The referred pain pattern from a trigger point at TH 5 in the extensor indicis muscle extends from TH 4 toward LI 4, LI 3, and LI 2. The overlap in pain patterns from myriad trigger points in the thoracic limb involving TH and LI points arises from the fact that both receive innervation from the radial nerve.

Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 5 may manifest from local or proximal trigger point pathology. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 5 and on toward TH 2, with pain also referred proximad to LI 11. Trigger points in the middle finger extensor describe a line of referred pain along the TH channel too, but head toward the middle, rather than ring, finger. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line near TH 5. A trigger point in the extensor indicis muscle, beneath TH 5 and TH 6, issues pain in the direction of LI 2, LI 3, and LI 4. Note the abundant myotendinous junctions located at the level of the antebrachium that house TH 5 and TH 6. These sites supply the tissue with Golgi tendon organs, affording opportunities to neuromodulate mechanoreceptors and adjust proprioceptive “set points” governing motor control. Several myofascial sources can cause pain in this region, thus making a complete myofascial palpation exam vital in order to identify contributors to distal thoracic limb discomfort.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[16] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles.

Clinical Relevance: Fractures of the thoracic limb can injure peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[17] Displacement of bone after high-energy trauma places traction on the nerve. Iatrogenic entrapment following fracture reduction can compress the nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and aids in functional restoration.

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[18]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[19]

Vessels

- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.
- **Anterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that courses along the distal posterior portion of the interosseous membrane.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health. Blood flow changes in nail-fold microcirculation following acupuncture at TH 5 involve spinal cord reflexes in related spinal segments.[20]

Hematomata or aneurysms of vessels in the extensor surface groove between radius and ulna may compress the posterior interosseous nerve.[21]

Indications and Potential Point Combinations

- **Myofascial restriction in the elbow, forearm, or wrist:** Check for trigger points in the ring finger extensor portion of the extensor digitorum muscle. Such triggers radiate pain to the elbow at LI 11, LI 10/TH 9, and distal along the TH line, including TH 5. Needle accordingly.
- **Shoulder problems:** Trigger points in the long head of the triceps brachii muscle radiate proximal to the shoulder region at TH 14 and then toward the neck near GB 21. The distal radiation pattern proceeds along the posterior/caudal brachium along the TH line to TH 10. It continues along the TH line toward TH 5 and TH4. Needle according to the trigger point and pain patterns.
- **Occipital headaches migrating to the forehead and eyes:** TH 5, TH 16, BL 10, BL 2, Taiyang.
- **Problems in the ear, nose, or throat:** TH 5, LI 4, GV 20, and local points for the ear (TH 21, TH 20), the nose (LI 20), and throat (CV 23).
- **Trigger finger:** LI 11, LI 10, LI 4, TH 5, TH 4.[22]

Evidence-Based Applications

- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **keratoconjunctivitis sicca (KCS).**[1]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[2]
- Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an **effective analgesic during oocyte aspiration;** these analgesic effects equal those of conventional analgesics.[3] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[4]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combi nation with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome,** thereby offering an alternative to pharmacologic induction of ovulation.[5]
- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[6]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[7]
- Acupuncture at LI 4, LI 10, LI 11, LI 15, and TH 5 alleviated pain and improved function in patients with **chronic lateral epicondylitis (tennis elbow).**[8]
- Needling TH 5 alone or in combination with GB 34 produced a concentrated activation of the **bilateral frontal and parietal lobes** of the brain based on fMRI evaluation.[9]
- Acupuncture at TH 5, GB 34, and GB 20 outperformed control acupuncture at ST 8, ST 36, and LI 6 for patients with **migraine.**[23] The former point grouping produced higher brain metabolism in the middle temporal cortex, the orbital frontal cortex, the insula, middle frontal gyrus, angular gyrus, post-cingulate cortex, precuneus, and middle cingulate cortex than that exhibited by migraineurs without acupuncture treatment.
- Acupuncture at TH 5 aids in the recovery of patients following **cerebrovascular accident,** or stroke, perhaps in part by regulating areas of the brain related to motor execution and vision.[24]
- Acupuncture at TH 5 and LI 11 affected subjective pain intensity on a numerical pain rating scale as well as endplate noise recorded from **myofascial trigger points in the upper trapezius**

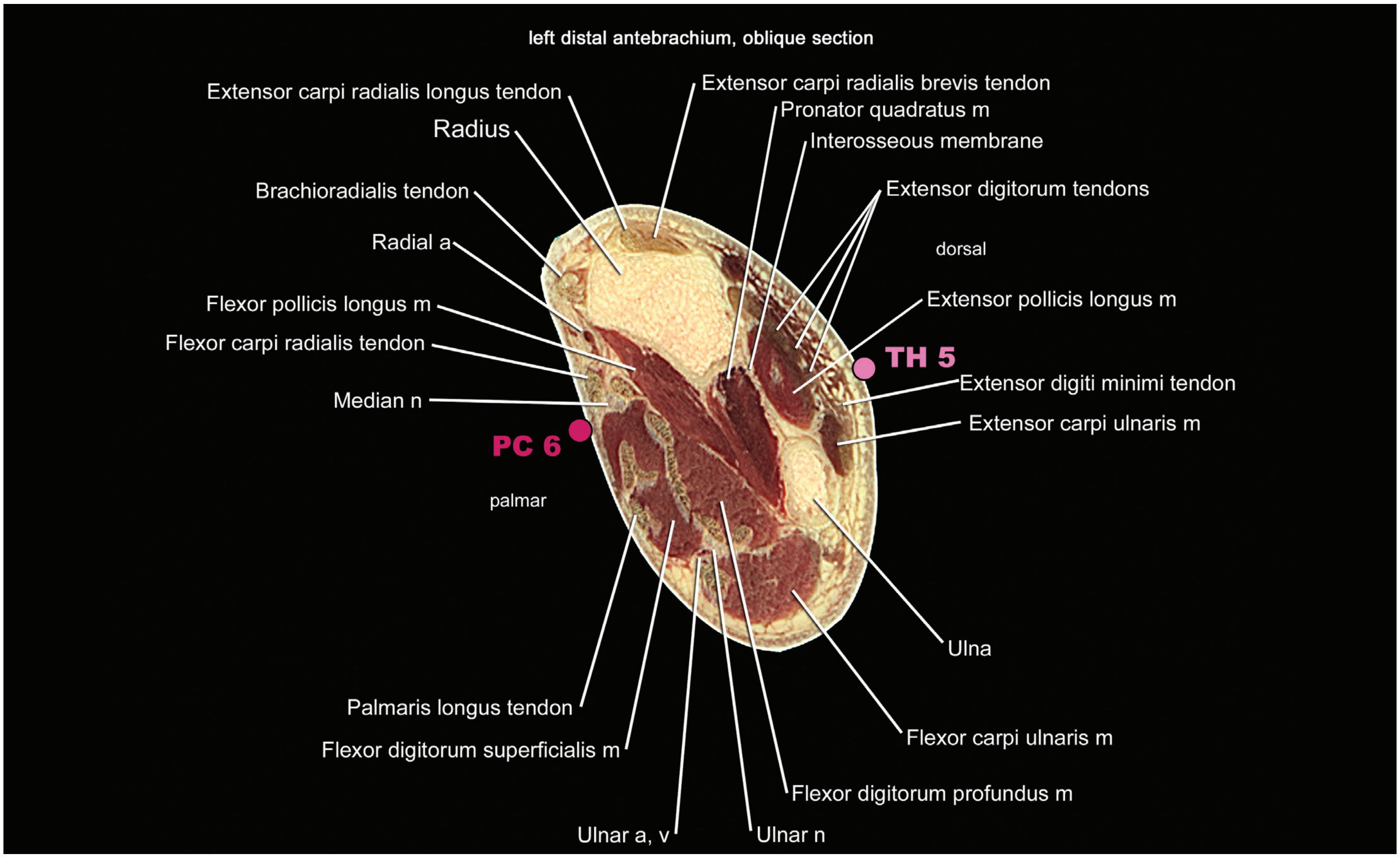

left distal antebrachium, oblique section
Extensor carpi radialis longus tendon
Radius
Brachioradialis tendon
Radial a
Flexor pollicis longus m
Flexor carpi radialis tendon
Median n
PC 6
palmar
Palmaris longus tendon
Flexor digitorum superficialis m
Ulnar a, v
Ulnar n
Flexor digitorum profundus m
Flexor carpi ulnaris m
Ulna
Extensor carpi radialis brevis tendon
Pronator quadratus m
Interosseous membrane
Extensor digitorum tendons
dorsal
Extensor pollicis longus m
TH 5
Extensor digiti minimi tendon
Extensor carpi ulnaris m

Figure 10-12. This cross-section portrays illustrates the dorsal-volar relationship of TH 5 and PC 6. Some practitioners have been known to stimulate both points with one long needle that enters PC 6 and tents the skin beneath TH 5. Such aggressive treatment may injure underlying vessels and/or nerves.

muscle, demonstrating the remote influence of acupuncture on trigger points.[10]

- Treatment of **“snapping” finger** was addressed by bilateral acupuncture at TH 4, TH 5, LI 4, LI 10, and LI 11.[25]
- Electroacupuncture in conjunction with general anesthesia **accelerated post-operative anesthetic recovery** after craniotomy, utilizing the following points connected to the electrical stimulator: TH 5, LI 4, ST 36, BL 63, LR 3, and GB 40.[26]
- Electrical stimulation of nerves and muscle involving local facial points as well as TH 5, LI 4, SP 6, and LR 3 accelerates recovery from **facial nerve injury.**[27]
- Weight loss in **obese patients elevated temperature** at TH 5 and LI 4.[28]
- Acupuncture at TH 5 appears to **balance autonomic tone** by means of changes in associated spinal cord segments.[29]

References

1. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2*. New York: Plenum Press, 1998. pp. 1011-1016.

2. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine.* 2003;21(4):138-149.

3. Stener-Victorin E, Waldenström U, Nilsson L, Wikland M, Janson PO. A prospective randomized study of electro-acupuncture versus alfentanil as anaesthesia during oocyte aspiration in in-vitro fertilization. *Human Reproduction.* 1999;14(10):2480-2484.

4. Stener-Victorin E, Waldenström U, Wikland M, Nilsson L, Hägglund L, and Lundeberg T. Electro-acupuncture as a preoperative analgesic method and its effects on implantation rate and neuropeptide Y concentrations in follicular fluid. *Human Reproduction.* 2003;18(7):1454-1460.

5. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand.* 2000;79:180-188.

6. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases.* 2000;6:15-24.

7. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and “sham” laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1-6.

8. Fink M, Wolkenstein E, Karst M, and Gehrke A. Acupuncture in chronic epicondylitis: a randomized controlled trial. *Rheumatology.* 2002;41:205-209.

9. Huang Y, Li T-L, Lai X-S. Functional brain magnetic resonance imaging in healthy people receiving acupuncture at Waiguan versus Waiguan plus Yanglingquan points: a randomized controlled trial. *J Chin Integr Med.* 2009;7(6):527-531.

10. Chou LW, Hsieh YL, Kao MJ, et al. Remote influences of acupuncture on the pain intensity and the amplitude changes of endplate noise in the myofascial trigger point of the upper trapezius muscle. *Arch Phys Med Rehabil.* 2009;90(6):905-912.

11. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.

12. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.

13. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.

14. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.

15. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.

16. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 2012;20(1):94-101.

17. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.

18. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.

19. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.

20. Jan Y-M, Li Y-C, and Hsieh C-L. A segmental effect involved in the changes of skin blood

flow induced by acupuncture in normal health human. *Am J Chin Med.* 2010;38(3):441-448.
21. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. J Vasc Surg. 2003;38:617-619.
22. Arichi S, Arichi H, and Toda S. Acupuncture and rehabilitation effect of acupuncture on normal side to snapping finger. *Am J Chin Med.* 1983;11(1-4):137-142.
23. Yang J, Zeng F, Feng Y, et al. A PET-CT study on the specificity of acupoints through acupuncture treatment in migraine patients. *BMC Complementary and Alternative Medicine.* 2012;12:123.
24. Huang Y, Tang C, Wang S, et al. Acupuncture regulates the glucose metabolism in cerebral functioning regions in chronic stage ischemic stroke patients – a PET-CT cerebral functional imaging study. *BMC Neurosci.* 2012;13:75.
25. Arichi S, Arichi H, and Toda S. Acupuncture and rehabilitation effect of acupuncture on normal side to snapping finger. *Am J Chin Med.* 1983;11(1-4):137-142.
26. Yang C, An L, Han R, et al. Effects of combining electroacupuncture with general anesthesia induced by sevoflurane in patients undergoing supratentorial craniotomy and improvements in their clinical recovery profile & blood encephalin. *Acupunct Electrother Res.* 2012;37(2-3):125-138.
27. Yang J-S, Cui C-B, Gao X-Y, et al. 44 cases of peripheral facial paralysis treated by the SXDZ-100 nerve and muscle stimulator. *J Tradit Chin Med.* 2009;29(3):182-185.
28. Kwon YD, Lee JH, and Lee MS. Increased temperature at acupuncture points induced by weight reduction in obese patients: a preliminary study. *Int J Neurosci.* 2007;117(5):591-595.
29. Hsieh CL, Chang YM, Tang NY, et al. Time course of changes in nail fold microcirculation induced by acupuncture stimulation at the Waiguan acupoints. *Am J Chin Med.* 2006;34(5):777-785.

TH 6

Zhi Gou "Branch Ditch"

On the dorsal distal antebrachium, 3 cun proximal to the dorsal wrist crease and TH 4, on the line connecting TH 4 and the tip of the olecranon. Between the radius and the extensor digitorum muscle, close to the radius, 1/4 the distance from TH 4 to the lateral epicondyle of the humerus.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface, in conjunction with a dorsal branch of the anterior interosseous vessels.

The interosseous membrane provides longitudinal stability to the forearm.[4] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[5] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[6]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[7] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[8] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles

- **Extensor digitorum muscle:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.

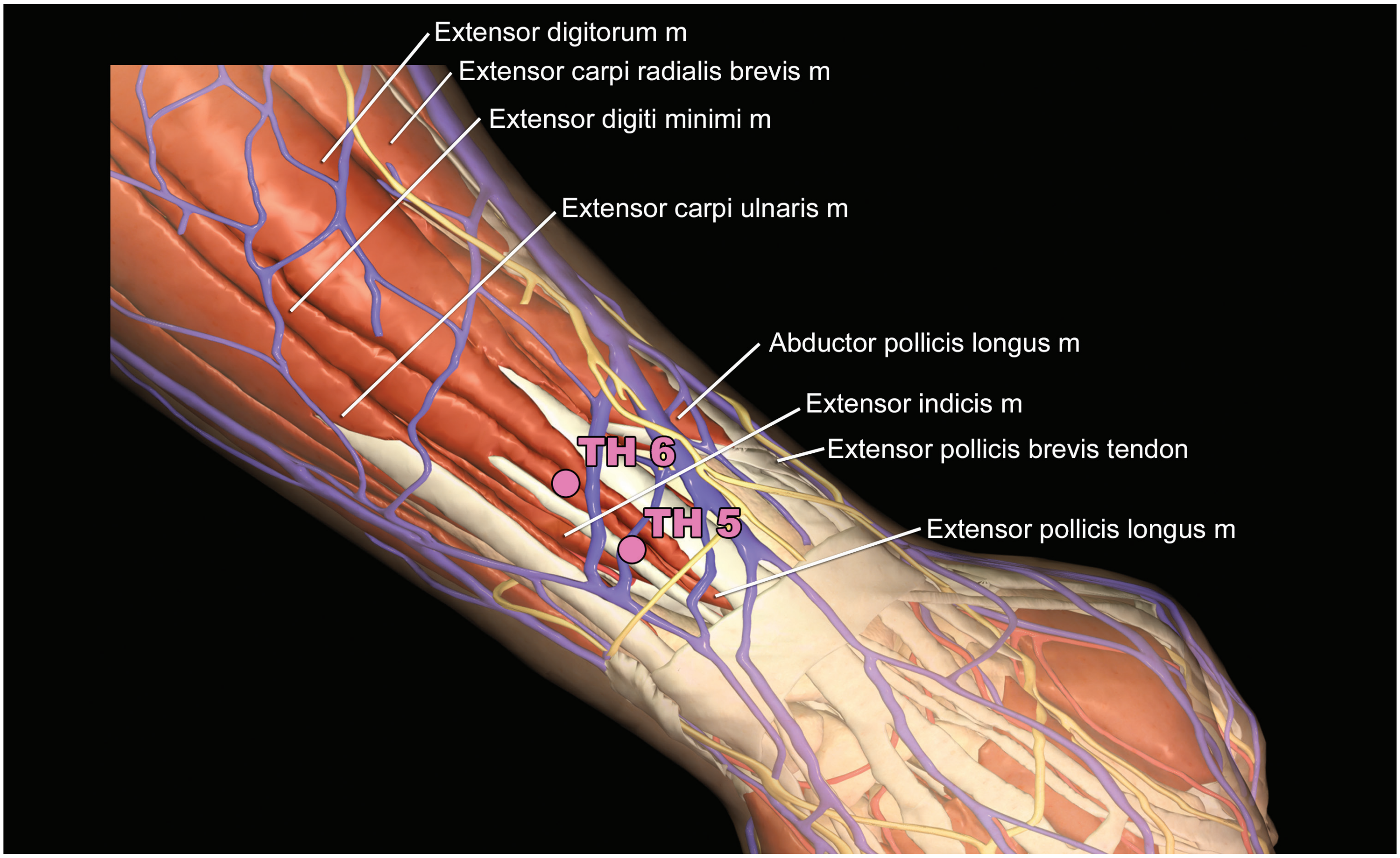

Extensor digitorum m
Extensor carpi radialis brevis m
Extensor digiti minimi m
Extensor carpi ulnaris m
Abductor pollicis longus m
Extensor indicis m
Extensor pollicis brevis tendon
TH 6
TH 5
Extensor pollicis longus m

Figure 10-13. Like TH 5, TH 6 deactivates myofascial trigger points palpated nearby, such as within the extensor indicis muscle. Other trigger points typically refer pain along the TH trajectory. For example, a trigger point in the extensor carpi radialis brevis muscle, near LI 8 and LI 9 region sends a pain referral pattern to the dorsum of the wrist along the TH channel. In addition, a trigger point in the ring finger extensor radiates pain to the ring finger from the vicinity of TH 9.

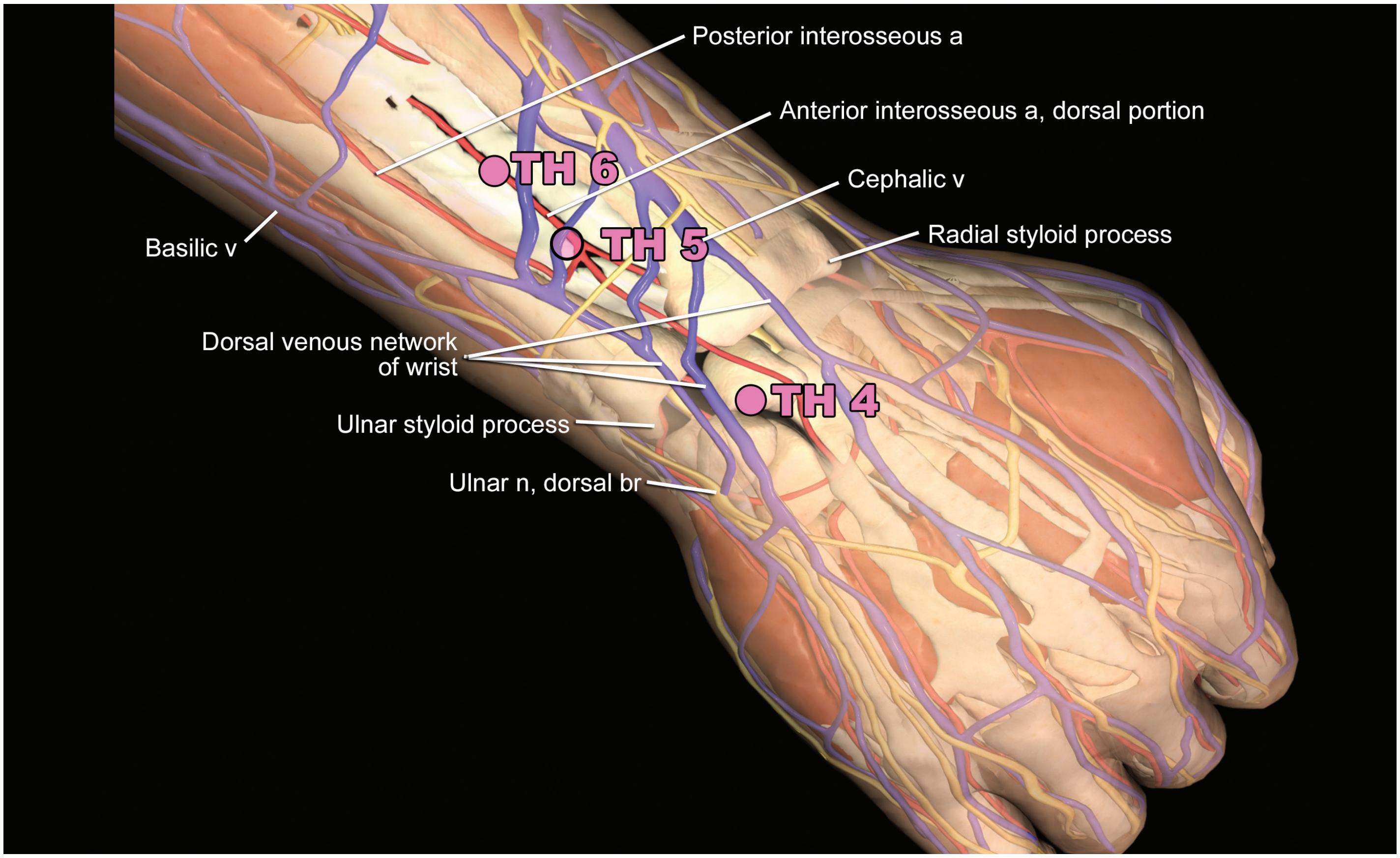


Figure 10-14. The descriptive name for TH 6, "Branch Ditch", connotes a deep waterway extending off of a main channel. The name pertains to the dorsal branch of the anterior interosseous artery that pierces the interosseous membrane, thus allowing it to supply the dorsal, as well as volar, surfaces.

- **Extensor indicis muscle:** Extends the index finger. Helps extend the entire hand.
- **Extensor pollicis longus muscle:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 6 may cause limited ring or little finger extension. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 6 may manifest from local or proximal trigger point pathology. A trigger point in the extensor indicis muscle, beneath TH 5 and TH 6, issues pain in the direction of LI 2, LI 3, and LI 4. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 6 and on toward TH 2, with pain also referred proximad to LI 11. Trigger points in the middle finger extensor describe a line of referred pain along the TH channel too, but head toward the middle, rather than ring, finger. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line.

Note the abundant myotendinous junctions available for activation at the level of the TH 5 and TH 6. The myotendinous junctions house Golgi tendon organs, affording opportunities to neuromodulate mechanoreceptors and adjust proprioceptive "set points" governing motor control. Several myofascial sources can cause pain in this region, thus making a complete myofascial palpation exam vital in order to identify contributors to distal thoracic limb discomfort.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[9] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles. Also supplies the posterior surface of the interosseous membrane.

Clinical Relevance: Fractures of the thoracic limb can injure

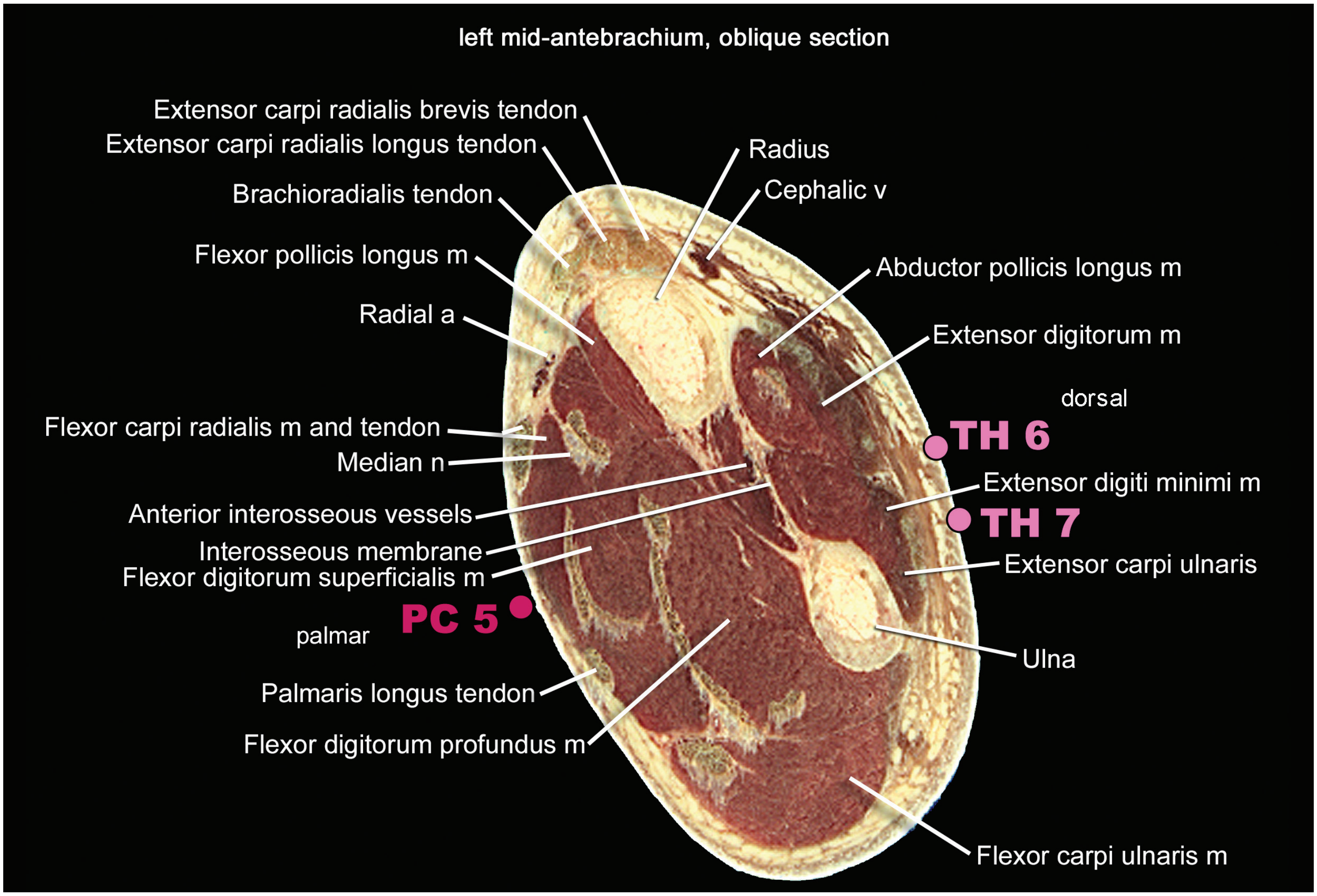

left mid-antebrachium, oblique section
Extensor carpi radialis brevis tendon
Extensor carpi radialis longus tendon
Brachioradialis tendon
Flexor pollicis longus m
Radial a
Flexor carpi radialis m and tendon
Median n
Anterior interosseous vessels
Interosseous membrane
Flexor digitorum superficialis m
PC 5
palmar
Palmaris longus tendon
Flexor digitorum profundus m
Radius
Cephalic v
Abductor pollicis longus m
Extensor digitorum m
dorsal
TH 6
Extensor digiti minimi m
TH 7
Extensor carpi ulnaris
Ulna
Flexor carpi ulnaris m

Figure 10-15. This cross-section illustrates the side-by-side location of TH 6 and TH 7 on either side of the extensor digiti minimi muscle.

peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[10] Displacement of bone after high-energy trauma places traction on the nerve. Iatrogenic entrapment following fracture reduction can compress the nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and aids in functional restoration.

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[11]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[12]

Vessels

- **Anterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The anterior interosseous artery supplies both sides of the interosseous membrane by providing a dorsal branch that courses along the distal posterior portion of the interosseous membrane.
- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health. Blood flow changes in nail-fold microcirculation following acupuncture at TH 5 and, likely, TH 6 involve spinal cord reflexes in related spinal segments.[13]

Hematomata or aneurysms of vessels in the extensor surface groove between radius and ulna may compress the posterior interosseous nerve.[14]

Indications and Potential Point Combinations

- **Myofascial restriction in the elbow, forearm, or wrist:** Check for trigger points in the ring finger extensor portion of the extensor digitorum muscle. Such triggers radiate pain to the elbow at LI 11, LI 10/TH 9, and distal along the TH line, including TH 5. Needle accordingly.
- **Constipation:** TH 6, ST 36, BL 32; or TH 6, ST 36, SP 6, and LI 4.[15]

Evidence-Based Application

- Acupuncture at BL 32, TH 6, and ST 36 improved **constipation due to diabetes mellitus** in a report on a series of cases.[1]
- Electroacupuncture at TH 6 improved colonic transit and reduced symptoms of **constipation.**[2]
- Electroacupuncture from ST 36 to SP 6 and LI 4 to TH 6 reduced the duration of postoperative ileus, time to ambulation, the requirements for **postoperative analgesia following laparoscopic surgery for colorectal cancer.**[16]
- Electroacupuncture of Jiaji points, focus-encircled needling ("circle the dragon"), TH 6, and SI 3 outperformed medication in speeding crust formation and providing analgesia for patients with **herpes zoster.**[3]

References

1. Xiong X-H and Deng De-Ming. Acupuncture treatment of constipation due to diabetes mellitus: an observation of 21 cases. *International Journal of Clinical Acupuncture.* 1995;6(1):19-21.
2. Zhang ZL, Ji XQ, Zhao SH, et al. (Chinese) Multicentral randomized controlled trials of electroacupuncture at Zhigou (TE 6) for treatment of constipation induced by stagnation or deficiency of qi. *Zhongguo Zhen Jiu.* 2007;27(7):475-478.
3. Li X, Zhang HX, Huang GF, et al. (Chinese) Observation on the therapeutic effect of electroacupuncture of Jiaji (EX-B-2) plus regional encircled needling for herpes zoster. *Zhen Ci Yan Jiu.* 2009;34(2):125-127, 135.
4. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.
5. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.
6. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.
7. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
8. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
9. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 2012;20(1):94-101.
10. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.
11. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.
12. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.
13. Jan Y-M, Li Y-C, and Hsieh C-L. A segmental effect involved in the changes of skin blood flow induced by acupuncture in normal health human. *Am J Chin Med.* 2010;38(3):441-448.
14. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. *J Vasc Surg.* 2003;38:617-619.
15. Ng SS, Leung WW, Mak TW, et al. Electroacupuncture reduces duration of postoperative ileus after laparoscopic surgery for colorectal cancer. *Gastroenterolgy.*2013;144(2):307-313.e.1.
16. Ng SS, Leung WW, Mak TW, et al. Electroacupuncture reduces duration of postoperative ileus after laparoscopic surgery for colorectal cancer. *Gastroenterolgy.*2013;144(2):307-313.e.1.

TH 7

Hui Zong "Ancestral Meeting" or "Converging and Gathering"

On the dorsal distal antebrachium, 3 cun proximal to the dorsal wrist crease and TH 4, approximately 1 fingerbreadth to the ulnar side of TH 6, on the radial border of the ulna.

In the depression between the ulna and the extensor digiti minimi, 1/4 the distance from the wrist to the lateral epicondyle of the humerus.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface, in conjunction with a dorsal branch of the anterior interosseous vessels.

The interosseous membrane provides longitudinal stability to the forearm.[1] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[2] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[3]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[4] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[5] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

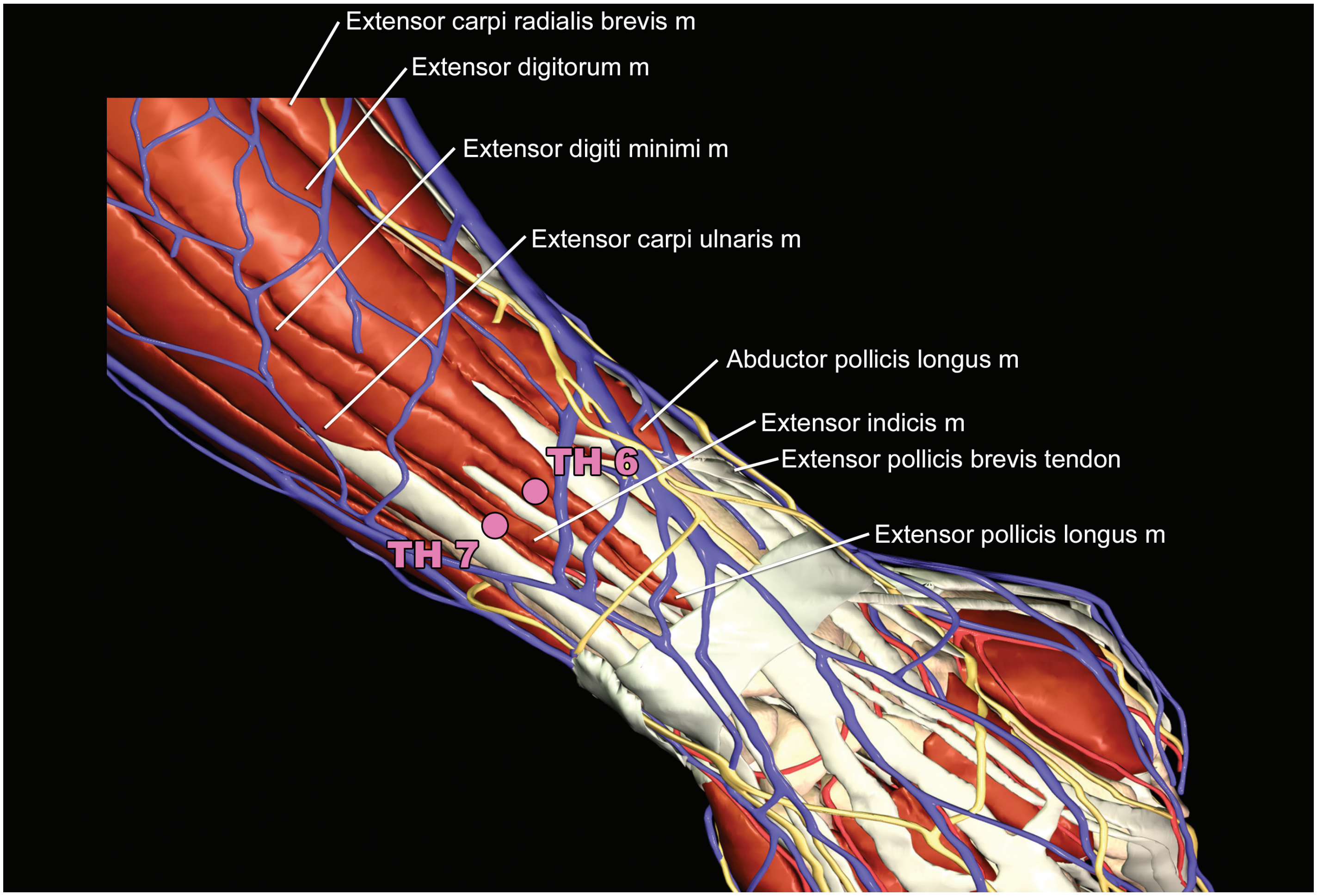

Extensor carpi radialis brevis m
Extensor digitorum m
Extensor digiti minimi m
Extensor carpi ulnaris m
Abductor pollicis longus m
Extensor indicis m
Extensor pollicis brevis tendon
TH 6
TH 7
Extensor pollicis longus m

Figure 10-16. As the Xi-Cleft point, TH 7 resides at the myotendinous junction of the extensor indicis and extensor digiti minimi muscles, thereby offering opportunities for mechanoreceptor neuromodulation.

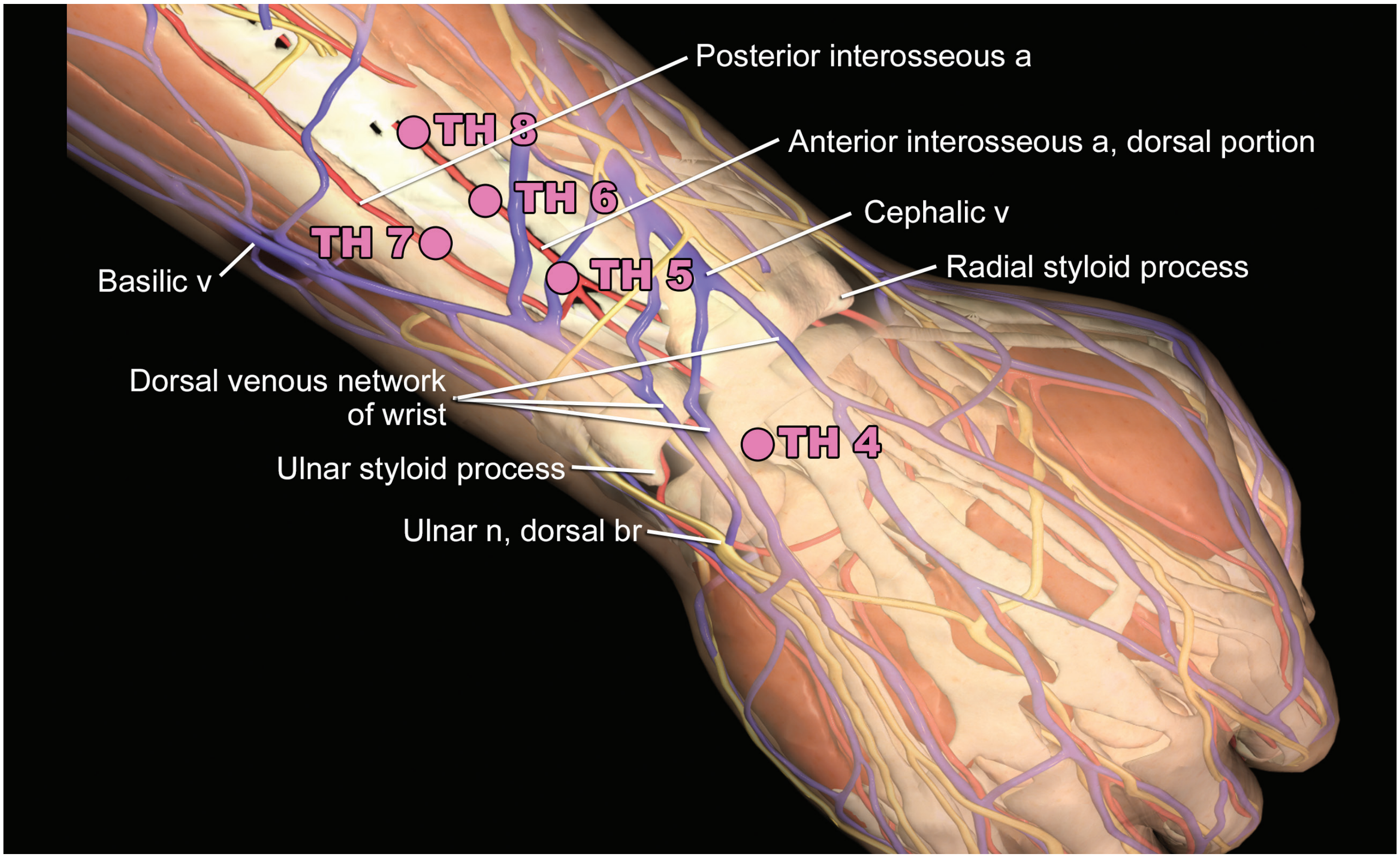


Figure 10-17. "Converging and Gathering" describes the behavior of the anterior and posterior interosseous arteries at TH 7. This image denotes how the location of TH 7 fits the parallel placement of posterior interosseous partner to the dorsal portion of the anterior interosseous artery.

Muscles

- **Extensor digitorum muscle:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.
- **Extensor indicis muscle:** Extends the index finger. Helps extend the entire hand.
- **Extensor pollicis longus muscle:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.
- **Extensor carpi ulnaris muscle:** Extends and adducts the hand at the wrist.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 7 may limit or otherwise disturb function in the ring or little fingers. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 7 may manifest from local or proximal trigger point pathology. A trigger point in the extensor indicis muscle, beneath TH 7, issues pain in the direction of LI 2, LI 3, and LI 4. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 6 and on toward TH 2, with pain also referred proximad to LI 11. Trigger points in the middle finger extensor describe a line of referred pain along the TH channel too, but head toward the middle, rather than ring, finger. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line.

Note the abundant myotendinous junctions available for activation at the level of the TH 7. The myotendinous junctions house Golgi tendon organs, affording opportunities to neuromodulate mechanoreceptors and adjust proprioceptive "set points" governing motor control. Several myofascial sources can cause pain in this region, thus making a complete myofascial palpation exam vital in order to identify contributors to distal thoracic limb discomfort.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[6] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

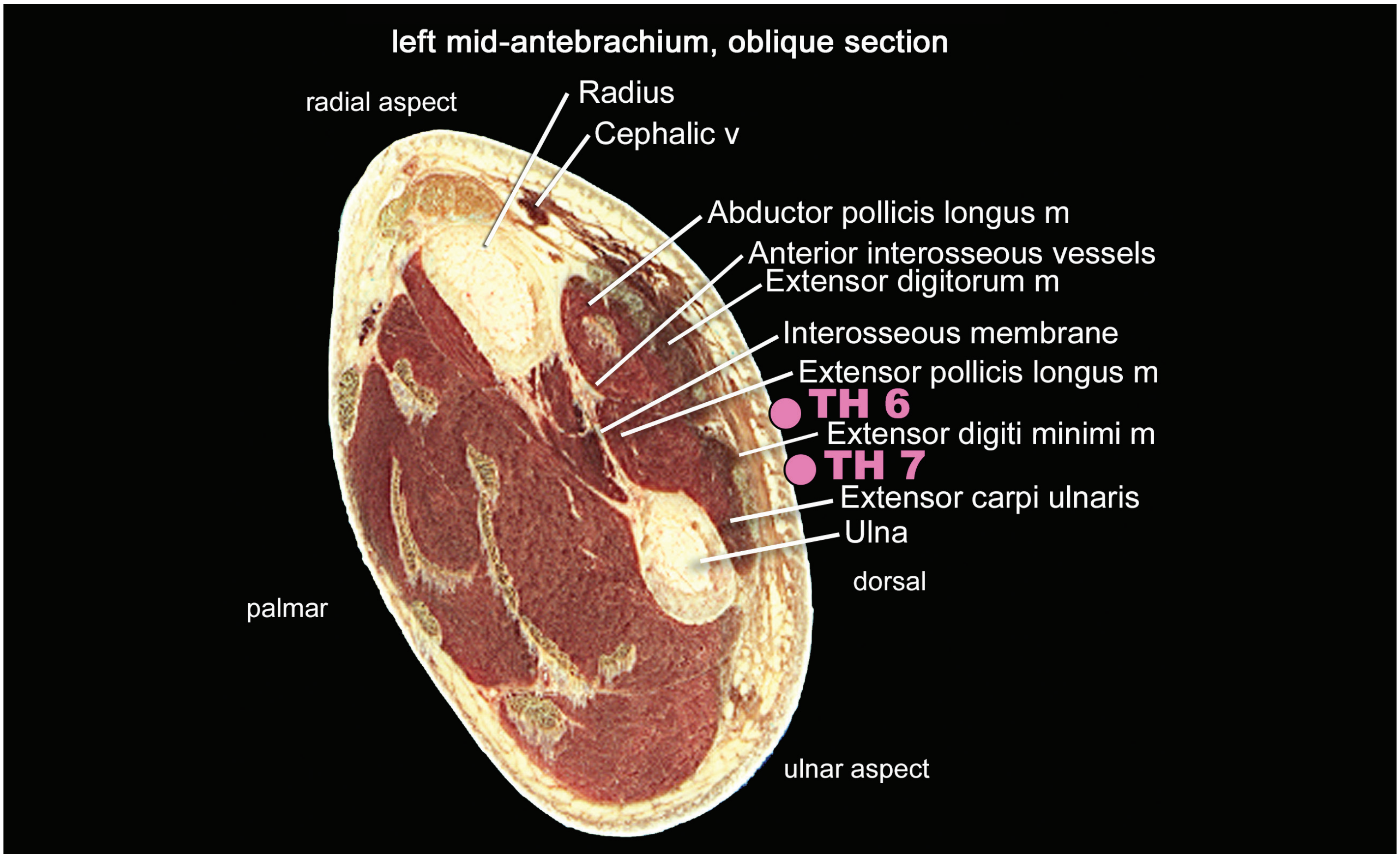


Figure 10-18. This cross-section presents the muscles and tendons within reach of an acupuncture needle entering TH 6 and TH 7, on alternate aspects of the extensor digiti minimi muscle.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles. Also supplies the posterior surface of the interosseous membrane.

Clinical Relevance: Fractures of the thoracic limb can injure peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[7] Displacement of bone after high-energy trauma places traction on the nerve. Iatrogenic entrapment following fracture reduction can compress the nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and aids in functional restoration.

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[8]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[9]

Vessels

- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health. Hematomata or aneurysms of vessels in the extensor surface groove between radius and ulna may compress the posterior interosseous nerve.[10]

Indications and Potential Point Combinations

- **Pain in the thoracic limb:** Locate responsible trigger points or other painful structures; consider radiating pain from the cervical spine. Add TH 7 for pain along the TH line on the thoracic limb.

References

1. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.

2. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.

3. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.

4. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.

5. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.

6. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 2012;20(1):94-101.

7. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.

8. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.

9. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.

10. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. *J Vasc Surg.* 2003;38:617-619.

TH 8

San Yang Luo
"Three Yang Connection"

On the distal dorsal antebrachium, 4 cun proximal to the dorsal wrist crease, between the radius and the ulna. On the radial side of the extensor digitorum muscle. Divide the distance between TH 4 and the lateral epicondyle of the humerus into thirds. TH 8 resides at the junction of the middle and distal thirds.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface, in conjunction with a dorsal branch of the anterior interosseous vessels.

The interosseous membrane provides longitudinal stability to the forearm.[2] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[3] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[4]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[5] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[6] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles

- **Extensor carpi ulnaris muscle:** Extends and adducts the hand at the wrist.
- **Extensor digitorum muscle:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor pollicis longus muscle:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.
- **Abductor pollicis longus muscle:** Abducts the thumb. Extends the thumb at the carpometacarpal joint.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 8 may limit or otherwise disturb function in the ring or little fingers. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other

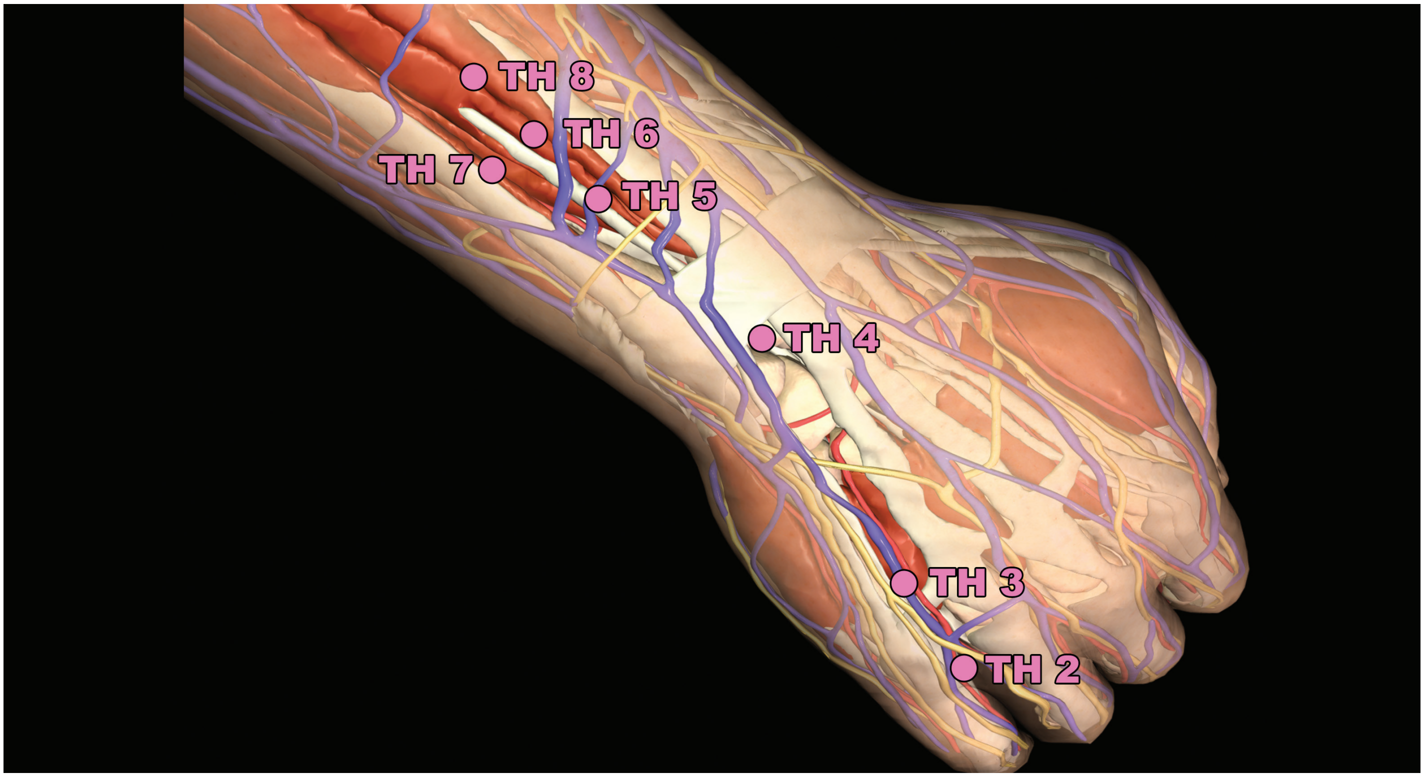


Figure 10-19. TH 2 through TH 8 line up nicely except for TH 7, the outlier.

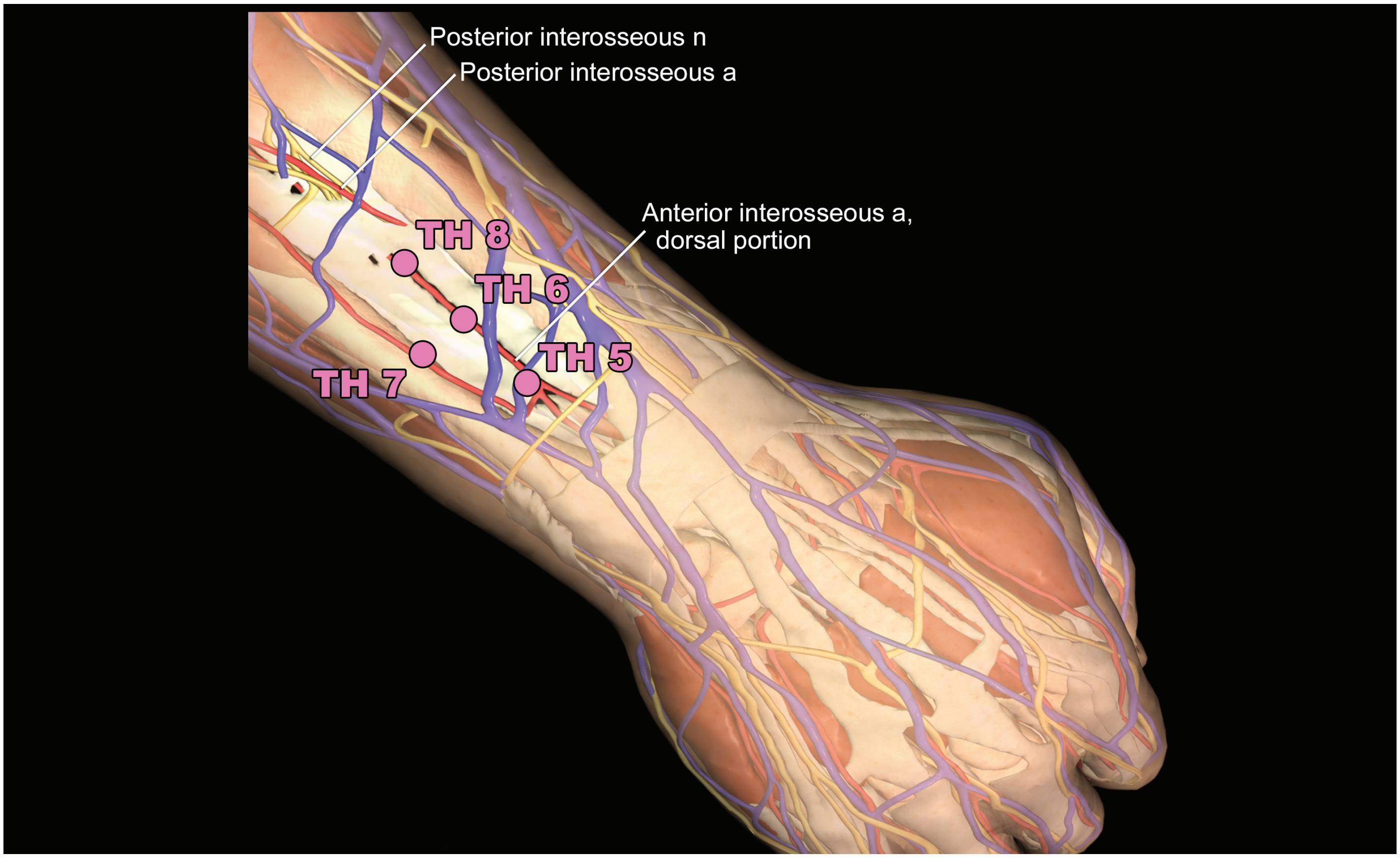


Figure 10-20. Three neurovascular structures supply TH 8, "Three Yang Connection": the anterior and posterior interosseous artery and the posterior interosseous nerve.

causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

Pain at TH 8 may manifest from local or proximal trigger point pathology. A trigger point in the extensor indicis muscle, beneath TH 8, issues pain in the direction of LI 2, LI 3, and LI 4. A trigger point in the ring finger extensor near TH 9 typically refers pain along the TH trajectory through TH 6 and on toward TH 2, with pain also referred proximad to LI 11. Trigger points in the middle finger extensor describe a line of referred pain along the TH channel too, but head toward the middle, rather than ring, finger. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain to the distal TH line.

Note the abundant myotendinous junctions available for activation at the level of the TH 8. The myotendinous junctions house Golgi tendon organs, affording opportunities to neuromodulate mechanoreceptors and adjust proprioceptive "set points" governing motor control. Several myofascial sources can cause pain in this region, thus making a complete myofascial palpation exam vital in order to identify contributors to distal thoracic limb discomfort.

Grasping and releasing objects with the hand and fingers constitute key components of the activities of daily living. Several pathologies reduce manual dexterity and limit functional independence. Neuromodulation of motor dysfunction assists in the repair of these movements for patients following cerebrovascular accident.[7] In patients afflicted with this problem, palpate all muscles from the neck and back to the fingers. Pay close attention to restriction found in the intrinsic muscles of the hand, the extensor digitorum communis (common digital extensor), flexor pollicis longus, and thenar muscle group. Needle, stretch, massage, and laser the regions accordingly.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles. Also supplies the posterior surface of the interosseous membrane.

Clinical Relevance: Fractures of the thoracic limb can injure peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[8] Displacement of bone after high-energy trauma places traction on the nerve. Iatrogenic entrapment following fracture reduction can compress the nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and aids in functional restoration.

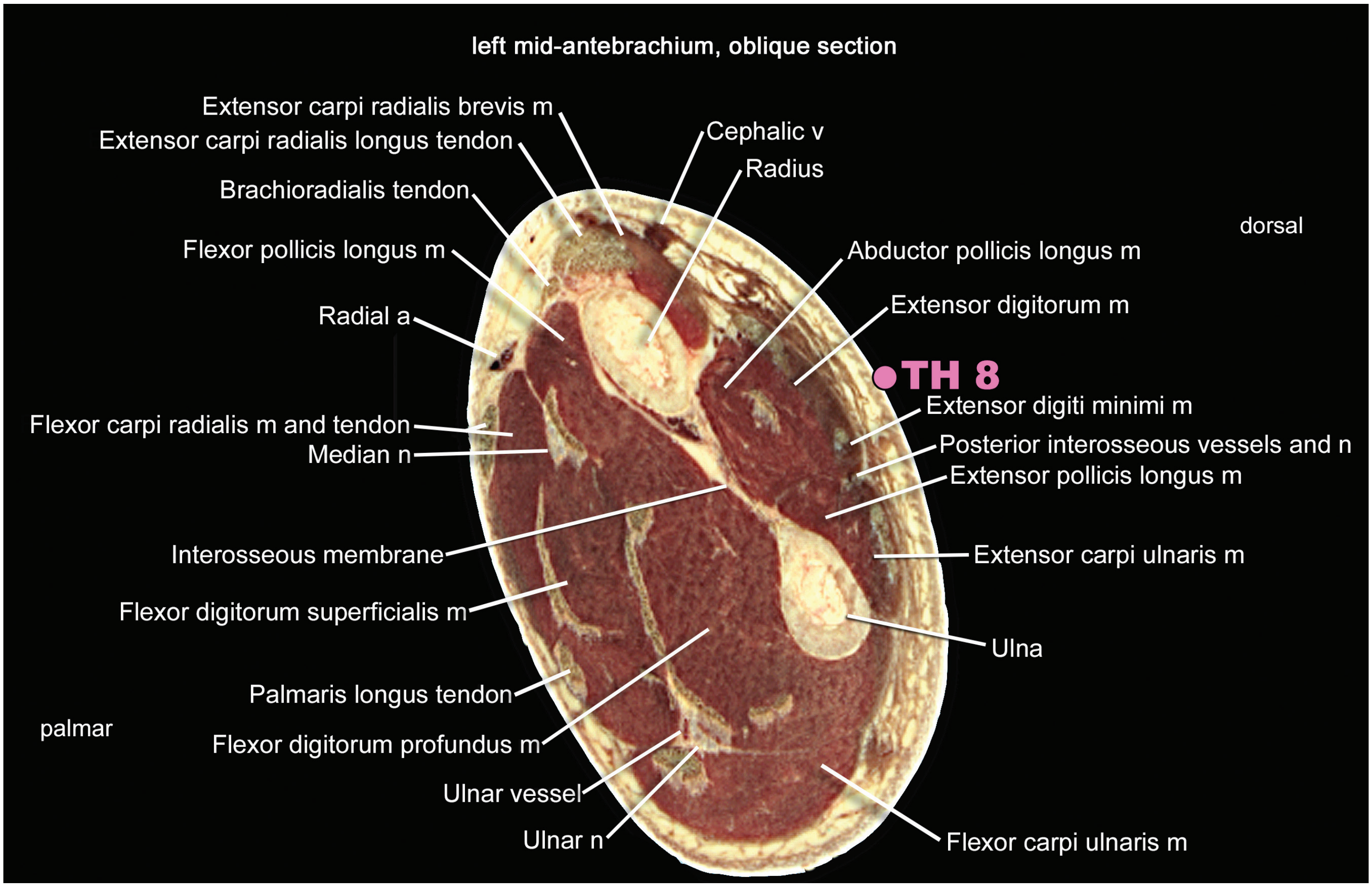

left mid-antebrachium, oblique section
Extensor carpi radialis brevis m
Extensor carpi radialis longus tendon
Brachioradialis tendon
Flexor pollicis longus m
Radial a
Flexor carpi radialis m and tendon
Median n
Interosseous membrane
Flexor digitorum superficialis m
Palmaris longus tendon
palmar
Flexor digitorum profundus m
Ulnar vessel
Ulnar n
Cephalic v
Radius
dorsal
Abductor pollicis longus m
Extensor digitorum m
TH 8
Extensor digiti minimi m
Posterior interosseous vessels and n
Extensor pollicis longus m
Extensor carpi ulnaris m
Ulna
Flexor carpi ulnaris m

Figure 10-21. Trigger points in muscles present in this cross section at TH 8 may refer pain into the wrist and/or ring finger. Deep antebrachial pain or ache from the abductor pollicis longus muscle may refer from TH 8 to LI 5 (the anatomical snuffbox).

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[9]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[10]

Vessels

- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying the radial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques implemented along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health. Hematomata or aneurysms of vessels in the extensor surface groove between radius and ulna may compress the posterior interosseous nerve.[11]

Indications and Potential Point Combinations

- **Pain in the thoracic limb:** Locate responsible trigger points or other painful structures; consider radiating pain from the cervical spine. Add TH 8 if tender for pain along the TH line on the thoracic limb.
- **Pain resembling de Quervain's tenosynovitis:** Rule out referred pain from the abductor pollicis longus muscle that can mimic de Quervain's tenosynovitis. TH 8, LI 5, SI 6.[1]
- **Aphasia:**[12,13] TH 8.

References

1. Hwang M, Kang YK, Shin JY, et al. Referred pain pattern of the abductor pollicis longus muscle. *American Journal of Physical Medicine and Rehabilitation.* 2005; 84(8):593-597.
2. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.
3. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.
4. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.
5. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
6. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of

twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg*. 2009;34A:953-961.

7. Westerveld AJ, Schouten AC, Veltink PH, et al. Selectivity and resolution of surface electrical stimulation for grasp and release. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 2012;20(1):94-101.

8. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.

9. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.

10. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery*. 2012;37(5):467-469.

11. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. *J Vasc Surg.* 2003;38:617-619.

12. Li G, Liu HL, Cheung RT, et al. An fMRI study comparing brain activation between word generation and electrical stimulation of language-implicated acupoints. *Hum Brain Mapp*. 2003;18(3):233-238.

13. Li G and Yang ES. An fMRI study of acupuncture-induced brain activation of aphasia stroke patients. *Complement Ther Med.* 2011;18 Suppl 1:S49-S59.

TH 9

Si Du "Four Rivers"

On the dorsal antebrachium, in a depression 7 cun proximal to the dorsal wrist crease, or 5 cun distal to the olecranon, between the radius and the ulna, on a line drawn between TH 4 and the lateral humeral epicondyle. Divide the distance between TH 4 and the lateral epicondyle into two equal parts. Find TH 9 at a location that is 1 cun proximal to this midpoint, between the bellies of the extensor digitorum and extensor carpi ulnaris muscles, directly over the extensor digiti minimi muscle belly. Ask the patient to extend and move about the little finger to identify the location of the muscle. This region often elicits tenderness to palpation.

Connective Tissues

- **Interosseous membrane between the radius and ulna:** Binds the two bones of the forearm. Allows load on the forearm to distribute between the radius and ulna. The interosseous membrane is a complex structure consisting of a central band, proximal interosseous band, membranous portions, and accessory bands. The central portion of the interosseous membrane possesses the most strength, considered by some tantamount in strength to the anterior cruciate ligament or patellar tendon. The anterior interosseous vessels and nerve supply the PC (volar) surface of the membrane; the posterior interosseous counterparts supply the TH (dorsal) surface, in conjunction with a dorsal branch of the anterior interosseous vessels.

The interosseous membrane provides longitudinal stability to the forearm.[1] The forearm acts as a joint with the interosseous membrane serving as the ligamentous connection.[2] The forearm complex, or joint, supports forearm function; rotation of the radius around the ulna is required for activities of daily living such as eating and maintaining personal hygiene.[3]

Clinical Relevance: High-force compressive trauma can injure the forearm and elbow, tearing the membrane, fracturing the radial head, and causing failure of the triangular fibrocartilage complex. Instability of the forearm leads to considerable pain and debility by limiting antebrachial motion and disturbing the biomechanics of the wrist.[4] One injury pattern that precipitates forearm instability involves axial load transmitted through the wrist to the elbow. The diagnosis is often overlooked; early recognition and effective care improve outcomes, as only a fifth of patients with delayed intervention experience satisfactory recovery.[5] Whether or not patients pursue surgery, restoring soft tissue stability remains a critical component in the treatment of chronic radioulnar dissociation injury. Nonsurgical means of improving tissue health and proprioception include acupuncture and related techniques. Laser therapy fosters tissue healing. Massage lessens myofascial restriction and improves proprioception and circulation, as does acupuncture.

Muscles

- **Extensor carpi ulnaris muscle:** Extends and adducts the hand at the wrist.
- **Extensor digitorum muscle:** The chief extensor of the medial four digits. Extends the digits at the metacarpophalangeal joints and extends the hand at the wrist.
- **Extensor digiti minimi muscle:** Extends the little finger at both the metacarpophalangeal and interphalangeal joints.

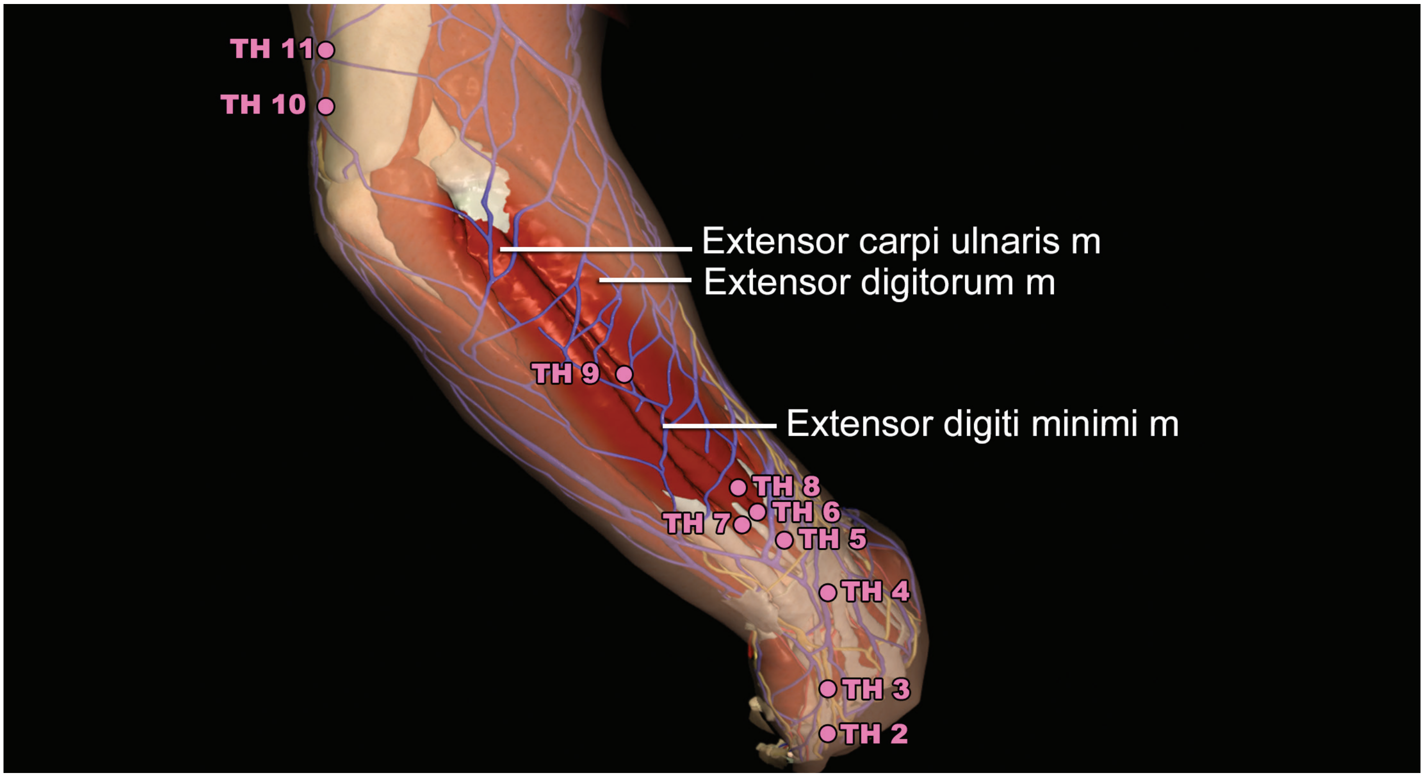


Figure 10-22. TH 9 stands alone on the mid-antebrachium. Its name, "Four Rivers", pertains either to the four extensor tendons fanning from this region to the fingers, or it may instead refer to the four extensor muscles within reach of a needle entering TH 9. These muscles include the extensor digitorum, extensor digiti minimi, extensor pollicis longus, and extensor carpi ulnaris muscles, as indicated in Figure 10-23.

- **Extensor pollicis longus muscle:** Extends the proximal phalanx of the thumb at the carpometacarpal joint.
- **Abductor pollicis longus muscle:** Abducts the thumb. Extends the thumb at the carpometacarpal joint.

Clinical Relevance: Myotendinous dysfunction in the vicinity of TH 9 may limit or otherwise disturb function in the ring or little fingers. Acupuncture, massage, and laser therapy may improve symptoms arising from degenerative joint disease or other causes of arthralgia and arthrosis of the 4th and 5th metacarpophalangeal joints. Physical medicine techniques such as these, including electroacupuncture, assist in ameliorating mechanical and neurologic dysfunction of the wrist and hand after central nervous system injury, often in accordance with measures to strengthen voluntary flexion and extension.

A trigger point in ring finger extensor and extensor digiti minimi muscle near TH 9 typically refers pain along the TH trajectory toward TH 2. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles can also refer pain along the distal TH line.

Nerves

- **Posterior cutaneous nerve of the forearm (C5-C8):** A branch of the radial nerve that supplies the skin on the posterior surface of the antebrachium.
- **Medial antebrachial cutaneous nerve (C8, T1):** Supplies the skin on the anterior and medial aspects of the forearm.
- **Posterior interosseous nerve (C7, C8):** A continuation of the deep branch of the radial nerve. Innervates the abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris muscles. Also supplies the posterior surface of the interosseous membrane.

Clinical Relevance: Fractures of the thoracic limb can injure peripheral nerves. Radial neck fracture may lead to injuries of the posterior interosseous and ulnar nerves.[6] Displacement of bone after high-energy trauma places traction on the nerve. Iatrogenic entrapment following fracture reduction can compress the nerves. Conservative management that includes acupuncture, massage, and/or laser therapy addresses neuropathic pain and aids in functional restoration.

The posterior interosseous nerve passes deep to the arcade of Frohse, otherwise known as the supinator arch. This superficial layer of the supinator muscle may entrapment the posterior interosseous nerve by means of Schwannoma, or through extrinsic compression with fibrous brands, ganglion cysts, fractures, etc.[7]

Deep needling of TH points distal to the elbow risks injuring the posterior interosseous nerve, which can cause progressive wrist drop. The posterior interosseous nerve supplies wrist and digital extensors. Mechanisms of neurotrauma secondary to acupuncture include compressive neuropathy following surrounding hematoma, irritation by a fractured needle tip, or laceration of the nerve through vigorous, deep needling.[8]

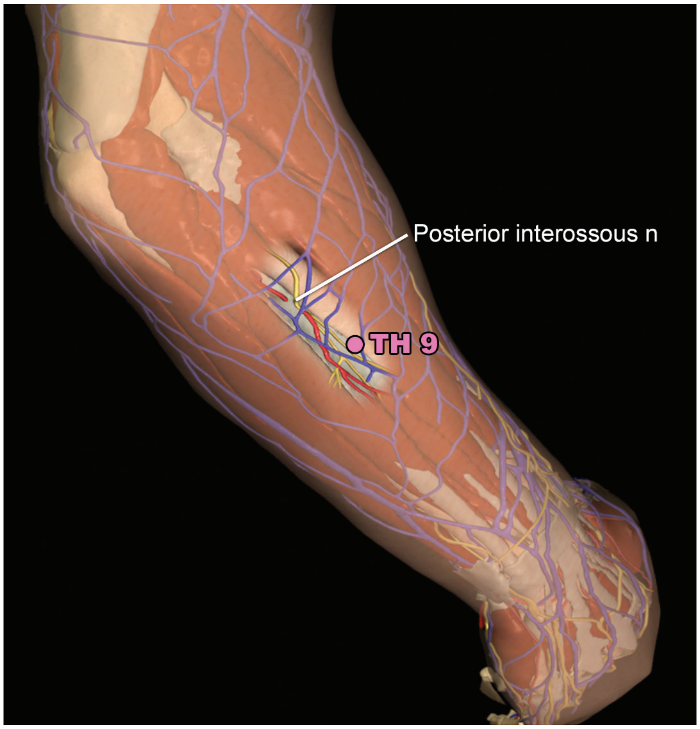


Figure 10-23. Deeply needling TH 9 can damage the posterior interosseous nerve, shown here.[10]

Vessels

- **Posterior interosseous artery:** Both the anterior and posterior interosseous arteries arise from the common interosseous artery, which branches off of the ulnar artery. Both interosseous arteries course along the interosseous membrane. The posterior interosseous artery gives rise to the recurrent interosseous artery, which participates in the anastomoses around the elbow joint.
- **Posterior interosseous vein:** These deep veins accompany the interosseous arteries. The drain into the veins accompanying theradial and ulnar arteries.

Clinical Relevance: Acupuncture and related techniques along the distal TH line may improve circulation for patients with peripheral vascular disease affecting ring or little finger mobility and/or tissue health. Hematomata or aneurysms of vessels in the dorsal groove between radius and ulna may compress the posterior interosseous nerve.[9]

Indications and Potential Point Combinations

- **Dorsal forearm, wrist, and hand pain:** Identify, to the extent possible, the source of the problem, be it trigger points in the digital extensors or the abductor pollicis longus, arthrodial elements, bone pain, or neuropathic pain. Select points accordingly, to address both the source (such as TH 9 for the noted trigger points) and the pain referral pattern (e.g., TH 5, TH 4, TH 3, and TH 2). Trigger points in the digital extensors typically issue referred pain along the TH line while myofascial dysfunction in the abductor pollicis longus will refer pain over to LI 5.

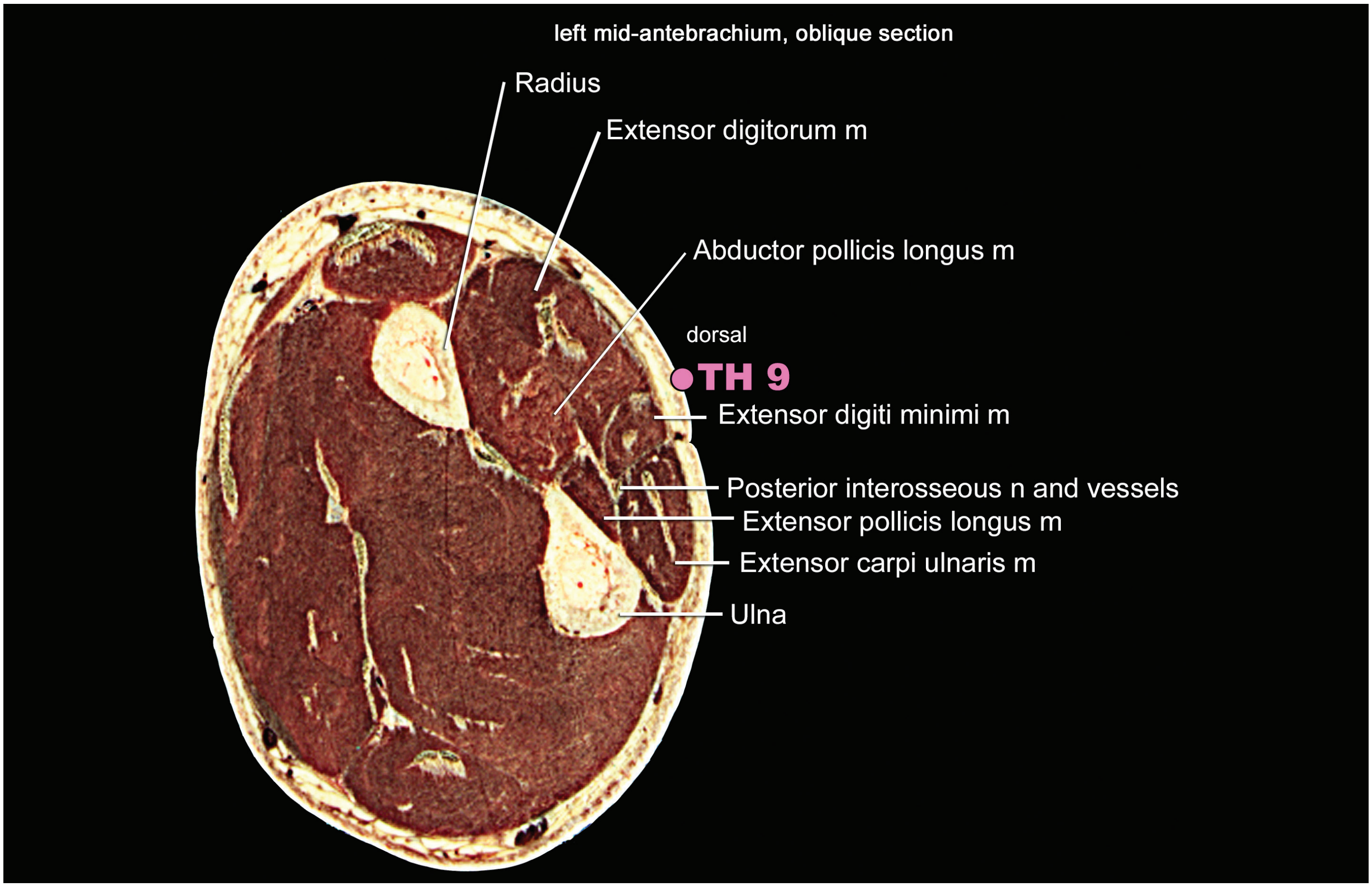

left mid-antebrachium, oblique section
Radius
Extensor digitorum m
Abductor pollicis longus m
dorsal
TH 9
Extensor digiti minimi m
Posterior interosseous n and vessels
Extensor pollicis longus m
Extensor carpi ulnaris m
Ulna

Figure 10-24. This cross section depicts the separation between the extensor digitorum and extensor digiti minimi muscles, structures that define the TH line distal to the elbow. Trigger points here refer pain along the TH trajectory to the wrist, hand, and fingers.

References

1. Murray PM. Diagnosis and treatment of longitudinal instability of the forearm. *Tech Hand Up Extrem Surg.* 2005;9(1):29-34.
2. Soubeyrand M, Lafont C, De Georges R, et al. Traumatic pathology of antibrachial interosseous membrane of forearm. *Chir Main.* 2007;26(6):255-277.
3. LaStayo PC and Lee MJ. The forearm complex: anatomy, biomechanics and clinical considerations. *J Hand Ther.* 2006;19:137-145.
4. Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
5. Trousdale RT, Amadio PC, Cooney WP, Morrey BF. Radioulnar dissociation. A review of twenty cases. J Bone Joint Surg 1992;74A: 1486–1497. Cited in: Green JB and Zelouf DS. Forearm instability. *J Hand Surg.* 2009;34A:953-961.
6. Stepanovich MT and Hogan CJ. Posterior interosseous and ulnar nerve motor palsies after a minimally displaced radial neck fracture. *J Hand Surg Am.* 2012;37(8):1630-1633.
7. Kara M, Tiftik T, Yetisgin A, et al. Ultrasound in the diagnosis and treatment of posterior interosseous nerve entrapment: a case report. *Muscle & Nerve.* 2012;45(2):299-300.
8. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.
9. Kassabian E, Coppin T, Combes M, et al. Radial nerve compression by a large cephalic aneurysm: case report. *J Vasc Surg.* 2003;38:617-619.
10. Sreedharan S, Lim AYT, and Puhaindran ME. Posterior interosseous nerve palsy after needle acupuncture. *Journal of Hand Surgery.* 2012;37(5):467-469.

TH 10

Tian Jing "Celestial Well"

On the dorsal elbow region, in the depression that appears 1 cun proximal to the tip of the olecranon process when the elbow flexes.

Tendons

- **Triceps brachii tendon:** Serves as the main extensor of the forearm. The long head steadies the head of the humerus of the abducted arm. Fibers from the three heads of the triceps brachii converge into a single tendon that inserts onto the olecranon process of the ulna as well as to the caudal wall of the elbow joint capsule where bursae may exist. Portions of the common tendon extend into the antebrachial fascia; these fibers may cover the anconeus muscle.

Clinical Relevance: In healthy adults, it takes substantial force to rupture the triceps brachii tendon, either completely or as a partial tear.[2] In addition to examining the tendon, clinicians should test for ulnar nerve injury or tunnel syndrome, which can complicate triceps tendon rupture. Most individuals with low functional demand tolerate a partial lesion fairly well, though pain may persist with triceps activation. The severe, sudden pain resolves relatively soon after the trauma, but patients may complain of reduced arm strength with elbow extension. Incorporation of acupuncture, laser therapy, and massage may aid in the recovery of the tissue and augment the ability to return to full function, whether or not surgery for a partial triceps tendon tear is pursued.

Trigger points in the long head of the triceps brachii muscle send telltale pain patterns along the entire TH channel, from TH 15 to TH 4. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles refer pain along the TH line toward the ring finger. A teres major trigger point issues pain strongly to the dorsal shoulder from TH 14 to SI 10 and distad to TH territory on the brachium and antebrachium. Teres minor trigger points send pain to TH 14, TH 13, and down the TH line toward TH 11. Referred pain from subscapularis trigger points covers the entire scapular region and centralizes over the dorsal shoulder from TH 14 to TH 13. The pain continues to TH 10 and then hops over the dorsal surface of the antebrachium to land at TH 4, spreading to the entire wrist with the dorsal aspect more intensely affected. Caudal deltoid trigger points extend from TH 14/SI 10 to TH 13, TH 12, and LI 11. Pain from coracobrachialis dysfunction may start at LU 2 but then migrate caudad toward LI 15 to focus heavily on the caudal brachium from TH 13 to TH 12, and TH 9 to TH 3.

Nerves

- **Posterior brachial cutaneous nerve:** A branch of the radial nerve that supplies the skin on the posterior surface of the brachium.

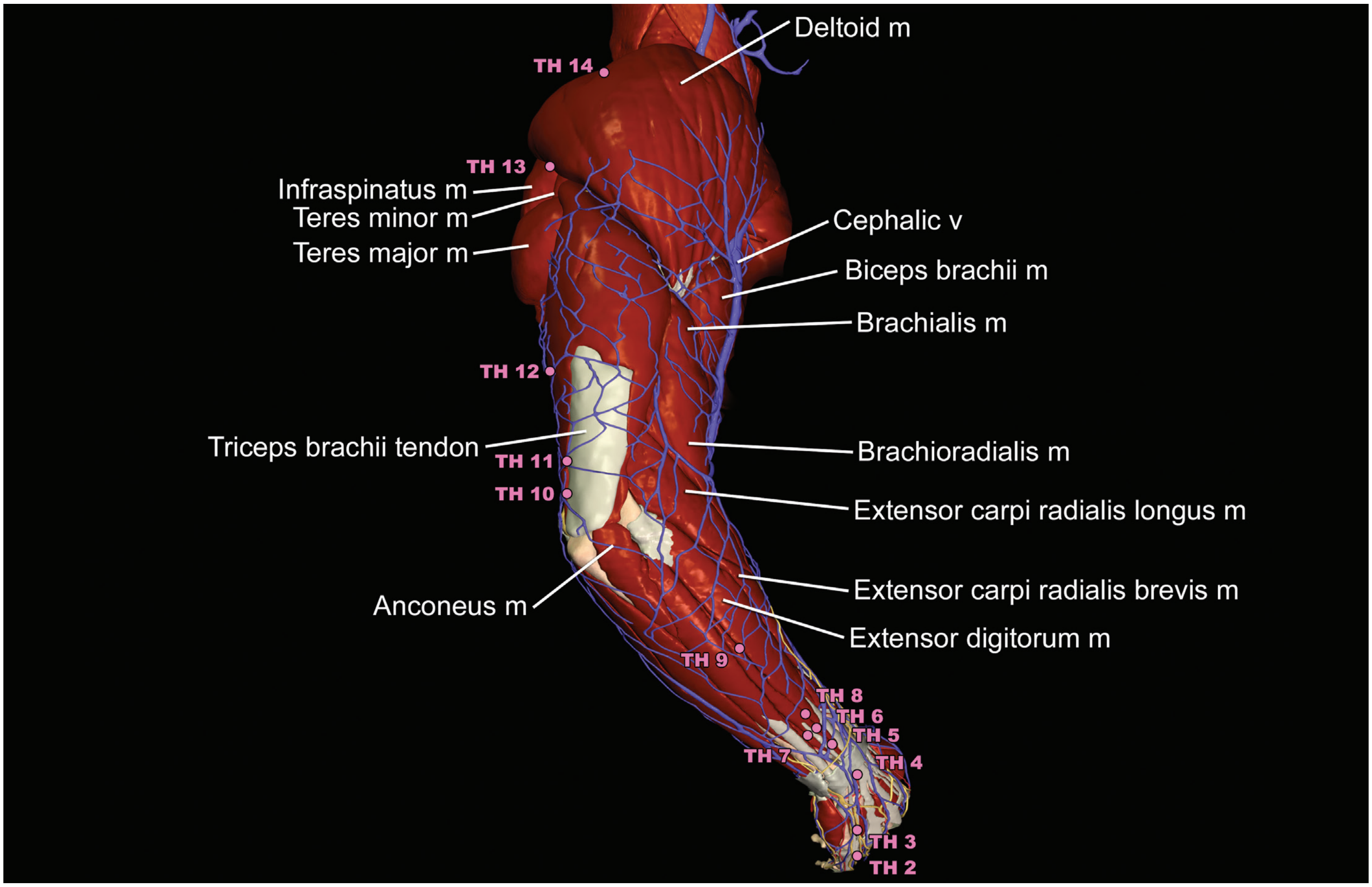


Figure 10-25. TH 10 sits in a well just proximal to the olecranon process. The Chinese character combination Tian Jing that identifies TH 10 as "Celestial Well" connotes a small pond surrounded by high cliffs (See Ellis A et al, Grasping the Wind, p. 239). The "pond" in this case is the depression palpated here, adjacent to the olecranon process, the "high cliff".

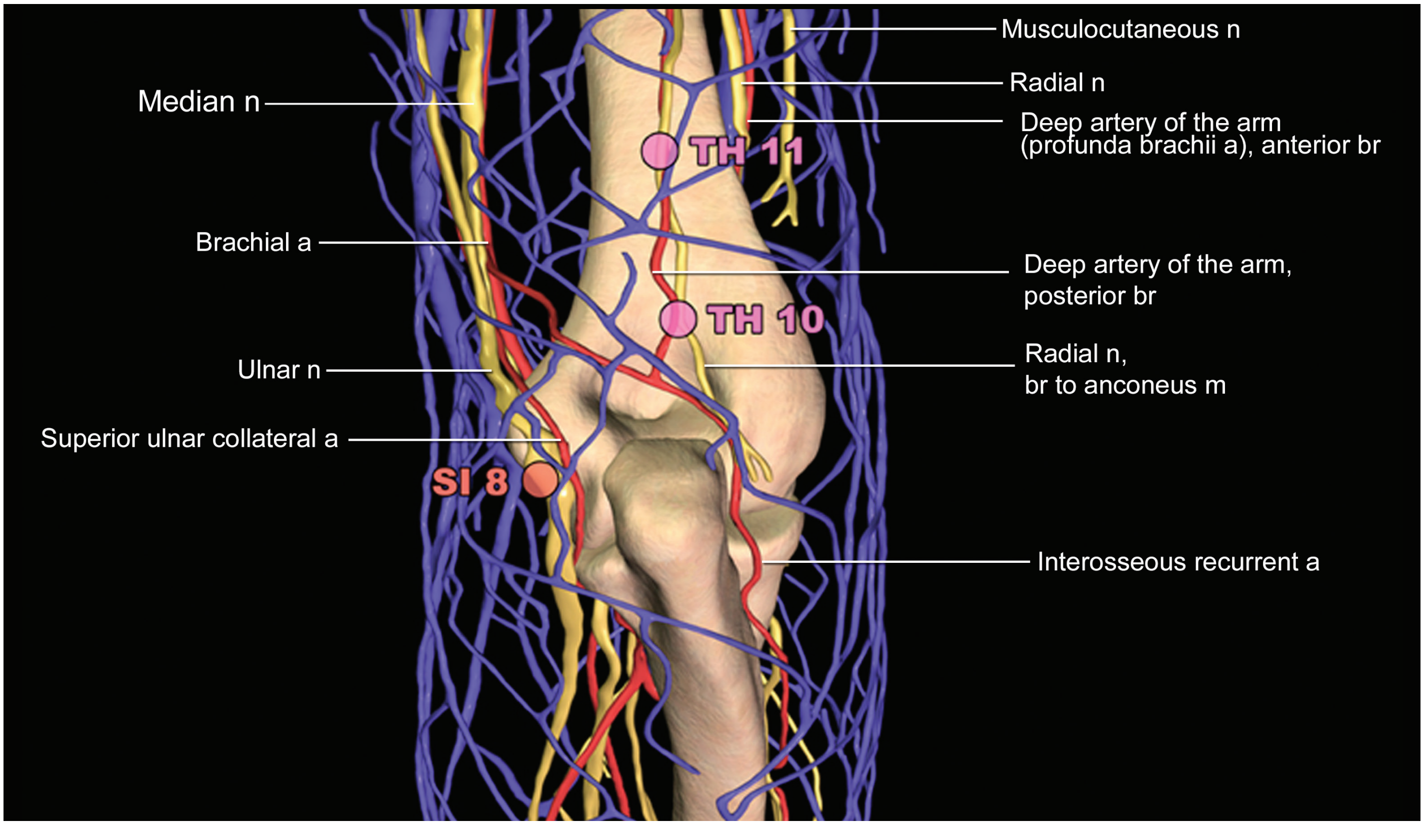

Musculocutaneous n
Median n
Radial n
Deep artery of the arm (profunda brachii a), anterior br
TH 11
Brachial a
Deep artery of the arm, posterior br
TH 10
Ulnar n
Radial n, br to anconeus m
Superior ulnar collateral a
SI 8
Interosseous recurrent a

Figure 10-26. This dorsal view of the elbow illustrates how closely TH 10 and TH 11 follow neurovascular structures. It becomes evident how a supracondylar fracture could disrupt nerve and blood supply to this section of the limb.

- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium, including the triceps brachii muscle. It divides into superficial and deep branches near the elbow. The deep branch further splits into muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist. Note in Figure 10-26 that the radial nerve branch deep to TH 10 is on its way to supply the anconeus muscle.
- **Intercostobrachial nerve (T2):** The ventral ramus of the 2nd thoracic spinal nerve divides into branches, the 2nd intercostal nerve (which is the larger of the two) and a smaller branch, which joins the brachial plexus. This smaller branch constitutes the lateral cutaneous branch of the 2nd intercostal nerve and is called the intercostobrachial nerve. It emerges from the 2nd intercostal space at the midaxillary line and penetrates the serratus anterior muscle to enter the brachial region, i.e., the axilla and arm. The floor of the axilla (i.e., the skin and its underlying subcutaneous tissue) receives its innervation from the intercostobrachial nerve. The intercostobrachial nerve communicates with the medial brachial cutaneous nerve to supply the posterior and medial surfaces of the arm. The intercostobrachial nerve may also communicate with the posterior brachial cutaneous nerve, a branch of the radial nerve.

Clinical Relevance: All major nerves of the thoracic limb, except the axillary nerve and medial brachial cutaneous nerve, send terminal articular branches to the elbow. These nerve endings issue from muscular nerves, cutaneous nerves, or nerves that arise directly from the brachial plexus.[3]

The myotendinous junction of the triceps brachii muscle deep to TH 10 indicates the presence of Golgi tendon organs and the opportunity to neuromodulate muscle tension and tone.

TH 10 also serves as a site of referred pain from the T2 region. As such, patients displaying tenderness to palpation from the upper thoracic paraspinal region to the axilla, caudal brachium, and dorsal antebrachium may benefit from a comprehensive treatment involving BL 11, BL 12, SI 9, TH 10, and distal TH or LI sites. A complete myofascial palpation evaluation should elucidate sources of somatic dysfunction. The clinical picture along with the pain pattern ultimately determines the neuromodulation protocol.

The extrathoracic course of the intercostobrachial nerve exhibits a variety of courses between individuals, putting it at risk of damage during surgical procedures of the chest wall such as mastectomy and axillary node clearance.[4]

Interrelationships of nerves supplying TH 10, such as the intercostobrachial nerve, provide sources of referred cardiac pain.

Vessels

- **Deep brachial artery, middle collateral branch:** Participates in the arterial anastomoses around the elbow joint. The middle collateral branch joins with the inferior ulnar collateral artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery, and the superior ulnar collateral artery. The middle

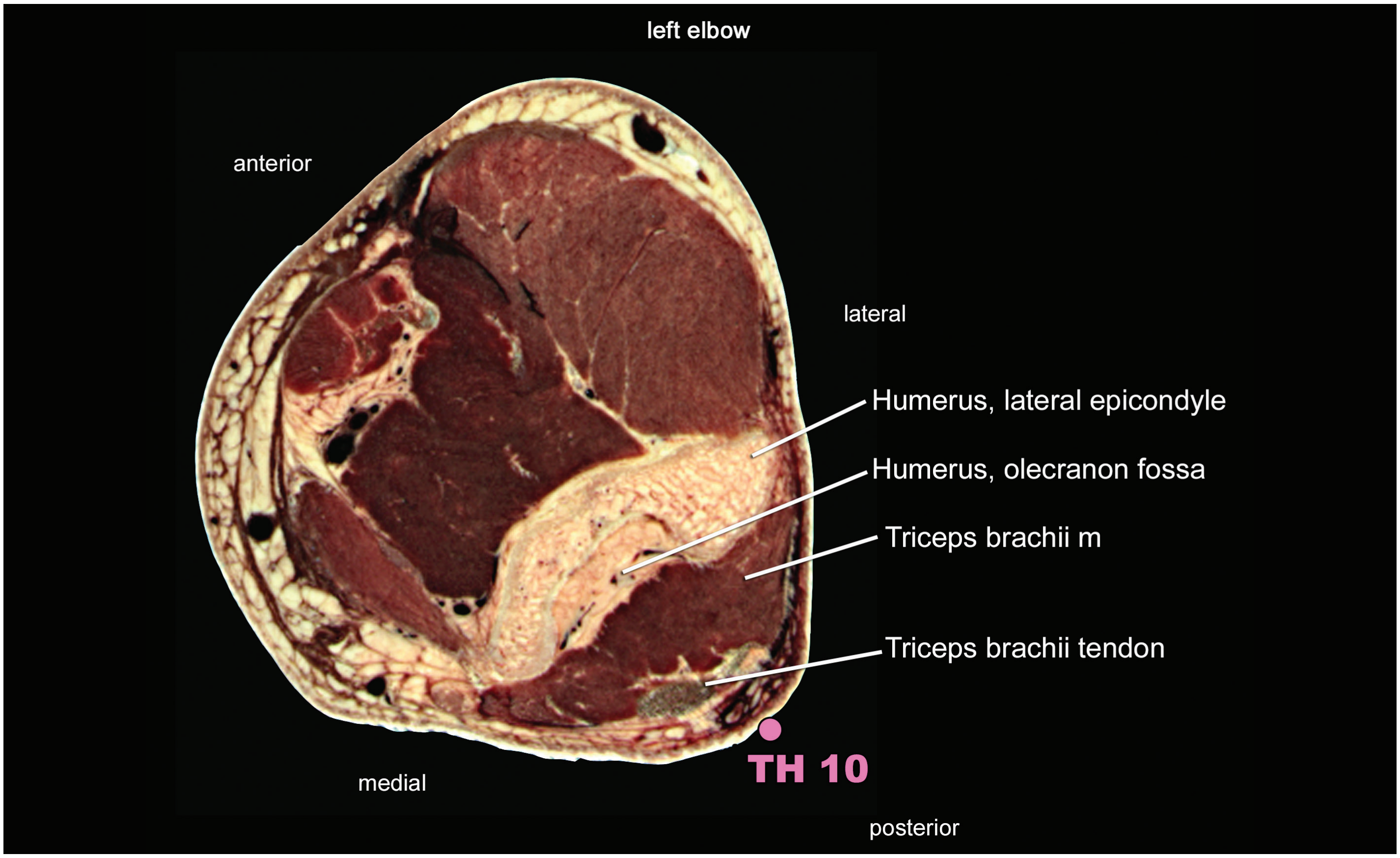


Figure 10-27. TH 10 Influences a host of structures implicated in elbow pain and mechanical dysfunction, including the triceps tendon and muscle, the radial nerve, and local blood supply and drainage channels.

collateral artery (also called the medial collateral artery) anastomoses as well with the interosseous recurrent artery near the elbow. See Figure 10-26 to examine this relationship.

Clinical Relevance: Supracondylar fractures of the distal humerus happen commonly in children and can cause neurovascular compromise.[5] Laser therapy may prematurely close epiphyses in immature patients. As such, after accurate neurovascular evaluation has assessed damage to vulnerable periarticular structures, other physical medicine measures may be preferable to revitalize the region and restore circulation and neurologic function.

The cross-section in Figure 10-27 discloses the abundant vascularity of the tissue deep to TH 10; note the extensive hemorrhage in the subcutaneous layer.

Indications and Potential Point Combinations

- **Lateral thoracic pain:** Consider trigger points in the subscapularis muscle, producing a pain referral pattern that centers in the SI 9/SI 10 region and extends to SI 11, SI 12, TH 11, TH 12, TH 14, TH 4, and PC 7. Needle appropriate trigger points and consider relevant spinal segments from C5 to T2.[6]
- **Neck, shoulder, arm, or elbow pain:** Palpate for triceps brachii trigger points. Myofascial dysfunction in the long head of the triceps refers pain to GB 21, SI 10, TH 14, TH 12, TH 11, TH 10, LI 11, LI 10, TH 9 to TH 4 and TH 3. Trigger points in the lateral triceps brachii may centralize over TH 10 and refer pain to the olecranon process. Trigger points within the medial head of the triceps brachii muscle begin near TH 10 and HT 2 and descend along the HT line. Needle appropriate trigger points and consider relevant spinal segments.
- **Thoracic limb spasticity after stroke:** TH 10, TH 4, LI 15; may also add HT 1, LU 5, and PC 7; electroacupuncture indicated.[7]

Evidence-Based Applications

- Dry needling at TH 10, TH 4, LI 15, PC 7, LU 5, and HT 1 performed as well as electroacupuncture for patients with **upper limb spasticity after stroke.** Both treatments significantly alleviated muscle spasm, improved motor function, and activities of daily living.[1]
- Patients with **chronic obstructive pulmonary disease (COPD)** experienced significant improvements in pulmonary function after receiving acupuncture at TH 10, TH 6, LI 11, LI 10, LU 7, and LU 5 as compared to those who received rehabilitation alone.[8]

References

1. Zhang ZM, Feng CL, Pi ZK, et al. (Chinese). Observation on clinical therapeutic effect of acupuncture on upper limb spasticity in the patient of poststroke. *Zhongguo Zhen Jiu.* 2008;28(4):257-260.

2. Khiami F, Tavassoli S, De Ridder Baeur L, et al. Distal partial ruptures of triceps brachii tendon in an athlete. *Orthopaedics & Traumatology: Surgery & Research.* 2012;98:242-246.

3. De Kesel R, Van Glabbeek F, Mugenzy D, et al. Innervation of the elbow joint: Is total denervation possible? A cadaveric anatomic study. *Clin Anat.* 2012;25(6):746-754.

4. Loukas M, Hullett J, Louis RG Jr, et al. The gross anatomy of the extrathoracic course of the intercostobrachial nerve. *Clin Anat.* 2006;19(2):106-111.

5. Patel K and McCann PA. The emergent assessment of supracondylar fractures of the paediatric humerus. *Hand Surg.* 2012;17(2):161-166.
6. Sebastian D. T2 radiculopathy: A differential screen for upper extremity radicular pain. *Physiotherapy Theory and Practice.* 2013; 29(1):75-85.
7. Zhang ZM, Feng CL, Pi ZK, et al. Observation on clinical therapeutic effect of acupuncture on upper limb spasticity in the patient of poststroke. *Zhongguo Zhen Jiu.* 2008;28(4):257-260.
8. Deering B. Acupuncture as an adjunct to pulmonary rehabilitation. *Journal of Cardiopulmonary Rehabilitation and Prevention.* 2011;31(6):392-399.

TH 11

Qing Leng Yuan "Clear Cold Abyss"

On the caudal brachial region, 1 cun proximal to TH 10, or 2 cun proximal to the tip of the olecranon process.

Muscles and Tendons

- **Triceps brachii muscle or tendon:** Serves as the main extensor of the forearm. The long head steadies the head of the humerus of the abducted arm. Fibers from the three heads of the triceps brachii converge into a single tendon that inserts onto the olecranon process of the ulna as well as to the caudal wall of the elbow joint capsule where bursae may exist. Portions of the common tendon extend into the antebrachial fascia; these fibers may cover the anconeus muscle.

Clinical Relevance: In healthy adults, it takes substantial force to rupture the triceps brachii tendon, either completely or as a partial tear.[1] In addition to examining the tendon, clinicians should test for ulnar nerve injury or tunnel syndrome, which can complicate triceps tendon rupture. Most individuals with low functional demand tolerate a partial lesion fairly well, though pain may persist with triceps activation. The severe, sudden pain resolves relatively soon after the trauma, but patients may complain of reduced arm strength with elbow extension. Incorporation of acupuncture, laser therapy, and massage may aid in the recovery of the tissue and augment the ability to return to full function, whether or not surgery for a partial triceps tendon tear is pursued.

Nerves

- **Posterior brachial cutaneous nerve:** A branch of the radial nerve that supplies the skin on the posterior surface of the brachium.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium, including the triceps brachii muscle. It divides into superficial and deep branches near the elbow. The deep branch further splits into muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist. Note in Figure 10-29 that the radial nerve branch deep to TH 10 is on its way to supply the anconeus muscle.
- **Intercostobrachial nerve (T2):** The ventral ramus of the 2nd thoracic spinal nerve divides into branches, the 2nd intercostal nerve (which is the larger of the two) and a smaller branch, which joins the brachial plexus. This smaller branch constitutes the lateral cutaneous branch of the 2nd intercostal nerve and is called the intercostobrachial nerve. It emerges from the 2nd

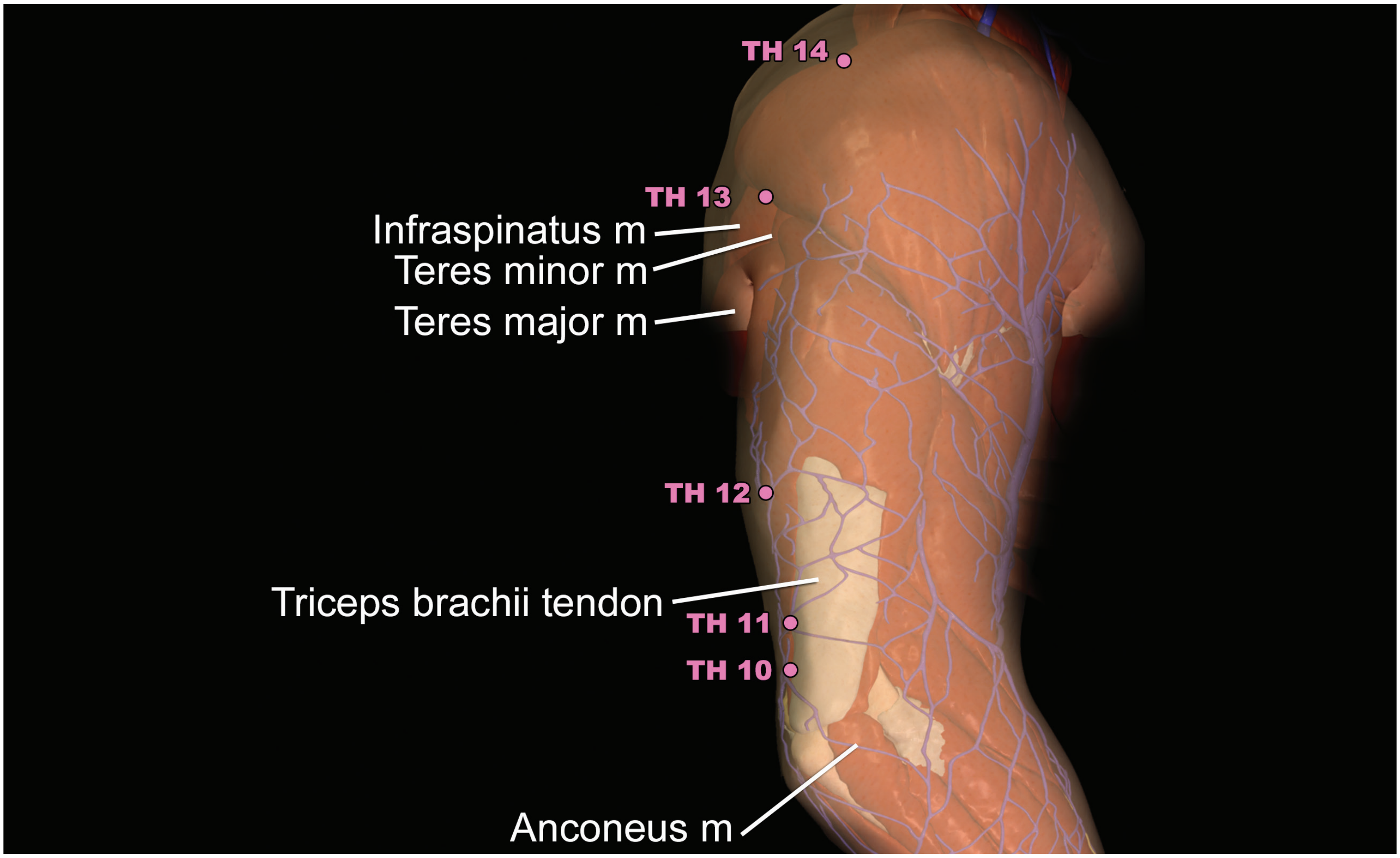


Figure 10-28. Both TH 10 and TH 11 reside over the tendon and underlying musculature of the triceps brachii. Either or both may become tender due to myofascial dysfunction in the triceps brachii muscle. Fascia from the triceps tendon extends to the anconeus muscle, distolateral to TH 11 and TH 10.

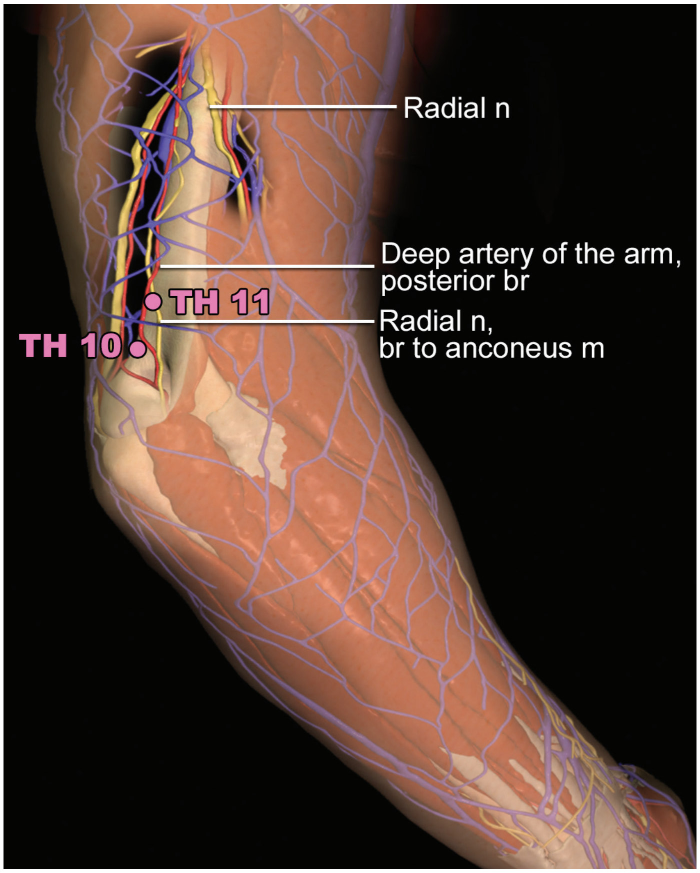

Radial n
Deep artery of the arm, posterior br
TH 11
Radial n, br to anconeus m
TH 10

Figure 10-29. The rationale for naming TH 11 "Clear Cold Abyss" may pertain to the ability of the point to reduce a sensation of heat along the channel.

intercostal space at the midaxillary line and penetrates the serratus anterior muscle to enter the brachial region, i.e., the axilla and arm. The floor of the axilla (i.e., the skin and its underlying subcutaneous tissue) receives its innervation from the intercostobrachial nerve. The intercostobrachial nerve communicates with the medial brachial cutaneous nerve to supply the posterior and medial surfaces of the arm. The intercostobrachial nerve may also communicate with the posterior brachial cutaneous nerve, a branch of the radial nerve.

Clinical Relevance: All major nerves of the thoracic limb, except the axillary nerve and medial brachial cutaneous nerve, send terminal articular branches to the elbow. These nerve endings issue from muscular nerves, cutaneous nerves, or nerves that arise directly from the brachial plexus.[2]

The myotendinous junction of the triceps brachii muscle deep to TH 11 indicates the presence of Golgi tendon organs and the opportunity to neuromodulate muscle tension and tone.

TH 11 also serves as a site of referred pain from the T2 region. As such, patients displaying tenderness to palpation from the upper thoracic paraspinal region to the axilla, caudal brachium, and dorsal antebrachium may benefit from a comprehensive treatment involving BL 11, BL 12, SI 9, TH 11, TH 10, and distal TH or LI sites. A complete myofascial palpation evaluation should elucidate sources of somatic dysfunction. The clinical picture along with the pain pattern ultimately determines the neuromodulation protocol.

The extrathoracic course of the intercostobrachial nerve exhibits a variety of courses between individuals, putting it at risk of damage during surgical procedures of the chest wall such as mastectomy and axillary node clearance.[3]

Interrelationships of nerves supplying TH 11, such as the intercostobrachial nerve, provide sources of referred cardiac pain.

Vessels

- **Deep brachial artery (or deep artery of the arm), middle collateral branch:** Participates in the arterial anastomoses around the elbow joint. The middle collateral branch joins with the inferior ulnar collateral artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery, and the superior ulnar collateral artery. The middle collateral artery (also called the medial collateral artery) anastomoses as well with the interosseous recurrent artery near the elbow. See Figure 10-26 to examine this relationship.
- **Superior ulnar collateral artery:** This artery arises from the brachial artery near the middle of the arm and travels with the ulnar nerve toward the humerus. It anastomoses with the posterior branch of the ulnar recurrent artery and inferior ulnar collateral artery which participate in the elbow anastomoses.
- Inferior ulnar collateral artery: This artery arises from the brachial artery about 5 cm proximal to the cubital crease. It joins the elbow anastomoses via its connection with the anterior branch of the ulnar recurrent artery.

Clinical Relevance: Supracondylar fractures of the distal humerus happen commonly in children and can cause neurovascular compromise.[4] Laser therapy may prematurely close epiphyses in immature patients. As such, after accurate neurovascular evaluation has assessed damage to vulnerable periarticular structures, other physical medicine measures may be preferable to revitalize the region and restore circulation and neurologic function.

The cross-section in Figure 10-30 discloses the abundant vascularity of the tissue deep to TH 11; note the extensive hemorrhage in the subcutaneous layer.

Indications and Potential Point Combinations

- **Back pain:** Latissimus dorsi trigger points in the GB 22, GB 23, and LR 13 vicinities may refer pain along the TH and HT lines.
- **Neck pain:** Identify the dysfunction involved and treat accordingly. For neck pain that radiates to the medial scapula, shoulder, pectoral region, and thoracic limb (along the TH and LI lines), evaluate the anterior, middle, and posterior scalene muscles as well as the scalenes minimus for trigger points. In addition to addressing the trigger points directly, consider adding points along the TH line such as TH 10, TH 11, and TH 4.
- **Shoulder pain:** Palpate for supraspinatus trigger point radiating to the shoulder and distal limb (LI 15, TH 14, LI 14, TH 11, TH 10, and LI 11). Evaluate the infraspinatus muscle for trigger points that may refer pain to the LI, TH, and LU lines of the thoracic limb and the medial scapula (BL 13, BL 14, and BL 15) and needle accordingly. Subscapularis trigger points can issue pain along the TH and SI lines; while inaccessible to needling, they can be reached via soft tissue maneuvers. Coracobrachialis trigger points in the LI 15/LU 2 region produces a referred pain pattern

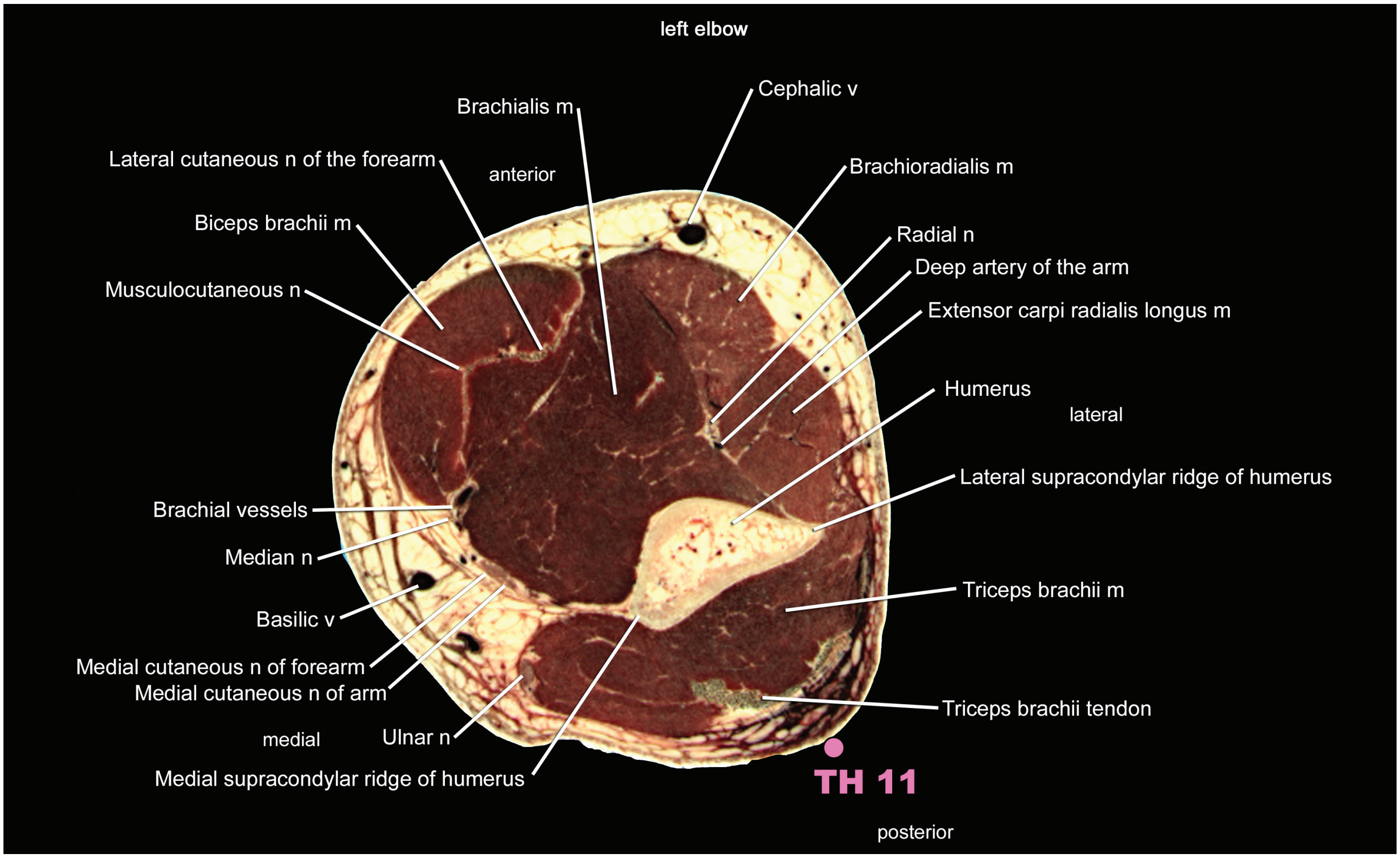

left elbow
Cephalic v
Brachialis m
Lateral cutaneous n of the forearm
anterior
Brachioradialis m
Biceps brachii m
Radial n
Deep artery of the arm
Musculocutaneous n
Extensor carpi radialis longus m
Humerus
lateral
Lateral supracondylar ridge of humerus
Brachial vessels
Median n
Triceps brachii m
Basilic v
Medial cutaneous n of forearm
Medial cutaneous n of arm
Triceps brachii tendon
medial
Ulnar n
Medial supracondylar ridge of humerus
TH 11
posterior

Figure 10-30. Comparing this figure with that of Figure 10-26, TH 11 affords a "meatier" avenue for neuromodulation than does TH 10, which houses relatively more tendon than muscle.

along the TH line, including TH 11 and TH 10, down to the TH 3.

- **Posterior arm pain:** TH 11 applications most closely pertain to the triceps brachii muscle and tendon, upon which it sits. An attachment trigger point deep under the triceps tendon, in the musculotendinous attachment region of the lateral head resides directly beneath TH 11. In addition, check the teres minor muscle at SI9 for a trigger point that refers pain to the TH 14, TH 13, TH 12, and TH 11 regions.

References

1. Khiami F, Tavassoli S, De Ridder Baeur L, et al. Distal partial ruptures of triceps brachii tendon in an athlete. *Orthopaedics & Traumatology: Surgery & Research.* 2012;98:242-246.
2. De Kesel R, Van Glabbeek F, Mugenzy D, et al. Innervation of the elbow joint: Is total denervation possible? A cadaveric anatomic study. *Clin Anat.* 2012;25(6):746-754.
3. Loukas M, Hullett J, Louis RG Jr, et al. The gross anatomy of the extrathoracic course of the intercostobrachial nerve. *Clin Anat.* 2006;19(2):106-111.
4. Patel K and McCann PA. The emergent assessment of supracondylar fractures of the paediatric humerus. *Hand Surg.* 2012;17(2):161-166.

TH 12

Xiao Luo "Dispersing Riverbed", "Relieving Thirst"

On the posterolateral brachium, on a line drawn from TH 14 to the olecranon, 4 cun proximal to TH 10, on the lower margin of the bulge of the lateral head of the triceps muscle when the forearm is pronated. In a depression in the triceps muscle, posterior to the humerus and between the long and lateral heads of the triceps muscle. Approximately midway between TH 11 and TH 13; about 1 cun distal to the midpoint between TH 10 and TH 14. Locate with elbow flexed and forearm in pronation. See Figure 10-31 for a pictorial depiction of its location.

Muscles

- **Triceps brachii muscle:** Serves as the main extensor of the forearm. The long head steadies the head of the humerus of the abducted arm. Fibers from the three heads of the triceps brachii converge into a single tendon that inserts onto the olecranon process of the ulna as well as to the caudal wall of the elbow joint capsule where bursae may exist. Portions of the common tendon extend into the antebrachial fascia; these fibers may cover the anconeus muscle.

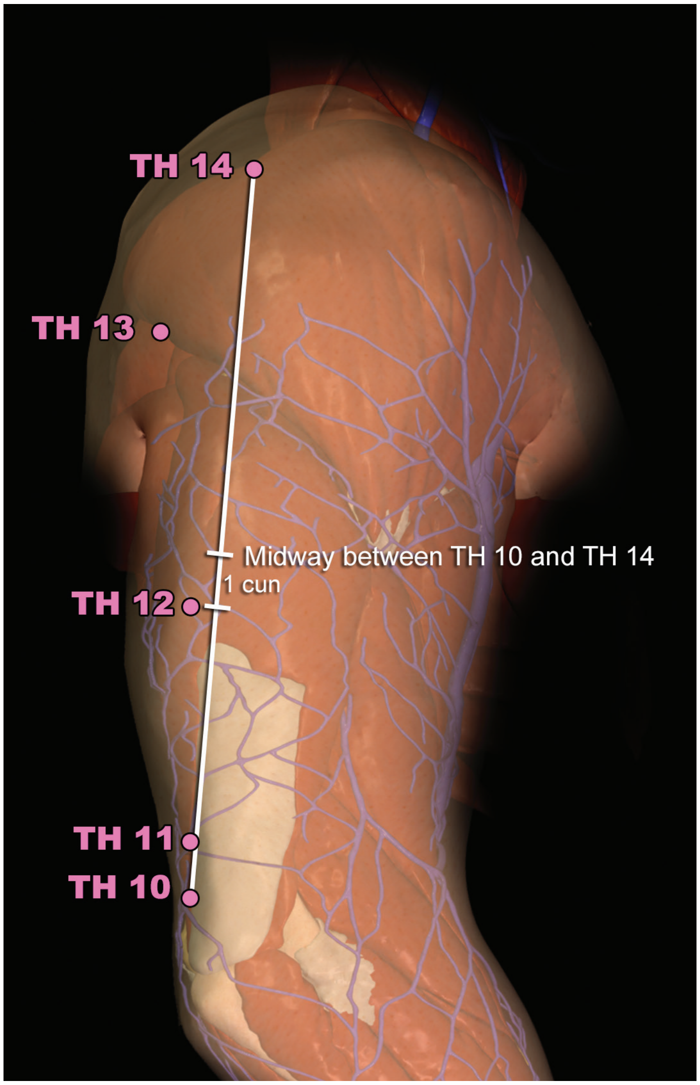


Figure 10-31. TH 12 accesses central trigger points in the triceps brachii muscle, in contrast to the attachment trigger points of TH 10 and TH 11.

Clinical Relevance: In healthy adults, it takes substantial force to rupture the triceps brachii tendon, either completely or as a partial tear.[1] In addition to examining the tendon, clinicians should test for ulnar nerve injury or tunnel syndrome, which can complicate triceps tendon rupture. Most individuals with low functional demand tolerate a partial lesion fairly well, though pain may persist with triceps activation. The severe, sudden pain resolves relatively soon after the trauma, but patients may complain of reduced arm strength with elbow extension. Incorporation of acupuncture, laser therapy, and massage may aid in the recovery of the tissue and augment the ability to return to full function, whether or not surgery for a partial triceps tendon tear is pursued.

Trigger points in the long head of the triceps brachii muscle send telltale pain patterns along the entire TH channel, from TH 15 to TH 4. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles refer pain along the TH line toward the ring finger. A teres major trigger point issues pain strongly to the dorsal shoulder from TH 14 to SI 10 and distad to TH territory on the brachium and antebrachium. Teres minor trigger points send pain to TH 14, TH 13, and down the TH line toward TH 11. Referred pain from subscapularis trigger points covers the entire scapular region and centralizes over the dorsal shoulder from TH 14 to TH 13. The pain continues to TH 10 and then hops over the dorsal surface of the antebrachium to land at TH 4, spreading to the entire wrist with the dorsal aspect more intensely affected. Caudal deltoid trigger points extend from TH 14/SI 10 to TH 13, TH 12, and LI 11. Pain from coracobrachialis dysfunction may start at LU 2 but then migrate caudad toward LI 15 to focus heavily on the caudal brachium from TH 13 to TH 12, and TH 9 to TH 3.

Nerves

- **Posterior brachial cutaneous nerve:** A branch of the radial nerve that supplies the skin on the posterior surface of the brachium.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium, including the triceps brachii muscle. It divides into superficial and deep branches near the elbow. The deep branch further divides into muscular and articular branches. The posterior interosseous nerve is a continuation of the deep branch. The superficial branch only supplies cutaneous nerves, providing sensation to the dorsum of the hand and the digits. The posterior cutaneous nerve of the forearm is a branch of the radial nerve that supplies the skin along the posterior aspect of the forearm to the wrist. The posterior antebrachial cutaneous nerve arises from the radial nerve to supply the skin along the lateral arm and posterior forearm and wrist.
- **Intercostobrachial nerve (T2):** The ventral ramus of the 2nd thoracic spinal nerve divides into branches, the 2nd intercostal nerve (which is the larger of the two) and a smaller branch, which joins the brachial plexus. This smaller branch constitutes the lateral cutaneous branch of the 2nd intercostal nerve and is called the intercostobrachial nerve. It emerges from the 2nd

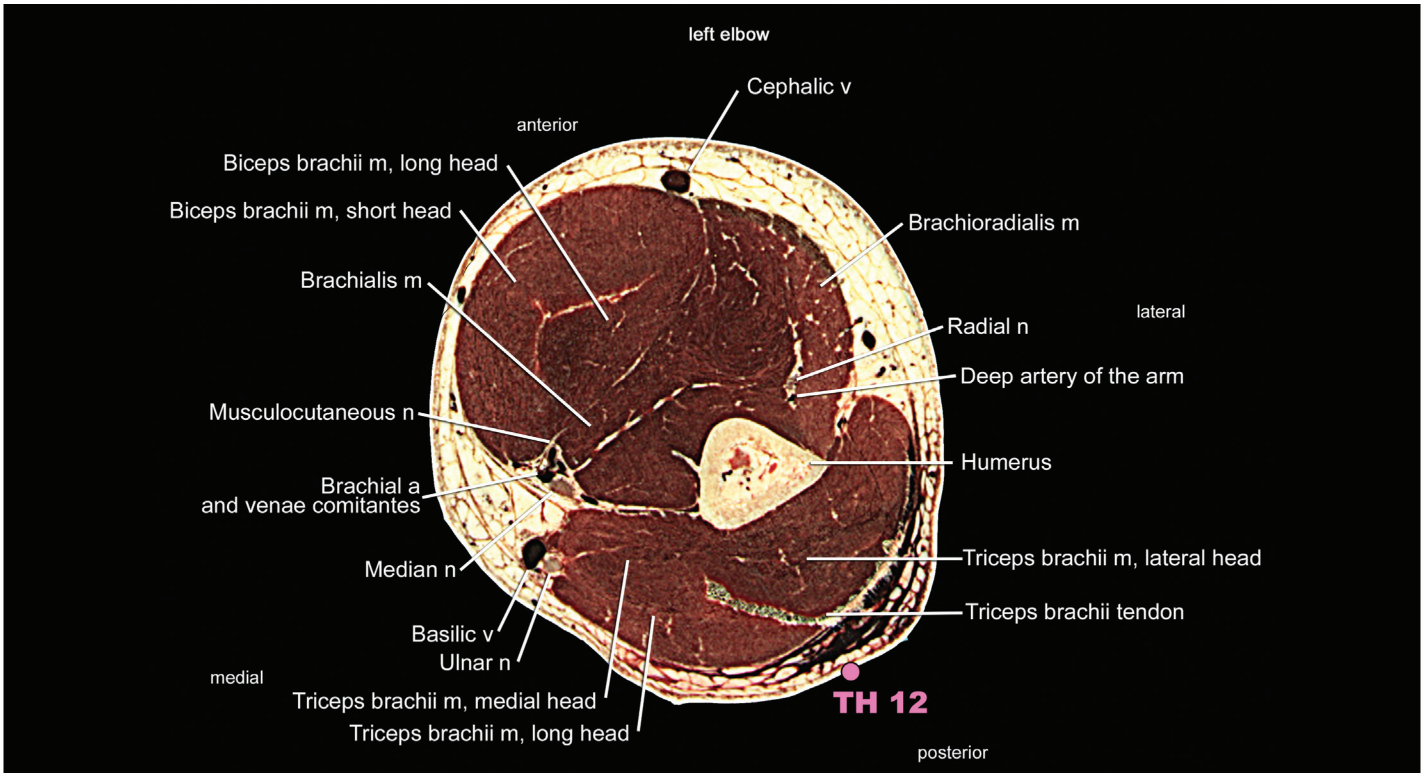


Figure 10-32. Depending on the direction of needle insertion, TH 12 needling may reach trigger points in the lateral, long, or medial head of the triceps brachii muscle. All three appear in this cross-section.

intercostal space at the midaxillary line and penetrates the serratus anterior muscle to enter the brachial region, i.e., the axilla and arm. The floor of the axilla (i.e., the skin and its underlying subcutaneous tissue) receives its innervation from the intercostobrachial nerve. The intercostobrachial nerve communicates with the medial brachial cutaneous nerve to supply the posterior and medial surfaces of the arm. The intercostobrachial nerve may also communicate with the posterior brachial cutaneous nerve, a branch of the radial nerve.

Clinical Relevance: All major nerves of the thoracic limb, except the axillary nerve and medial brachial cutaneous nerve, send terminal articular branches to the elbow. These nerve endings issue from muscular nerves, cutaneous nerves, or nerves that arise directly from the brachial plexus.[2]

TH 12 also serves as a site of referred pain from the T2 region. As such, patients displaying tenderness to palpation from the upper thoracic paraspinal region to the axilla, caudal brachium, and dorsal antebrachium may benefit from a comprehensive treatment involving BL 11, BL 12, SI 9, TH 12, TH 11, TH 10, and distal TH or LI sites. A complete myofascial palpation evaluation should elucidate sources of somatic dysfunction. The clinical picture along with the pain pattern ultimately determines the neuromodulation protocol.

The extrathoracic course of the intercostobrachial nerve exhibits a variety of courses between individuals, putting it at risk of damage during surgical procedures of the chest wall such as mastectomy and axillary node clearance.[3]

Interrelationships of nerves supplying TH 12, such as the intercostobrachial nerve, provide sources of referred cardiac pain.

Vessels

- **Deep brachial artery, middle collateral branch:** Participates in the arterial anastomoses around the elbow joint. The middle collateral branch joins with the inferior ulnar collateral artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery, and the superior ulnar collateral artery. This deep artery of the arm, also know as the profunda brachii artery, arise from the lateral and posterior portions of the brachial artery, just distal to the teres major muscle. The deep brachial artery closely follows the radial nerve, coursing between the medial and lateral heads of the triceps brachii and then along the radial nerve groove (or sulcus) of the humerus under cover of the lateral head of the triceps. It pierces the lateral intermuscular septum and descends between the brachioradialis and brachialis toward the cranial aspect of the lateral epicondyle of the humerus. It ends in an anastomosis with the radial recurrent artery.
- **Superior ulnar collateral artery:** This artery arises from the brachial artery near the middle of the arm and travels with the ulnar nerve toward the humerus. It anastomoses with the posterior branch of the ulnar recurrent artery and inferior ulnar collateral artery which participate in the elbow anastomoses.

Clinical Relevance: Supracondylar fractures of the distal humerus happen commonly in children and can cause neurovascular compromise.[4] Laser therapy may prematurely close epiphyses in immature patients. As such, after accurate neurovascular evaluation has assessed damage to vulnerable periarticular structures, other physical medicine measures may be preferable to revitalize the region and restore circulation and neurologic function.

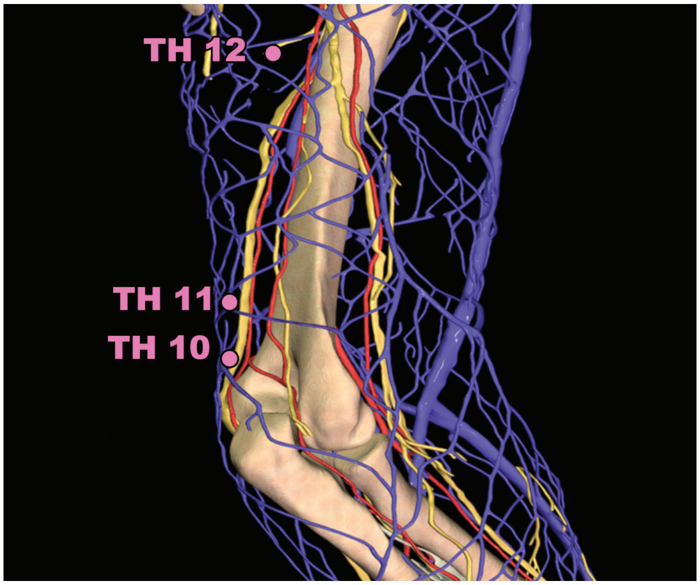


Figure 10-33. The name for TH 12, "Dispersing Riverbed", applies to the diverging vessels and nerves found at this point, as shown here.

Indications and Potential Point Combinations

- **Back pain:** Latissimus dorsi trigger points in the GB 22, GB 23, and LR 13 vicinities may refer pain along the TH and HT lines.
- **Neck pain:** Identify the dysfunction involved and treat accordingly. For neck pain that radiates to the medial scapula, shoulder, pectoral region, and thoracic limb (along the TH and LI lines), evaluate the anterior, middle, and posterior scalene muscles as well as the scalenes minimus for trigger points. In addition to addressing the trigger points directly, consider adding points along the TH line such as TH 10, TH 12, TH 11, and TH 4.
- **Shoulder pain:** Palpate for supraspinatus trigger point radiating to the shoulder and distal limb (LI 15, TH 14, LI 14, TH 12, TH 11, TH 10, and LI 11). Evaluate the infraspinatus muscle for trigger points that may refer pain to the LI, TH, and LU lines of the thoracic limb and the medial scapula (BL 13, BL 14, and BL 15) and needle accordingly. Subscapularis trigger points can issue pain along the TH and SI lines; while inaccessible to needling, they can be reached via soft tissue maneuvers. Coracobrachialis trigger points in the LI 15/LU 2 region produces a referred pain pattern along the TH line, including TH 12, TH 11 and TH 10, down to the TH 3.
- **Posterior arm pain:** Check the teres minor muscle at SI 9 for a trigger point that refers pain to the TH 14, TH 13, TH 12, and TH 11 regions.

References

1. Khiami F, Tavassoli S, De Ridder Baeur L, et al. Distal partial ruptures of triceps brachii tendon in an athlete. *Orthopaedics & Traumatology: Surgery & Research.* 2012;98:242-246.
2. De Kesel R, Van Glabbeek F, Mugenzy D, et al. Innervation of the elbow joint: Is total denervation possible? A cadaveric anatomic study. *Clin Anat.* 2012;25(6):746-754.
3. Loukas M, Hullett J, Louis RG Jr, et al. The gross anatomy of the extrathoracic course of the intercostobrachial nerve. *Clin Anat.* 2006;19(2):106-111.
4. Patel K and McCann PA. The emergent assessment of supracondylar fractures of the paediatric humerus. *Hand Surg.* 2012;17(2):161-166.

TH 13

Nao Hui "Upper Arm Convergence"

Between the long and lateral heads of the triceps muscle, where the triceps brachii muscle meets the caudal border of the deltoid muscle. The point lands 3 cun distal to TH 14, along the line connecting TH 10 and TH 14. See Figure 10-34 for point placement.

Muscles

- **Triceps brachii muscle:** Serves as the main extensor of the forearm. The long head steadies the head of the humerus of the abducted arm.

Clinical Relevance: TH 13 lives between the long and lateral heads of the triceps brachii muscle. The long head may often receive innervation by a branch of the axillary nerve, while the radial nerve supplies the lateral and medial heads.[1] Thus, when treating paresis or paralysis of the triceps brachii muscle, neuromodulation should address both radial and axillary nerve points. This suggests selecting SI 9, SI 10, TH 14 for axillary nerve stimulation and TH 12 and LI 12 for radial nerve activation. TH 13 may address both the radial and axillary nerves.

Trigger points in the long head of the triceps brachii muscle send telltale pain patterns along the entire TH channel, from TH 15 to TH 4. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles refer pain along the TH line toward the ring finger. A teres major trigger point issues pain strongly to the dorsal shoulder from TH 14 to SI 10 and distad to TH territory on the brachium and antebrachium. Teres minor trigger points send pain to TH 14, TH 13, and down the TH line toward TH 11. Referred pain from subscapularis trigger points covers the entire scapular region and centralizes over the dorsal shoulder from TH 14 to TH 13. The pain continues to TH 10 and then hops over the dorsal surface of the antebrachium to land at TH 4, spreading to the entire wrist with the dorsal aspect more intensely affected. Caudal deltoid trigger points extend from TH 14/SI 10 to TH 13, TH 12, and LI 11. Pain from coracobrachialis dysfunction may start at LU 2 but then migrate caudad toward LI 15 to focus heavily on the caudal brachium from TH 13 to TH 12, and TH 9 to TH 3.

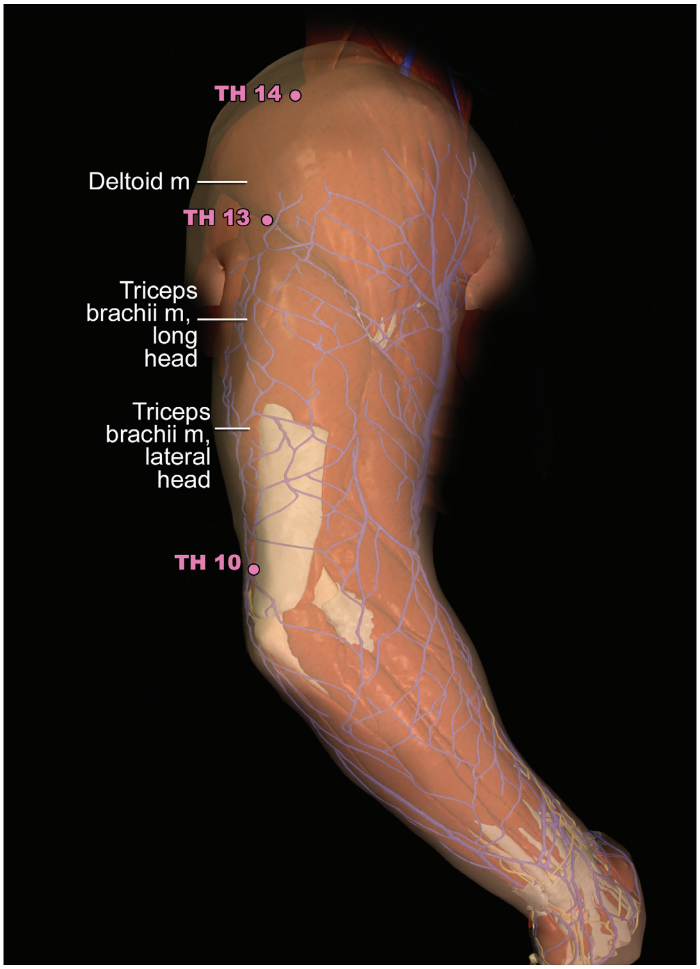
Nerves

- **Posterior brachial cutaneous nerve:** A branch of the radial nerve that supplies the skin on the posterior surface of the brachium.
- **Radial nerve (C5-C8):** Supplies all the muscles in the posterior compartment of the brachium, including the triceps brachii muscle (lateral and medial heads). It divides into superficial and deep branches near the elbow.
- **Axillary nerve (C5, C6):** Innervates the deltoid muscle and teres minor muscle. Appears to also innervate, at least in a subset of the population, the long head of the triceps brachii muscle. Supplies the shoulder joint and the skin overlying the inferior deltoid region.
- **Intercostobrachial nerve (T2):** The ventral ramus of the 2nd thoracic spinal nerve divides into branches, the 2nd intercostal nerve (which is the larger of the two) and a smaller branch, which joins the brachial plexus. This smaller branch constitutes the lateral cutaneous branch of the 2nd intercostal nerve and is called the intercostobrachial nerve. It emerges from the 2nd intercostal space at the midaxillary line and penetrates the serratus anterior muscle to enter the brachial region, i.e., the axilla and arm. The floor of the axilla (i.e., the skin and its underlying subcutaneous tissue) receives its innervation from the intercostobrachial nerve. The intercostobrachial nerve communicates with the medial brachial cutaneous nerve to supply the posterior and medial surfaces of the arm. The intercostobrachial nerve may also communicate with the posterior brachial cutaneous nerve, a branch of the radial nerve.

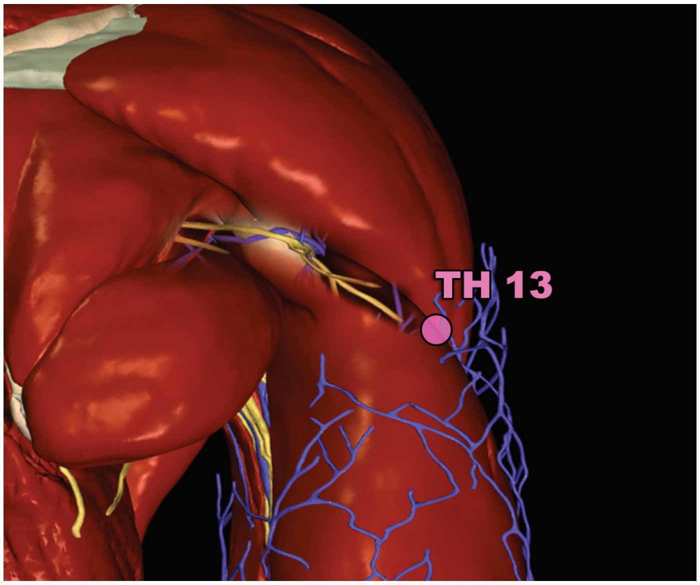
Clinical Relevance: Tension in the shoulder and proximal arm may compress one or more nerves traveling through various muscle layers to arrive at TH 13. As such, careful palpation of the entire region should help elucidate the source of pain and motor dysfunction that secondarily manifests. Deactivate relevant trigger points with acupuncture, relax the tissue further with soft tissue treatment, and follow up with laser therapy to aid in the restoration of appropriate blood flow and fluid drainage.

Vessels

- **Posterior humeral circumflex artery and vein:** Arise from the axillary vessels and exit along with the axillary nerve through the



Figures 10-34. TH 13 occupies the often-tender intersection of the long and lateral heads of the triceps brachii muscle, just distal to the deltoid. Hence its descriptive name, "Upper Arm Convergence".



Figures 10-35. This image takes a peek through a window created in the dorsal shoulder at the axillary nerve and posterior circumflex humeral vein (artery not shown), supplying the region around TH 13.

quadrangular space (bordered by the subscapularis/teres minor muscles, the teres major, the long head of the triceps brachii, and the surgical neck of the humerus). Supply and drain the teres minor, deltoid, and possibly portions of the triceps brachii muscle at TH 13.

- **Scapular circumflex artery and vein:** Travel through the anatomical triangular space, bordered by the teres major, teres minor, and long head of the triceps brachii muscles. Supply and drain each muscle.

Clinical Relevance: Both the quadrangular and triangular spaces create passageways that may compress the contents if muscle tension and fascial restriction grow too great. It behooves the physical medicine practitioner to alleviate such dysfunction when treating the dorsal shoulder in order to free the fascia and the neurovascular structures it surrounds.

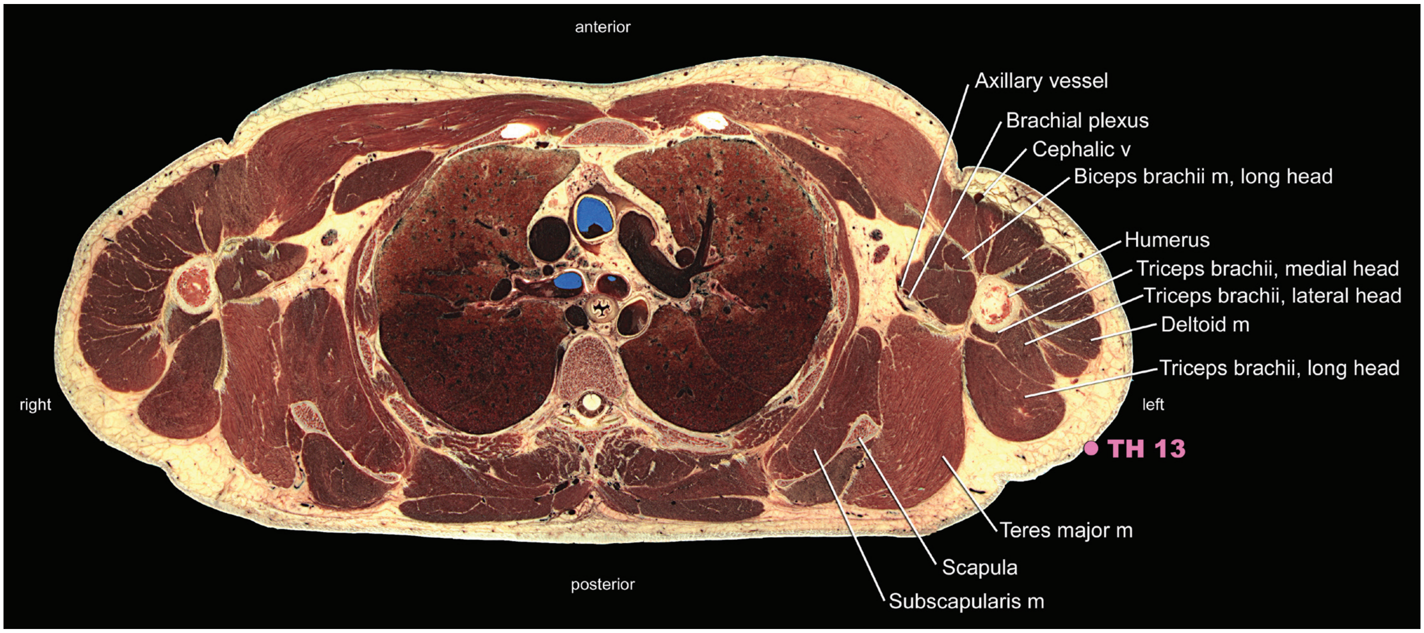
Indications and Potential Point Combinations

- **Local pain:** TH 13 plus pertinent trigger points.
- **Shoulder arthritis:** TH 13, SI 10, LI 15, Jianqian (located midway between LI 15 and the anterior axillary crease).[2]

References

1. De Seze M-P, Rezzouk J, De Seze M, et al. Does the motor branch of the long head of the triceps brachii arise from the radial nerve? *Surgical and Radiologic Anatomy*. 2004;26(6):459-461.

2. Zhang JC, Liu S, Lu JL, et al. Periarthritis of shoulder treated with deep puncture by elongated needle combined with spike-hooked needle and cupping: a multicentral randomized controlled study. *Zhongguo Zhen Jiu*. 2011;31(10):869-873.


anterior
Axillary vessel
Brachial plexus
Cephalic v
Biceps brachii m, long head
Humerus
Triceps brachii, medial head
Triceps brachii, lateral head
Deltoid m
Triceps brachii, long head
right
left
TH 13
Teres major m
Scapula
Subscapularis m
posterior

Figures 10-36. Applications for TH 13 pertain mostly to local pain in the triceps, deltoid, and scapular attachments. As indicated here, structures in the vicinity of TH 13 are mainly muscular.

TH 14

Jian Liao "Shoulder Crevice" or "Shoulder Bone-Hole"

Between the acromial and spinal parts of the deltoid muscle, in the caudal of two depressions appearing on either side of the acromion when the arm is abducted 90°. TH 14 lies in the depression caudal and distal to the acromion, whereas LI 15 is in the depression that lies cranial and distal to the acromion.

Connective Tissues

- **Subacromial bursa:** A synovial structure that facilitates gliding of proximal humerus under the coracoacromial arch.

Clinical Relevance: Subacromial impingement syndrome comprises a spectrum of problems ranging from subacromial bursitis to rotator cuff tears or tendon damage.[1] Shoulder problems have historically been "lumped" together as "bursitis" or "arthritis" without clear differentiation based on palpatory findings and ancillary examinations or diagnostic evaluation.

Wayward injections (e.g., vaccinations) into the deltoid muscle risk injury to the shoulder if fluids find themselves "shot" into the subacromial bursa, leading to a condition known as "shoulder injury related to vaccine administration (SIRVA).[2] Acupuncture and related techniques may aid in the resolution of resultant pain and inflammation.

Patients with adhesive capsulitis, or frozen shoulder, demonstrate overexpression of inflammatory cytokines in the subacromial bursa.[3] This argues for treatment with acupuncture and related techniques in order to modulate cytokine levels.

Muscles

- **Deltoid muscle:** The posterior part extends the arm and rotates it laterally. The anterior part flexes the arm and rotates it medially. The middle part abducts the arm.

Clinical Relevance: Caudal deltoid trigger points extend from TH 14/SI 10 to TH 13, TH 12, and LI 11. Trigger points in the long head of the triceps brachii muscle send telltale pain patterns along the entire TH channel, from TH 15 to TH 4. Myofascial dysfunction in the serratus posterior superior, latissimus dorsi, and infraspinatus muscles refer pain along the TH line toward the ring finger. A teres major trigger point issues pain strongly to the dorsal shoulder from TH 14 to SI 10 and distad to TH territory on the brachium and antebrachium. Teres minor trigger points send pain to TH 14, TH 13, and down the TH line toward TH 11. Referred pain from subscapularis trigger points covers the entire scapular region and centralizes over the dorsal shoulder from TH 14 to TH 13. The pain continues to TH 10 and then hops over the dorsal surface of the antebrachium to land at TH 4, spreading to the entire wrist with the dorsal aspect more intensely affected. Pain from coracobrachialis dysfunction may start at LU 2 but then migrate caudad toward LI 15 to focus heavily on the caudal brachium from TH 13 to TH 12, and TH 9 to TH 3.

Nerves

- **Axillary nerve (C5, C6):** Innervates the deltoid muscle and teres minor muscle. Also supplies the shoulder joint and the skin overlying the inferior deltoid region. Appears to also innervate, at least in a subset of the population, the long head of the triceps brachii muscle.
- **Lateral supraclavicular nerve (C3, C4):** Supplies the skin over the shoulder.
- **Superior lateral brachial cutaneous nerve (C5, C6):** Arises from the axillary nerve. Supplies the skin over the lower portion of the deltoid and the lateral part of the mid-arm.
- **Suprascapular nerve ((C4), C5, C6):** Supplies the supraspinatus and infraspinatus muscles. Also provides sensory branches to the caudal joint capsule of the shoulder. May provide cutaneous sensation to the skin at TH 14.[4,5]

Clinical Relevance: Tension in the shoulder and proximal arm may compress one or more nerves traveling through various muscle layers to arrive at TH 14. As such, careful palpation of the entire region should help elucidate the source of pain and motor dysfunction that secondarily manifests. Deactivate relevant trigger points with acupuncture, relax the tissue further with soft tissue treatment, and follow up with laser therapy to aid in the restoration of appropriate blood flow and fluid drainage.

Several orthopedic surgical procedures put the axillary nerve at risk.[6] Iatrogenic injury can occur following shoulder arthroscopy, thermal shrinkage of the shoulder, and plate fixation of the proximal humerus. The caudal branch of the axillary nerve associates closely with distal aspects of the glenoid and shoulder joint capsule.[7] This is where the nerve can suffer damage during capsular plication or thermal shrinkage. The superior lateral brachial cutaneous nerve arises from this caudal, or posterior, branch. The caudal deltoid more often receives innervation from the anterior or cranial branch of the axillary nerve, which may lead to injury during a posterior deltoid-splitting approach to the shoulder. In cases of nerve injury at or around TH 14, consider acupuncture and related techniques to revitalize the nerve(s) and accelerate soft tissue healing and return of function.

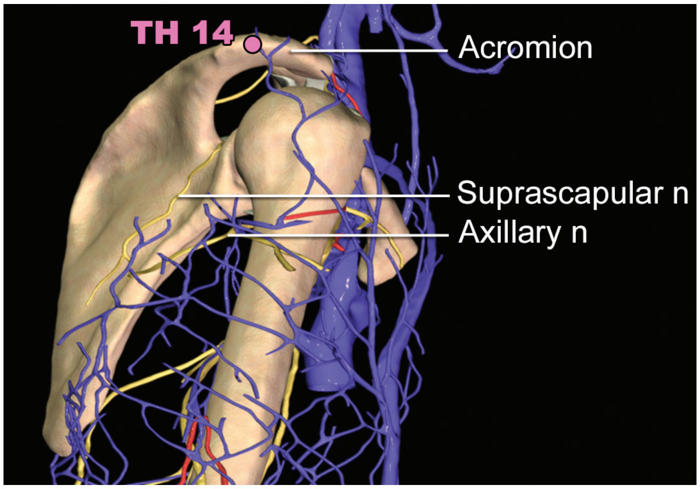


Figure 10-37. This lateral view of the shoulder exposes why TH 14 is called "Shoulder Crevice" or "Shoulder Bone-Hole".

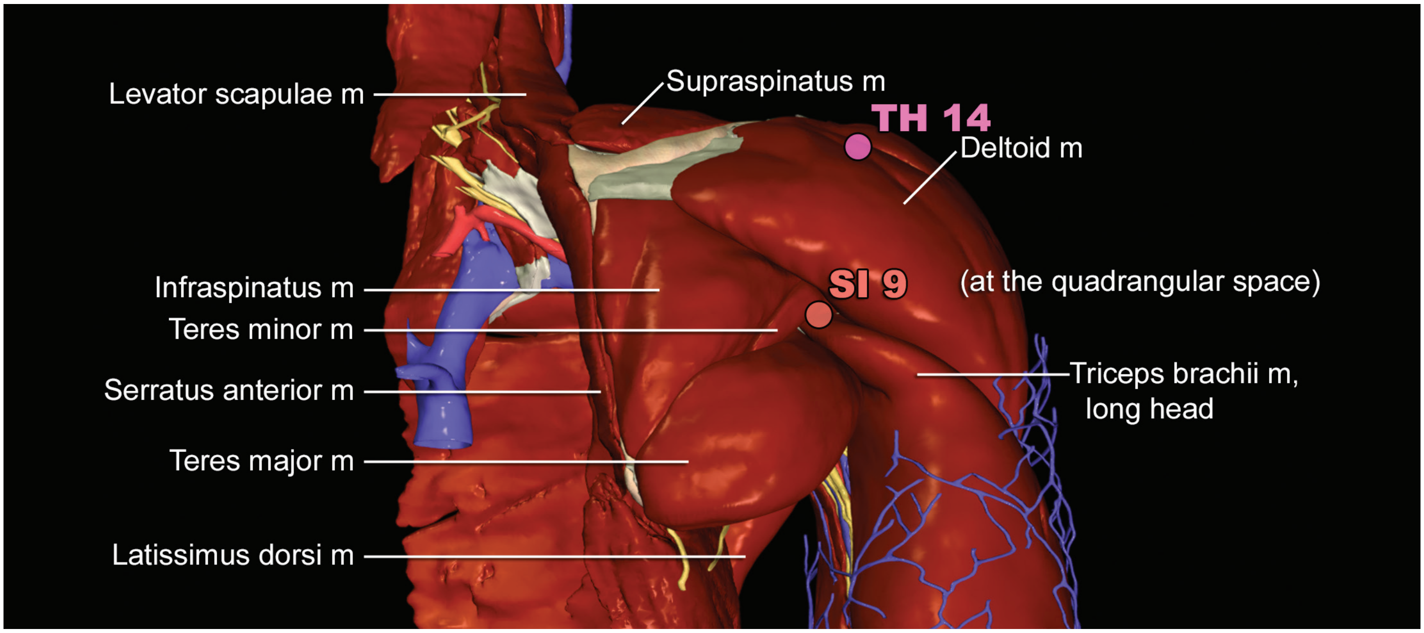

Levator scapulae m
Supraspinatus m
TH 14
Deltoid m
Infraspinatus m
Teres minor m
SI 9
(at the quadrangular space)
Serratus anterior m
Triceps brachii m, long head
Teres major m
Latissimus dorsi m

Figure 10-38. A posterior deltoid trigger point sends pain to the caudal shoulder between TH 14 and SI 9, illustrated here.

Vessels

- Posterior circumflex humeral artery and vein: Arises from the axillary vessels and passes through the quadrangular space with the axillary nerve. Anastomoses with the anterior circumflex humeral vessels to provide a circular anastomosis around the surgical neck of the humerus.

Clinical Relevance: Both the quadrangular and triangular spaces create passageways that may compress the contents if muscle tension and fascial restriction grow too great. It behooves the physical medicine practitioner to alleviate such dysfunction when treating the dorsal shoulder in order to free the fascia and the neurovascular structures it surrounds. Some of the vessels supplying the area around TH 14 must course through intersecting layers of myofascia. They may experience compression and result in insufficient circulation and drainage to and from the shoulder, respectively.

Indications and Potential Point Combinations

- **Shoulder pain from myofascial dysfunction or arthritis:** TH 14, LI 15; check regional musculature for trigger/acupuncture points that refer pain to the shoulder, such as those at or near SI 9, SI 10, SI 11, and SI 12.
- **Shoulder pain after stroke:**[8] TH 14, LI 15, LU 5, PC 3, GB 21, as well as additional areas that manifest restriction or tenderness. Add electroacupuncture and soft tissue manual therapy. Apply bilaterally.
- **Brachial plexus injury after birth:**[9] TH 14, LI 15, SI 9, LI 14, LI 13, LI 11, and other pertinent points depending on neurologic involvement.
- **Frozen shoulder:**[10] TH 14, LI 15, SI 9. Add heat or laser therapy to tender points.

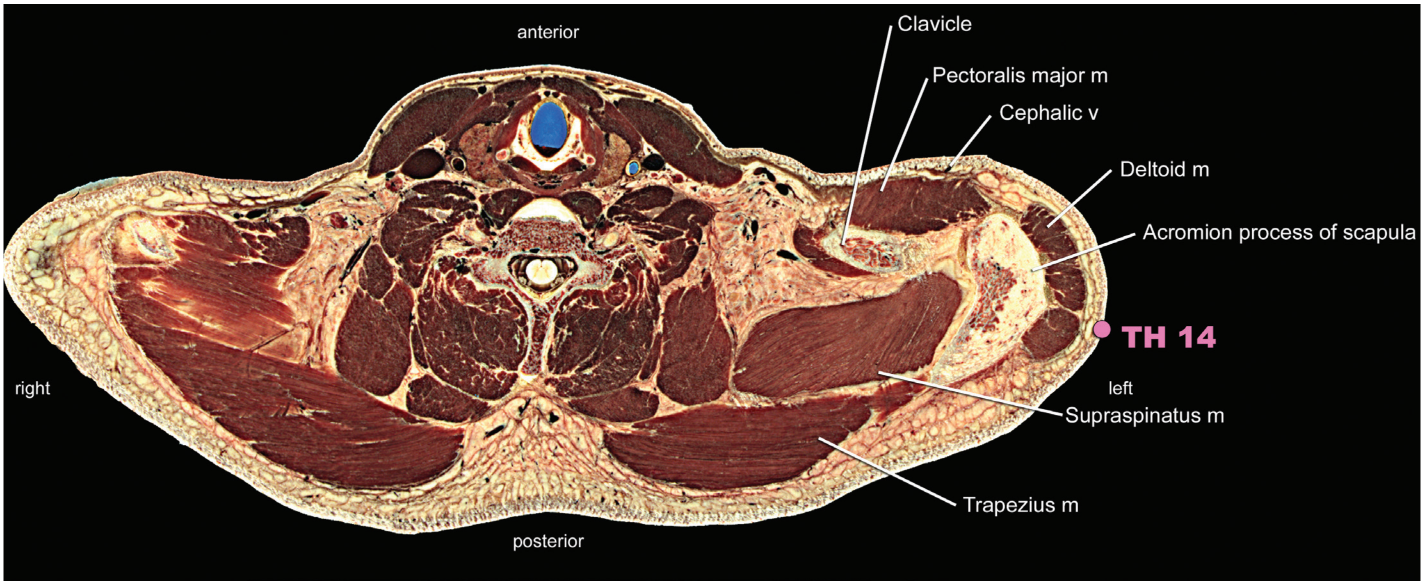

anterior
Clavicle
Pectoralis major m
Cephalic v
Deltoid m
Acromion process of scapula
TH 14
right
left
Supraspinatus m
Trapezius m
posterior

Figure 10-39. TH 14 resides between the middle and caudal portions of the deltoid muscle.

References

1. Harrison AK and Flatow EL. Subacromial impingement syndrome. *Journal of the American Academy of Orthopaedic Surgeons.* 2011;19(11):701-708.

2. Barnes MG, Ledford C, and Hogan K. A "needling" problem: shoulder injury related to vaccine administration. *J Am Board Fam Med.* 2012;25:919-922.

3. Lho YM, Ha E, Cho CH, et al. Inflammatory cytokines are overexpressed in the subacromial bursa of frozen shoulder. *J Shoulder Elbow Surg.* 2013;22(5):666-672.

4. Horiguchi M. The cutaneous branch of some human suprascapular nerves. *J Anat.* 1980;130(1):191-195.

5. Vorster W, Lange CP, Briet RJ, et al. The sensory branch distribution of the suprascapular nerve: an anatomic study. *J Shoulder Elbow Surg.* 2008; 17(3):500-502.

6. Loukas M, Grabska J, Tubbs RS, et al. Mapping the axillary nerve within the deltoid muscle. *Surg Radiol Anat.* 2009;31:43-47.

7. Ball CM, Steger T, Galatz LM, et al. The posterior branch of the axillary nerve: an anatomic study. *J Bone Joint Surg Am.* 2003;85-A(8):1497-1501.

8. Li N, Tian FW, Wang CW, et al. Double-center randomized controlled trial on post-stroke shoulder pain treated by electroacupuncture combined with Tuina. *Zhongguo Zhen Jiu.* 2012;32(2):101-105.

9. Luo W and Cheng JZ. Clinical study on acupuncture and Tuina for treatment of birth brachial plexus injury. *Zhongguo Zhen Jiu.* 2010;30(11):918-920.

10. Wang XH, Xu YZ, Hu WB, et al. Frozen shoulder due to cold damp treated with acupuncture and moxibustion on tender points. *Zhongguo Zhen Jiu.* 2010;30(5):364-366.

TH 15

Tian Liao "Celestial Crevice" or "Celestial Bone-Hole"

Midway between GB 21 and SI 13, in a depression in the suprascapular fossa where the levator scapulae muscle inserts onto the superior angle of the scapula. Also located midway between the lateral limit of the acromion and GV 14; approximately 1 cun dorsocaudal to GB 21. See Figure 10-40 for placement.

Caution: Deep insertion may cause pneumothorax.

Muscles

- **Trapezius muscle:** Acts on the scapula to elevate, retract, and rotate it.
- **Supraspinatus muscle:** Helps the deltoid muscle abducts the arm and initiates the abduction movement. Acts as a rotator cuff muscle along with the infraspinatus, teres minor, and subscapularis muscles.
- **Levator scapulae muscle:** Tilts the glenoid cavity of the scapula inferiorly while rotating and elevating the scapula.

Clinical Relevance: Trigger points in the neck and shoulders commonly produce pain and morbidity in the human population.

A trigger point at TH 15 in the middle fibers of the trapezius issues pain toward the midline between C7 and T4. Levator scapulae trigger points in this same zone send pain signals in the angle between the neck and shoulder, down the medial border of the scapula, and toward the zone spanning TH 14 to SI 10.

A variety of interventions aid in alleviating trigger point pathology in the trapezius muscle, including manual pressure,[1] extracorporeal shock wave therapy,[2] acupuncture,[3] transcutaneous electrical point stimulation,[4] and laser therapy.[5,6]

Figure 10-42 reveals the depth of needle insertion required in a heavily muscled patient to reach the levator scapulae muscle at this level.

Nerves

- **Spinal nerves T1-T3:** Innervate the skin.
- **Spinal accessory nerve (also known as the spinal root of the accessory nerve, CN XI):** Provides motor innervation for the trapezius muscle.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.
- **Dorsal scapular nerve (C4, C5):** Innervates the levator scapulae and rhomboid major and minor muscles.

Clinical Relevance: Dorsal scapular nerve injury following trauma can present as a sharp pain in the shoulder that worsens when lifting heavy objects overhead.[7] Mechanism of injury includes traction or compression of the nerve through extended overhead work. Lifting a heavy box overhead places the dorsal scapular nerve at risk, as do occupational activities (for painters, electricians, dry wallers, etc.) involving raising the arms for long

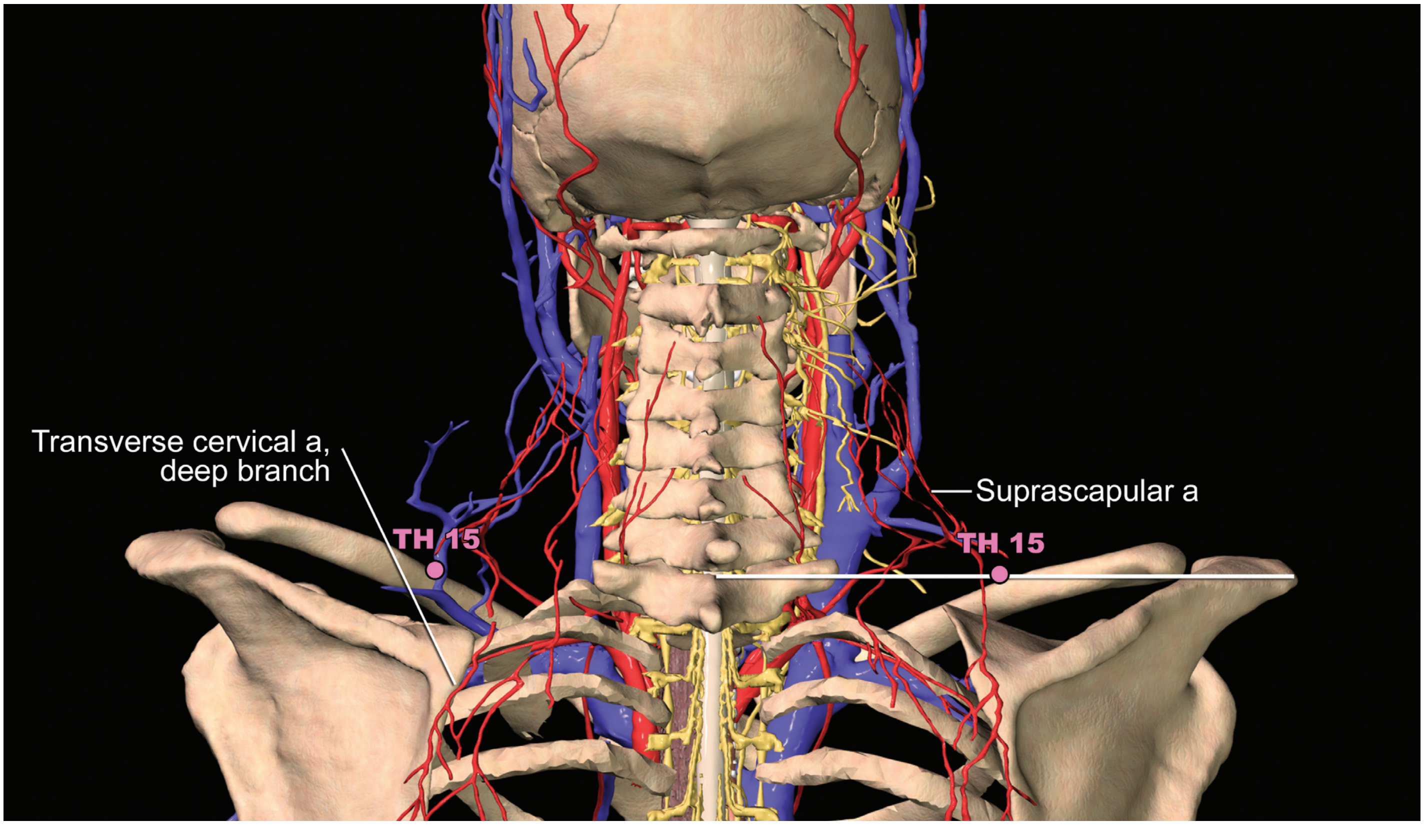


Figure 10-40. The bones forming the "Celestial Crevice" at TH 15 include the spine, the clavicle, and the 1st rib (absent on the right side in this individual). The white line on the right side of this image denotes the distance between GV 14 at the cervicothoracic junction and the tip of the acromion. TH 15 lands equidistant between them. In practice, one will palpate this region at the craniomedial angle of the scapula; doing so will likely reveal the presence of several trigger points.

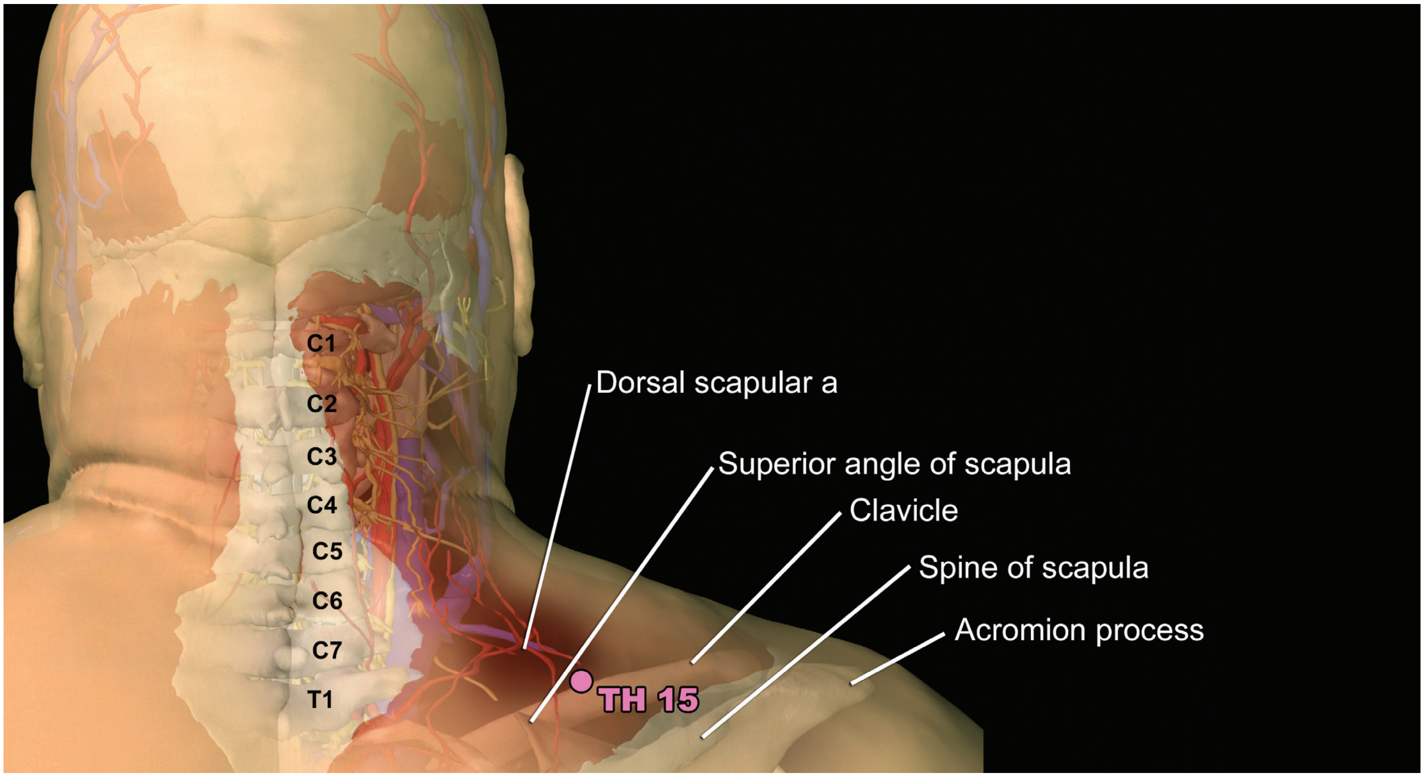


Figure 10-41. TH 15 figures prominently in trigger point treatments for neck and shoulder pain. Acupuncture, massage, and laser therapy aid in alleviating myofascial restriction as well as supporting proper blood flow.

periods of time. Hypertrophy of the middle scalene muscle can lead to dorsal scapular nerve entrapment as well. Pain becomes more severe with the addition of strain from compensatory or parascapular muscles or spasm in antagonists of the rhomboids and levator scapulae. On physical examination, the caudomedial border and caudal angle of the scapula become prominent ("winged"); the scapula as a whole moves laterad. Denervation or neuropathy of the dorsal scapular nerve causes the muscles it supplies to thin (levator scapulae and rhomboids) or atrophy; changes become visible on magnetic resonance imaging. Scapular winging as a result of dorsal scapular neuropathy is much less common than winging from long thoracic nerve injury (i.e., the nerve that supplies the serratus anterior muscle) or spinal accessory neuropathy (CN XI innervates the trapezius and sternocleidomastoid muscles). Long thoracic nerve palsy produces winging that worsens with arm forward elevation and pushing with outstretched arms. Spinal accessory nerve injury is accentuated by slowly lowering the arms from the arm forward-elevated position. Dorsal scapular nerve injury can be distinguished from C5 root lesion by the absence of abnormal electromyographic findings in other muscles supplied by C5. Rehabilitation includes range of motion, strengthening, and proprioceptive retraining as well as neuromodulation through acupuncture and related techniques. Entrapment of the dorsal scapular nerve due to compression by tension in the middle scalene muscle that it pierces may respond to massage and gentle stretching.

Vessels

- **Suprascapular artery:** Arises from the thyrocervical trunk (from the subclavian artery). Supplies the supraspinatus and infraspinatus muscles.
- **Suprascapular vein:** Accompanies the suprascapular artery. Empties into the external jugular vein.
- **Transverse cervical artery:** Arises from the thyrocervical trunk, along with the suprascapular artery, to supply the muscles in the posterior cervical triangle, the trapezius, and the medial scapular muscles.
- **Dorsal scapular artery:** This artery arises either from the transverse cervical or subclavian artery, runs deep to the levator scapulae muscle, and supplies the rhomboid muscles. The dorsal scapular artery joins with other arteries (the suprascapular and the subscapular, via the circumflex scapular) around the scapula to form arterial anastomoses. This collateral circulatory route provides another avenue of blood flow in the event of an interruption of blood supply through either the subclavian or axillary arteries. This interruption may result from ligation, in cases of a lacerated axillary or subclavian artery, or from vascular stenosis in the axillary artery secondary to atherosclerosis. In either situation, blood flow in the subscapular artery reverses direction, thereby allowing blood to reach the third part of the axillary artery. (The subscapular artery receives blood from the suprascapular, transverse cervical, and intercostal arteries via several anastomotic junctures.) See Figure 10-41 to view the dorsal scapular artery.

Clinical Relevance: The dorsal scapular artery travels intimately with the dorsal scapular nerve. As such, compression or traction injuries of the dorsal scapular nerve would conceivably affect the accompanying artery and vein in a similar fashion.

The transverse cervical artery crosses the phrenic nerve about 3 cm cranial to the clavicle at a right angle; hence the name "Red Cross Syndrome" when ischemic neuropraxia results from arterial compression of the nerve. While it stands anatomically apart from the well-defined prevertebral fascia, surgical,

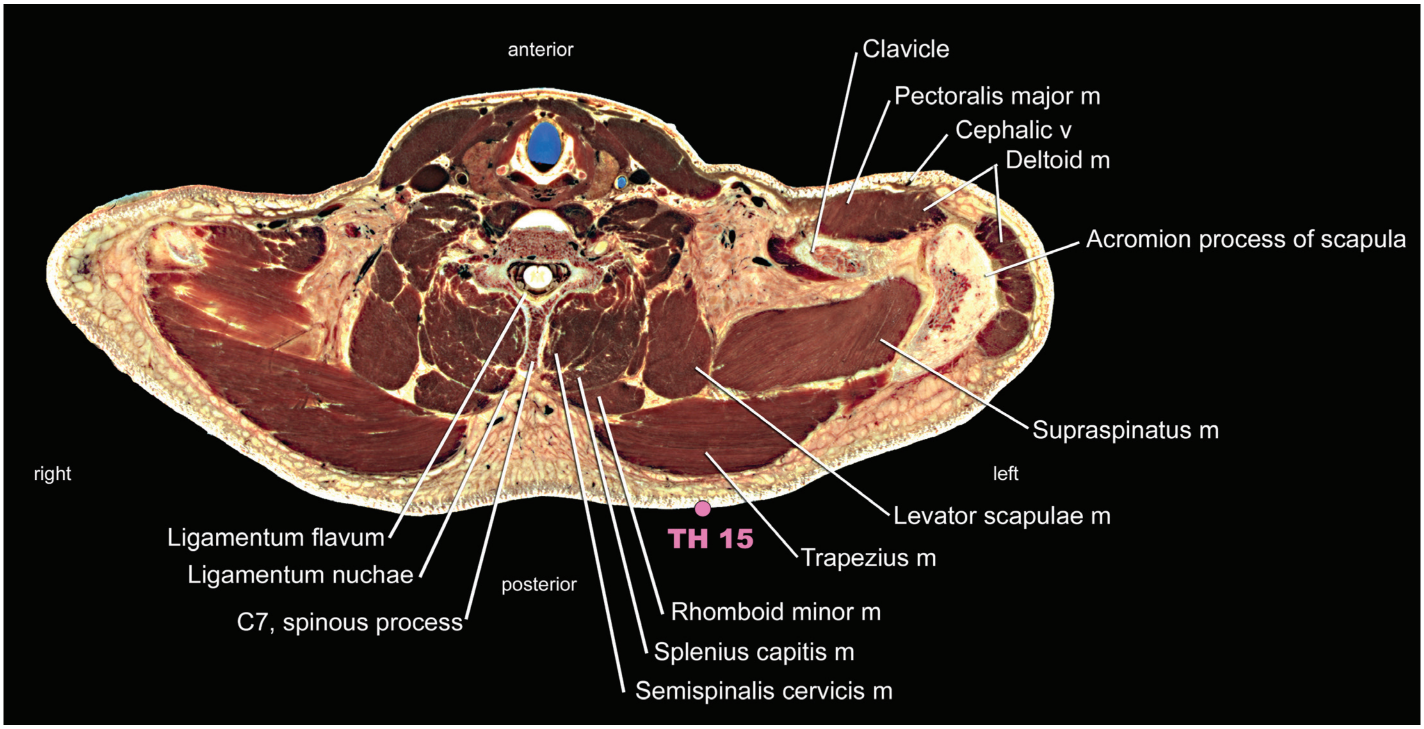


Figure 10-42. Trigger points treatable through TH 15 may reside in the trapezius, the “levator scapulae, or supraspinatus muscle, each accessible with needling, massage, or laser treatment to this region. Note the difference in muscle texture and color from the erector spinae group close to the center of the body and these larger, broader, movers of the shoulder joint.

anesthetic, or chiropractic procedures applied to the neck can stretch or transect the nerve. Trauma to the fascia and nerve may result in fibrosis and scarring in the area. Loss of tissue plane separation and adhesion of normally separate anatomical layers invites nerve compression and/or dysfunction.[8] Iatrogenic or traumatic injury to the cervical fascia may similarly impact the transverse cervical artery. Changes to the course and caliber of the artery from anatomical changes, preceding trauma, and/or inflammation can induce further compression of the phrenic nerve that lies deep to it. Phrenic nerve injury in the neck from transverse cervical artery is one source of diaphragm paralysis from peripheral causes.

Needling in the vicinity of TH 15 may augment blood flow through the vertebral and transverse cervical artery.[9] This may aid patients with cerebral blood flow insufficiency.

Acupuncture and related techniques alleviate myofascial restriction in the shoulder to allow better blood flow and improve tissue impair. Points to treat include TH 15, SI 14, SI 15, SI 16, ST 10, ST 11, and LI 18.

Indications and Potential Point Combinations

- **Neck or upper back stiffness or pain:** TH 15, for levator scapulae trigger points. Consider adding SI 16, SI 10, BL 13 through BL 17, and scalene trigger points.[10]

References

1. Fryer G and Hodgson L. The effect of manual pressure release on myofascial trigger points in the upper trapezius muscle. *Journal of Bodywork and Movement Therapies.* 2005;9:248-255.
2. Jeon JH, Jung YJ, Lee JY, et al. The effect of extracorporeal shock wave therapy on myofascial pain syndrome. *Ann Rehabil Med.* 2012;36(5):665-674.
3. Aranha MFM, Alves MC, Berzin F, et al. Efficacy of electroacupuncture for myofascial pain in the upper trapezius muscle: a case series. *Rev Bras Fisioter.* 2011;15(5):371-379.
4. Gemmell H and Hilland A. Immediate effect of electric point stimulation (TENS) in treating latent upper trapezius trigger points: a double blind randomised placebo-controlled trial. *J Bodyw Mov Ther.* 2011;15(3):348-354.
5. Ilbuldu E, Cakmak A, Disci R, et al. Comparison of laser, dry needling, and placebo laser treatments in myofascial pain syndrome. *Photomed Laser Surg.* 2004;22(4):306-311.
6. Altan L, Bingol U, Aykac M, et al. Investigation of the effect of GaAs laser therapy on cervical myofascial pain syndrome. *Rheumatol Int.* 2005;25:23-27.
7. Akgun K, Aktas I, and Terzi Y. Winged scapula caused by a dorsal scapular nerve lesion: a case report. *Arch Phys Med Rehabil.* 2008;89:2017-2020.
8. Kaufman MR, Willekes LJ, Elkwood AI, et al. Diaphragm paralysis caused by transverse cervical artery compression of the phrenic nerve: The Red Cross syndrome. *Clinical Neurology and Neurosurgery.* 2012;114:502-505.
9. Qie ZW, Cheng FK, and Cheng LH. Blood flow capacity of the vertebra and cervical artery affected by propagated sensation with acupuncture excitation. Zhong Xi Yi Jie He Za Zhi. 1991;11(1):31-3, 5.
10. Munoz-Munoz S, Munoz-Garcia MT, Alburquerque-Sendin F, et al. Myofascial trigger points, pain, disability, and sleep quality in individuals with mechanical neck pain. *J Manipulative Physiol Ther.* 2012;35:608-613.

TH 16

Tian You "Celestial Window" or "Window of Heaven"

On the dorsal margin of the sternocleidomastoid muscle, just caudal to the mastoid process, level with the angle of the mandible, SI 17, and BL 10. Approximately 1 cun caudal to GB 12.

Muscles

- **Splenius capitis muscles:** The splenius muscles bend the head laterally and rotate it to the side of active muscles acting unilaterally; acting bilaterally, the splenius muscles extend the head and neck. Both right and left splenius capitis muscles function in concert to rotate the head and lift the chin.
- **Longissimus capitis muscle:** The longissimus muscles comprise the intermediate column of the intermediate layer of the intrinsic muscles of the back, the erector spinae.
- **Semispinalis capitis muscle:** The semispinalis capitis muscle resides deep to the splenius and medial to the longissimus cervicis and capitis. It functions to extend the head.[1]

Clinical Relevance: Referred pain patterns in muscles near TH 16 often flow along the TH trajectory.

Trigger points in neck, shoulder, and head muscles produce pain in a large segment of the population, in both office workers and manual laborers.[2]

Note in Figure 10-43 that TH 16 sits in the space between the trapezius and SCM. As such, while treatment applied to this area may impact myofascial dysfunction along the borders of these muscles, the main trigger point target of TH 16 is the splenius capitis muscle and those structures deep to the splenius. Pressure at TH 16 may activate trigger points in the splenius capitis and produce diffuse pain at the vertex, centered strongly over the ipsilateral parietal region.

Deep to the splenius capitiis lays the semispinalis capitis and longissimus capitis muscles, as revealed by the cross section in Figure 10-45. Myofascial pathology in the semispinalis sends pain signals to the occiput while trigger point dysfunction in the longissimus issues pain toward the mastoid region. Pain referred from the longissimus may extend caudad down the neck; it may also reach rostrad to the retro- or periorbital locations. This explains in part the pain that migraineurs report in the eye secondary to cervical somatic dysfunction.

Jaw clenching and teeth grinding co-activate muscles of the neck, including the splenius, SCM, trapezius, and levator scapulae. Sustained contraction leads to the typical and widespread myofascial dysfunction associated with TMJ and other stress-induced craniofacial disorders.[3] In turn, active trigger points disturb sleep, which further worsens pain and disability.[4]

Nerves

- **Lesser occipital nerve (C2):** Supplies the skin of the neck, and the scalp located dorsal and medial to the auricle.
- **Greater auricular nerve (C2, C3):** Supplies the skin over the

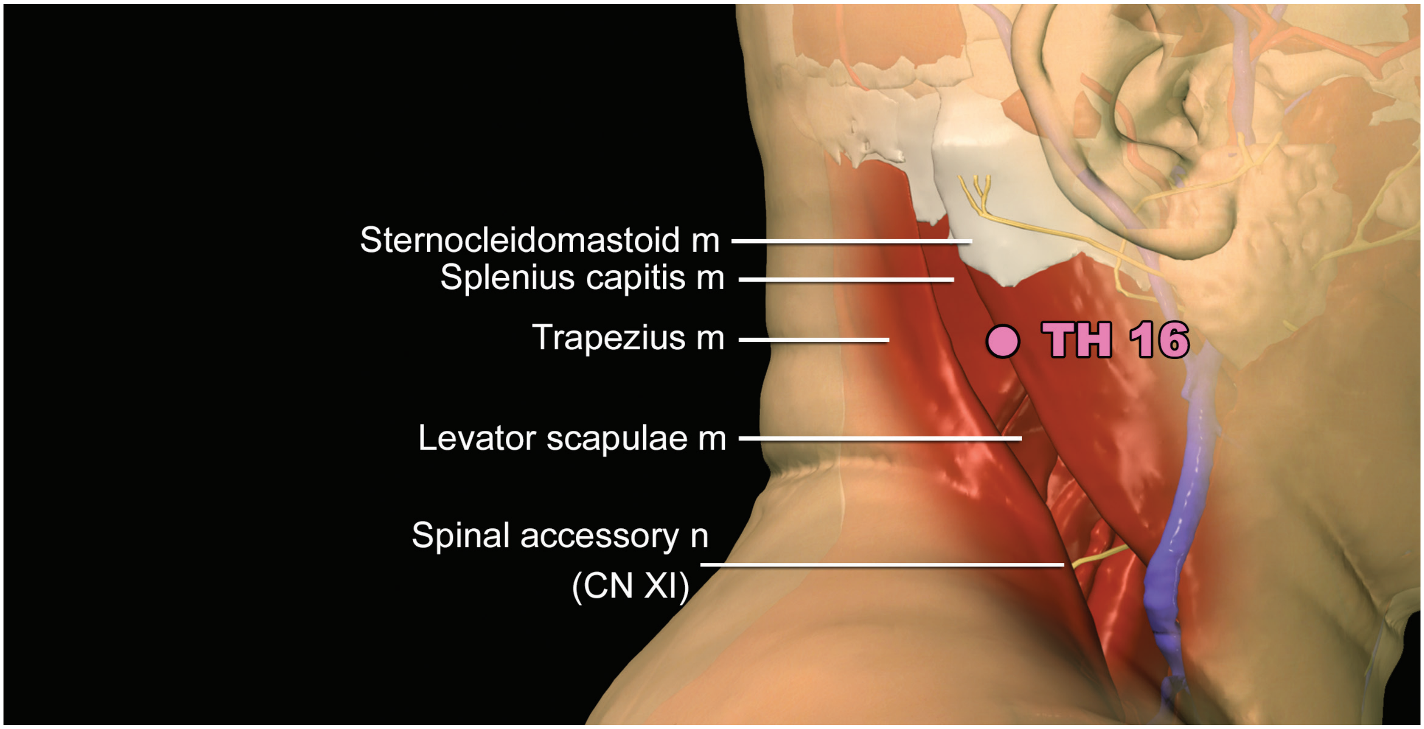


Figure 10-43. TH 16, as a "Celestial Window" sits at the juncture of the neck and head, creating a "window" or portal via the posterior (or dorsal) triangle of the neck. The borders of this triangle include the dorsal aspect of the sternocleidomastoid (SCM) muscle, the cranial border of the trapezius muscle, and the clavicle. The floor include the splenius capitis, levator scapulae, middle scalene, and posterior scalene muscles. The spinal accessory nerve (CN XI), shown in this image, supplies the (SCM) and superior part of the trapezius muscles that lie adjacent to TH 16. The cranial portion of the spinal accessory nerve joins with the vagus nerve and provides motor supply to striated muscle of the pharynx, larynx, soft palate, and esophagus, helping explain the applications for pharyngitis and dysphagia. Sensory fibers from C2, C3, and C4 meld with CN XI in this posterior triangle of the neck and supply pain and proprioception to the SCM and trapezius muscles.

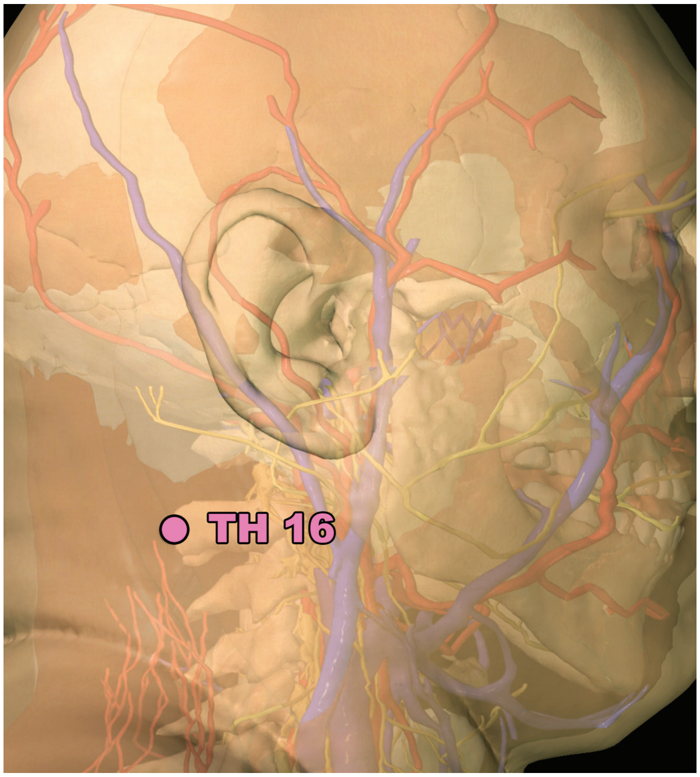


Figure 10-44. This semitransparent muscle layer reveals the relationship between TH 16 and the angle of the mandible.

parotid gland and the dorsal aspect of the auricle. Also supplies the skin between the angle of the mandible and the mastoid process.

- **C2-C6 spinal nerves, dorsal rami:** Innervate the splenius and erector spinae group of the neck.

Clinical Relevance: Cervical radiculopathy increases the prevalence of active myofascial trigger points in the neck.[5]

Peripheral nerve blocks of the greater occipital, lesser occipital, supratrochlear, supraorbital, and auriculotemporal nerves provide relief of headaches.[6] Neuromodulation by means of acupuncture and related techniques may involve similar nerves but also succeed in alleviating the motor component of area innervation that perpetuates the myofascial trigger points also involved in headache instigation.

Enlargement of superficial or deep occipital lymph nodes in the vicinity of TH 16 could promote nerve irritation.[7]

Vessels

- **External jugular vein:** The external jugular vein drains the side of the face and most of the scalp. It forms as a result of the union of the retromandibular vein and the dorsal auricular vein.
- **Occipital artery:** The occipital artery supplies the dorsal half of the scalp. It is a branch of the external carotid artery.
- **Occipital vein:** The occipital scalp region is drained by the occipital vein, which then drains into the suboccipital venous plexus.

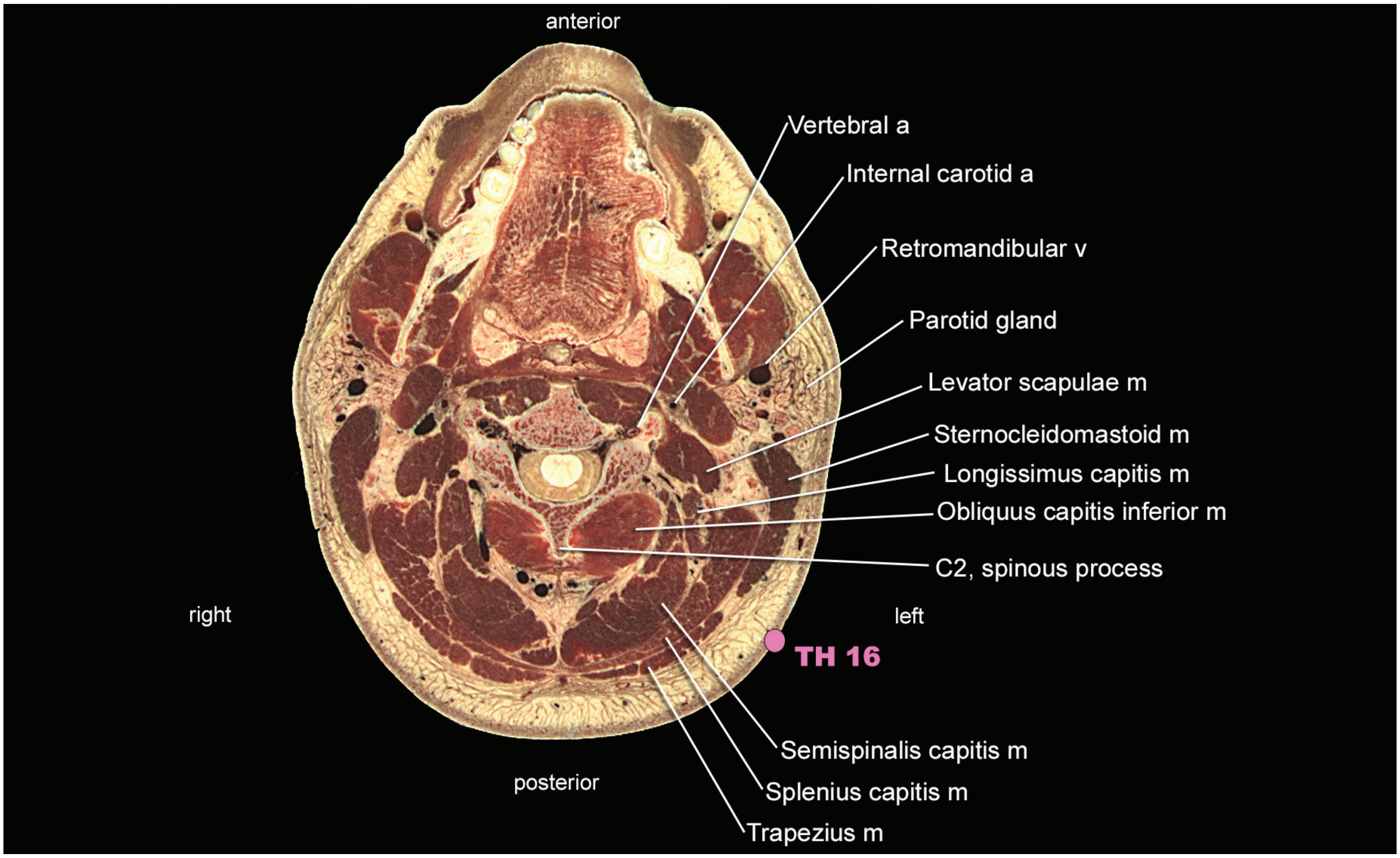

anterior
Vertebral a
Internal carotid a
Retromandibular v
Parotid gland
Levator scapulae m
Sternocleidomastoid m
Longissimus capitis m
Obliquus capitis inferior m
C2, spinous process
right
left
TH 16
Semispinalis capitis m
posterior
Splenius capitis m
Trapezius m

Figure 10-45. This cross section illustrates the multiple muscles accessible to a needle entering the "Celestial Window" of TH 16. Trigger point pathology in these structures participates in producing referred pain patterns responsible for a spectrum of headache disorders.

Clinical Relevance: The occipital artery crosses the greater occipital nerve over 50% of the time.[8] Their interaction may range from a single intersection to a helical intertwining. Vascular pulsation in the artery can irritate the nerve, explaining how occipital neurovascular pathology triggers migraine and peripheral neurogenic headache.

Indications and Potential Point Combinations

- **Neck pain, stiffness, soreness that mimics discomfort from cervical lymphadenopathy, or torticollis, stemming from myofascial dysfunction in the SCM:** TH 16 plus other relevant and tender trigger points.
- **Sudden hearing loss or tinnitus related to trigger point(s) in the clavicular division of the SCM:** TH 16 plus trigger points associated with TMJ dysfunction; consider TH 21, SI 19, GB 2, TH or GB points around the year, active and latent SCM trigger points, GV 20.
- **Tension-type headache and referred pain from the SCM to the occiput, ear, eyebrow, zygomatic arch and cheek, chin, hyoid bone, and forehead from the sternal insertion:** TH 16, TH 17, TH 23, SI 18, SI 17, SI 16, LI 18, LI 17, BL 10, GV 20, tender trigger points.
- **Pharyngitis, dysphagia:** TH 16, CV 23, CV 22, ST 9, ST 10, ST 11, LI 4, LI 10, ST 36.
- **Unilateral autonomic dysfunction of the face, including ipsilateral sweating of the forehead, conjunctival hyperemia, tearing of the eye, rhinitis, narrowed palpebral fissure (resembles ptosis), possible diplopia with normal papillary light reflex, and visual disturbances, all related to trigger points in the sternal division of the SCM:** TH 16, TH 23, SI 19, GB 1, BL 2, Yintang, Taiyang, relevant trigger points.
- **Frontal headache, postural dizziness, carsick feeling, disturbed weight perception and equilibrium related to trigger points in the clavicular division of the SCM:** TH 16, relevant trigger points around the ear, temporal region, and SCM, ST 12, ST 13.

References

1. Takeve K, Vitti M, and Basmajian JV. The functions of semispinalis capitis and splenius capitis muscles: an electromyographic study. *The Anatomical Record.* 1974;179(4):477-480.
2. Fernandez-de-las-Penas C, Grobli C, Ortega-Santiago R, et al. Referred pain from myofascial trigger points in head, neck, shoulder, and arm muscles reproduces pain symptoms in blue-collar (manual) and white-collar (office) workers. *Clin J Pain.* 2012;28(6):511-518.
3. Giannakopoulos NN, Hellmann D, Schmitter M, et al. Neuromuscular interaction of jaw and neck muscles during jaw clenching. *J Orofac Pain.* 2013;27(1):61-71.
4. Munoz-Munoz S, Munoz-Garcia MT, Albuerquerque-Sendin F, et al. Myofascial trigger points, pain, disability, and sleep quality in individuals with mechanical neck pain *J Manipulative Physiol Ther.* 2012;35(8):608-613.
5. Sari H, Akarirmak U, and Uludag M. Active myofascial trigger points might be more frequent in patients with cervical radiculopathy. *Eur J Phys Rehabil Med.* 2012;48(2):237-244.
6. Blumenfeld A, Ashkenazi A, Napchan U, et al. Expert consensus recommendations for the performance of peripheral nerve blocks for headaches – a narrative review. *Headache.* 2013;53(3):437-446.
7. Pan W-R, Le Roux CM, and Briggs CA. Variations in the lymphatic drainage pattern of the head and neck: further anatomic studies and clinical implications. *Plast Reconstr Surg.* 2011;127:611.
8. Janis JE, Hatef DA, Reece EM, et al. Neurovascular compression of the greater occipital nerve: implications for migraine headaches. *Plast Reconstr Surg.* 2010;126(6):1996-2001.

TH 17

Yi Feng "Wind Screen"

Immediately caudal to the root of the ear, beneath the earlobe, in the depression between the mastoid process and the ramus of the mandible. Just cranial to the palpable transverse process of C1. See Figure 10-46 for placement.

Needle cautiously. Several large vessels and delicate nerves reside at or near this point. See Figure 10-48 to learn more.

Glands

- **Parotid gland:** The largest of the three paired salivary glands. The facial nerve courses through the parotid gland, as does the retromandibular vein, and the external carotid artery (ECA) and its nerve plexus. The gland contains parotid lymph nodes both within the gland and on its tough fascial capsule, the parotid sheath. These lymph nodes drain lymphatic fluid from the forehead, lateral eyelids, temporal region, lateral auricular surface, anterior wall of the external acoustic meatus, and the middle ear.

Clinical Relevance: A number of tumors, both benign and malignant, as well as infections can enlarge the parotid gland. Tumor growth within the gland can induce facial pain (mediated by the trigeminal nerve) and facial nerve dysfunction, leading to paresis or paralysis of the muscles of facial expression. Remain cognizant of the possible presence of salivary gland tissue at or near TH 17. Avoid needling tumorous or other abnormal tissue.

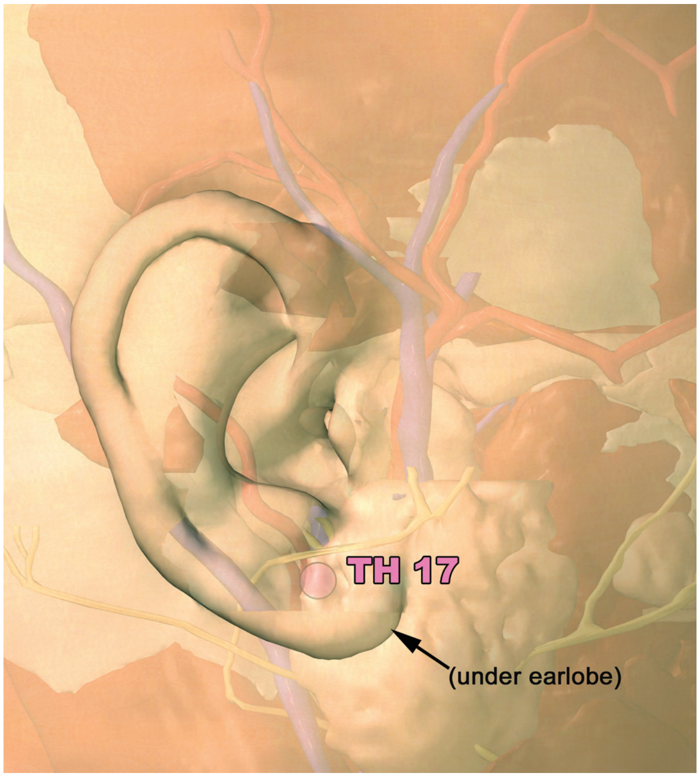


Figure 10-46. TH 17 sits coddled beneath the earlobe, tucked between the mastoid process and the ramus of the mandible. Its position close to the facial nerve trunk explains its clinical value for facial nerve dysfunction.

Nerves

- **Great auricular nerve (C2, C3):** Innervates the parotid sheath and the skin over the gland, along with the skin in the posterior aspect of the auricle and in the area between the angle of the mandible and the mastoid process. Its anterior branch communicates with the facial nerve (CN VII) inside the substance of the parotid gland. The posterior branch communicates with the lesser occipital nerve, the auricular branch of the vagus, and the posterior auricular branch of the facial nerve.
- **Facial nerve (CN VII):** The motor root of the facial nerve emerges from the skull at the stylomastoid foramen and courses through the parotid gland. It then divides into six terminal branches: the posterior auricular, temporal, zygomatic, buccal, mandibular, and cervical branches of the facial nerve. These nerve branches supply the muscles of facial expression via the motor root of the facial nerve. The other root of the facial nerve is smaller, called the intermediate nerve (or nervus intermedius). The intermediate nerve carries taste, parasympathetic, and somatic sensory fibers and travels in a distinct fascial sheath from the motor root. While the motor root emerges through the stylomastoid foramen, the intermediate nerve heads elsewhere, supplying visceral motor fibers to the lacrimal, submandibular, and sublingual glands and the mucous membranes of the nose, soft palate, and hard palate. The intermediate nerve also carries sensation from the skin of the concha (the deepest depression in the auricle) and a small area of skin behind the ear. It may assist the mandibular nerve (CN V_3) in supplying the wall of the acoustic meatus and external tympanic membrane. The intermediate nerve provides special sensory fibers to the anterior two-thirds of the tongue and palates to carry taste.

Clinical Relevance: The main clinical significance of TH 17 pertains to its relationship with the motor trunk of the facial nerve as it exits the skull. Upon leaving the brainstem at the ponto-medullary junction, the facial nerve enters the internal acoustic meatus and courses through the facial canal of the temporal bone. It exits the canal and skull through the stylomastoid foramen. Figure 10-48 exposes the intracranial and extracranial journey by means of this unusual glimpse through semi-transparent bone.

The facial nerve communicates with several other cranial nerves.[4] These include all three divisions of the trigeminal nerve (including branches of the auriculotemporal, buccal, mental, lingual, Infraorbital, zygomatic, and ophthalmic nerves). The facial nerve also communicates with branches of cranial nerves VIII, IX, and X. In the cervical region, it exhibits relationships with the great auricular, the greater and lesser occipital, and the transverse cervical nerves. These networks form circuits through which neuromodulation at TH 17 can produce myriad effects.

At TH 17, the most salient interconnection involves the facial nerve and the auriculotemporal nerve, a branch of the mandibular nerve (CN V_3) that supplies sensation to the lateral aspect of the head. The clinical significance of this connection means that needling or otherwise stimulating TH 17 may also neuromodulate the somatosensory root of the auriculotemporal nerve, which supplies sensation to the auricle, the external acoustic meatus, the outer aspect of the tympanic membrane, and skin over the temporal region. A few articular branches of the auriculotemporal nerve carry sensation from the temporomandibular joint, meaning that TH 17 may benefit patients with TMJ dysfunction and pain.

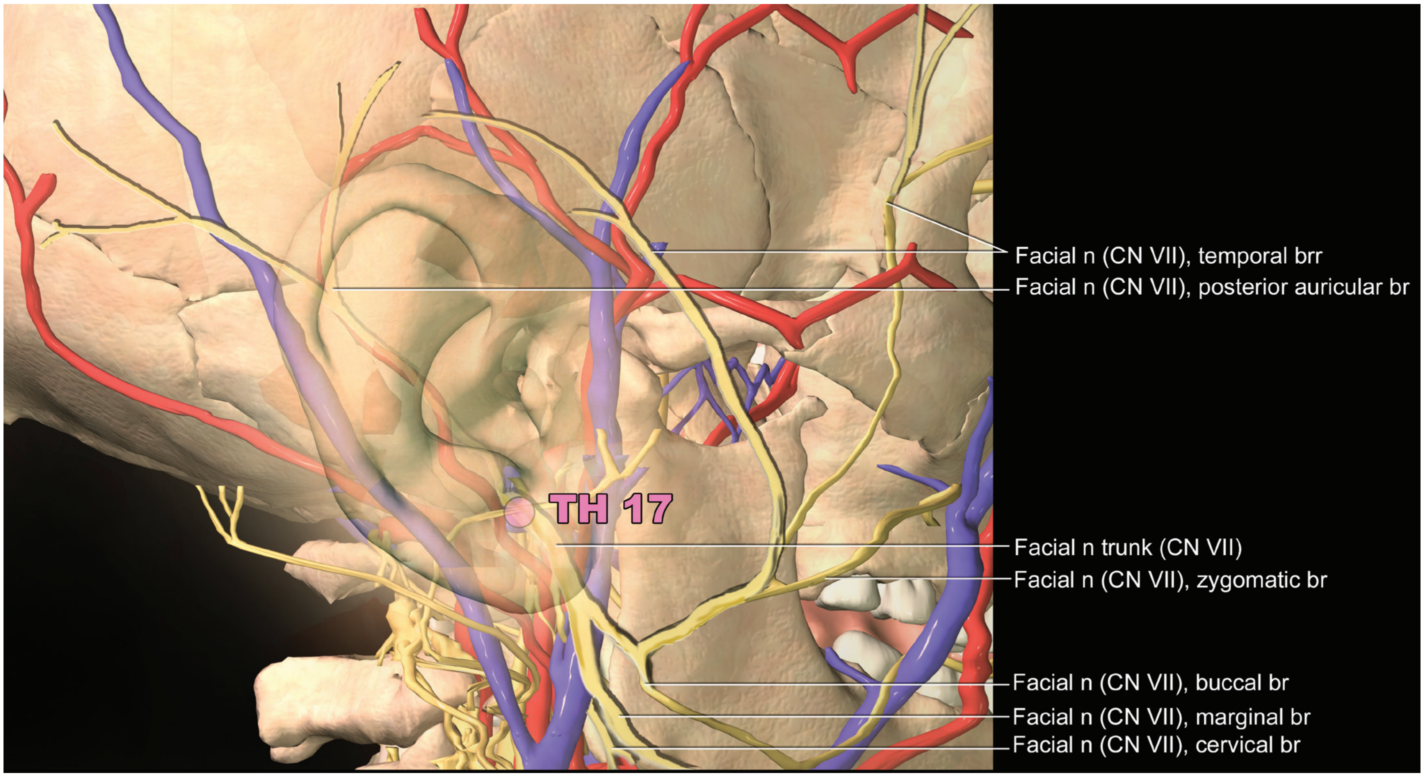

Facial n (CN VII), temporal brr
Facial n (CN VII), posterior auricular br
TH 17
Facial n trunk (CN VII)
Facial n (CN VII), zygomatic br
Facial n (CN VII), buccal br
Facial n (CN VII), marginal br
Facial n (CN VII), cervical br

Figure 10-47. As the "Wind Screen", TH 17's indications strongly relate to its proximity to the facial nerve. In Chinese medicine, if "wind" metaphorically enters the cranium through this portal, it leads to "wind" type diseases, which in the head refer to neural dysfunction and viral infection. In this case, "wind" would affect the facial nerve. Ancient Chinese acupuncturists may have envisioned that twirling a needle at this site drove out wind that succeeded in traversing the screen. This figure displays numerous facial nerve branches fanning away from TH 17.

From a functional perspective, crosstalk between the trigeminal and facial nerves facilitates control over the muscles of facial expression. Proprioceptive input conveyed by trigeminal nerve branches carries information to the brain from the skin overlying these muscles. Trigeminal nerve linkages with these muscles occur at motor endplates. This interconnection appears to offer an alternate pathway for impulses from the motor cortex to reach facial muscles in the event of facial nerve injury, providing a substitute route for motor supply to reach otherwise denervated muscles of facial expression.

Another portion of the auriculotemporal nerve, its parasympathetic or "inferior" root, carries postganglionic fibers to the parotid gland. These preganglionic secretomotor fibers originate from the glossopharyngeal nerve (CN IX) and emerge as the lesser petrosal nerve. Fibers from this nerve synapse in the otic ganglion; from here, the inferior, parasympathetic root of the auriculotemporal nerve emerges. Secretomotor fibers hitchhike with the auriculotemporal nerve. They will depart from the somatosensory portion to innervate the parotid gland. From here, the auriculotemporal nerve will ferry supply sensation to the temporal region.

The vast amount of neural networking between the facial nerve and its neighbors explains why certain syndromes of facial pain improved when surgeons intentionally sever facial nerve branches as a means to treat conditions such as pterygopalatine neuralgia, a neurologic disorder involving both facial pain and autonomic dysfunction, in the eye.[5] Even if in some cases the neuralgia responds to greater petrosal nerve neurectomy, it would seem that neuromodulation through acupuncture and related techniques should be tried long before any nerves become further damaged, whether due to the disease or an iatrogenic misstep.

The facial nerve connects to cranial nerves VIII, IX, X, IX, and XII. CN VIII, the vestibulocochlear nerve, comes into contact with the facial inside the internal acoustic meatus. Connections include the nervus intermedius and the vestibular nerve as well as fibers of the genu of the facial nerve and the vestibular ganglion. Thus, when for patients with vertigo, TH 17 and nearby points (GB 12, GB 20, TH 20, TH 21 may offer an indirect conduit through which to induce neuromodulation to the vestibulocochlear nerve.

Note, too, that the stylomastoid foramen resides near the jugular foramen. The latter exit site transmits CN IX, X, XI, and XII along with the internal jugular vein. All these structures passing through this narrow canal relate closely to the transverse process of C1 (the atlas) and the styloid process. Thus, treatment applied to the vicinity of TH 17 may neuromodulate one or more of these four most caudal cranial nerves by dint of their proximity to the point. The styloid process of the temporal bone, labeled in Figure 10-48, serves as a landmark for the glossopharyngeal nerve[6] along with the transverse process of C!, evident in Figure 10-47.

The glossopharyngeal nerve makes several connections with the facial. These include twigs linking the two not only within the facial canal but elsewhere as well. At the base of the skull, anastomoses take place between the facial and glossopharyngeal nerves through an ascending branch off of the stylopharyngeal branches from CN IX and a stylohyoid branch of CN VII. The nature of the anastomosis can range from a single neural connection to a delicate neural plexus. A small branch from the digastric branch of the facial nerve can also communicate with the glossopharyngeal.

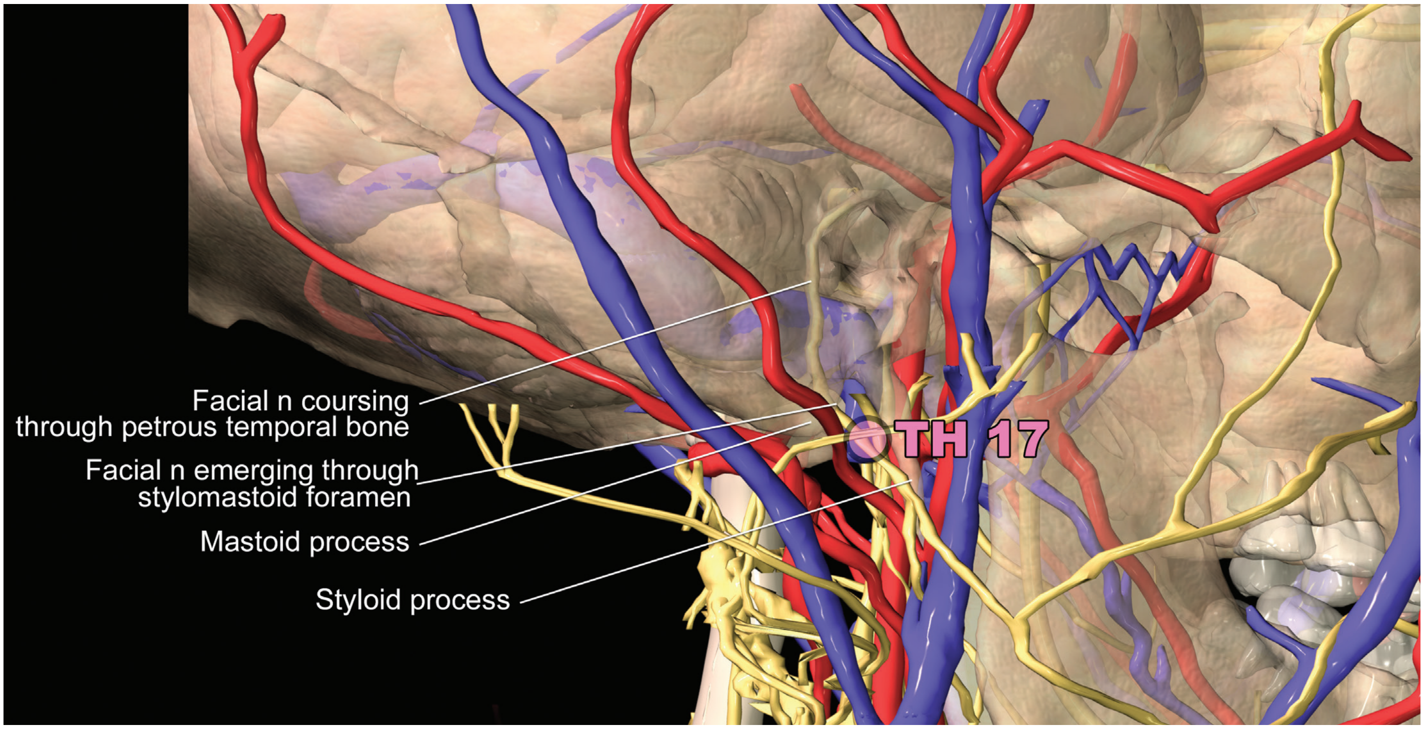


Figure 10-48. This see-through skull image allows visualization of cranial nerves inside the head. These usually hidden structures include the optic nerve heading toward the orbit, the mandibular nerve coursing toward the chin inside the mandible, and the facial nerve emerging through the stylomastoid foramen. Here, the nerve has just made its way through the petrous portion of the temporal bone. TH 17 catches the facial nerve trunk after it exits the skull, destined for the muscles of facial expression. This depiction also reveals the rich neurovascular traffic present at TH 17.

This reinforces the clinical potential of treatment at TH 17 to neuromodulate a variety of craniofacial functions.

Vagal crosstalk occurs between the facial nerve at TH 17, nearby TH points, and the ear. This takes place by means of communicating fibers from the posterior auricular branch of the facial nerve and Arnold's nerve, also known as the auricular branch of the vagus. Laser, massage therapy, and acupuncture can thus neuromodulate the parasympathetic limb of the autonomic nervous system via this nexus.

As discussed above (see great auricular nerve description), the facial nerve connects with the great auricular nerve from the cervical plexus. The facial nerve may therefore offer a conduit by which to enhance neuromodulation of the greater and lesser occipital nerves, the transverse cervical nerve, and sympathetic fibers exiting the superior cervical ganglion, as connections exist between the facial nerve and each of these structures. This may explain why patients with headache pain and autonomic dysregulation of the head and neck benefit strongly from neuromodulation with acupuncture and related techniques.

Vessels

- **External jugular vein and its tributaries:** The external jugular vein drains the side of the face and most of the scalp. It forms as a result of the union of the retromandibular vein and the posterior auricular vein.
- **Internal jugular vein:** This vein drains blood from the brain, cervical visceral, deep cervical muscles, and the face. It begins at the jugular foramen located in the posterior cranial fossa as a direct continuation of the sigmoid sinus.
- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.
- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, one of the dural venous sinuses.
- **External carotid artery:** This artery branches into the maxillary and superficial temporal arteries. It supplies mainly extracranial structures, except for the middle meningeal artery (which branches off of the maxillary artery), the largest of the meningeal arteries.

Clinical Relevance: Ordinarily, blood that drains from the brain empties into the posterior fossa and, from there, into the internal jugular veins or vertebral venous system.[7] The external jugular veins ordinarily drain the viscerocranium (i.e., the face) and the neurocranium (i.e., the part of the skull that houses the brain) but much less commonly receive cerebral venous drainage. In some cases, however, cerebral drainage connects with the external jugular venous system by means of connections between middle cerebral veins, the pterygoid plexus, cavernous sinus, and/or emissary veins from the middle cranial fossa.

In other cases, the rostral end of the transverse sinus and veins of the temporal fossa connect through a petrosquamosal sinus. This sinus starts where the transverse and sigmoid sinuses meet, located at the juncture of the petrous and squamous portions of the temporal bone. In most human adults, the petrosquamosal sinus regresses into an embryonic venous remnant or disappears entirely. Its main clinical significance pertains to the hemorrhagic hazard it poses with respect to surgical procedures

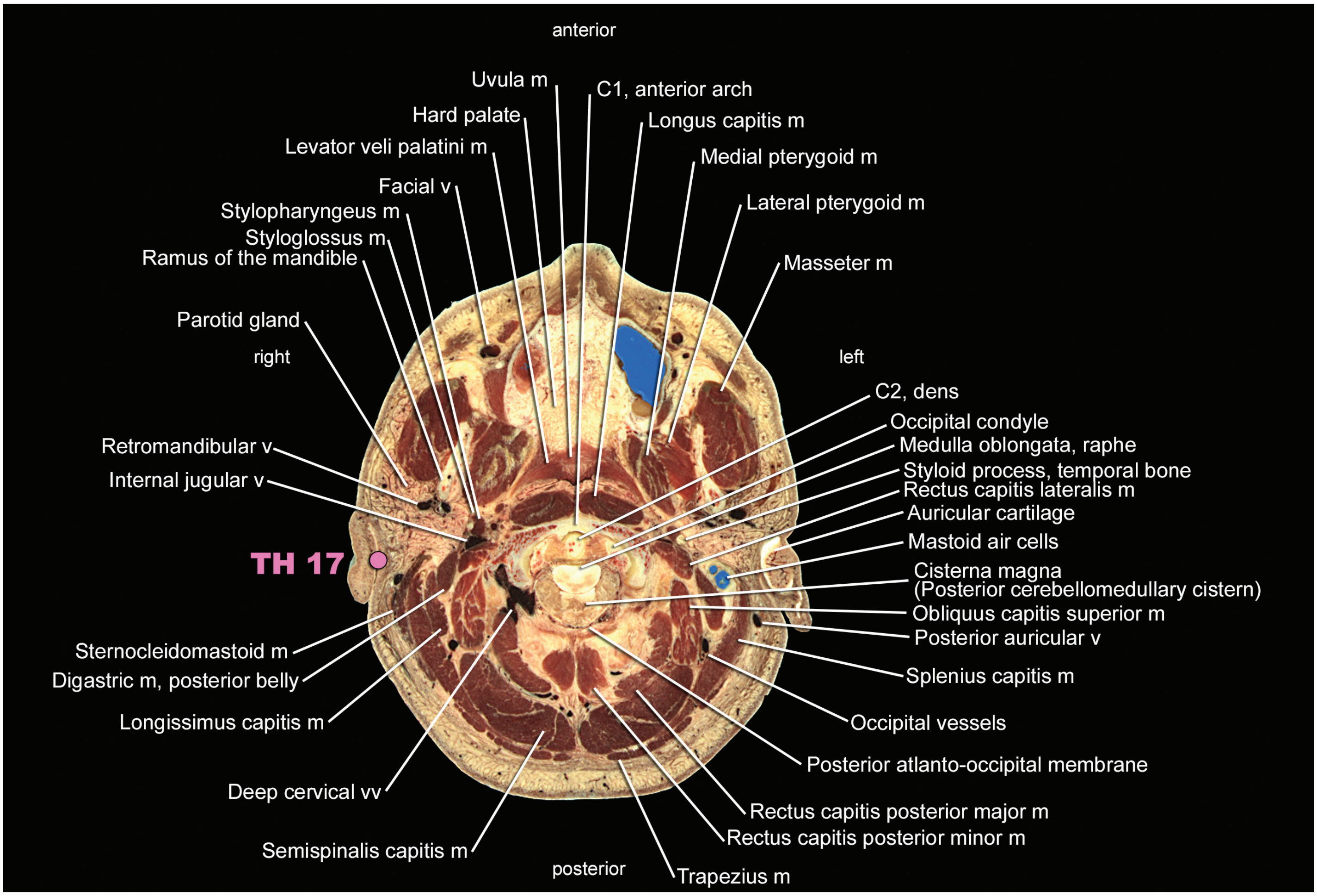

anterior
Uvula m
C1, anterior arch
Hard palate
Longus capitis m
Levator veli palatini m
Medial pterygoid m
Facial v
Lateral pterygoid m
Stylopharyngeus m
Styloglossus m
Ramus of the mandible
Masseter m
Parotid gland
right
left
C2, dens
Occipital condyle
Medulla oblongata, raphe
Retromandibular v
Styloid process, temporal bone
Internal jugular v
Rectus capitis lateralis m
Auricular cartilage
Mastoid air cells
TH 17
Cisterna magna
(Posterior cerebellomedullary cistern)
Obliquus capitis superior m
Posterior auricular v
Sternocleidomastoid m
Digastric m, posterior belly
Splenius capitis m
Longissimus capitis m
Occipital vessels
Posterior atlanto-occipital membrane
Deep cervical vv
Rectus capitis posterior major m
Rectus capitis posterior minor m
Semispinalis capitis m
posterior
Trapezius m

Figure 10-49. TH 17 constitutes one of the few points in the acupuncture matrix that does not incorporate local trigger point deactivation as an indication. This cross section illustrates the presence of bone, rather than muscle, deep to the site, more clearly shown on the left side of the head (right side of the image).

of the mastoid region. For a medical acupuncturist, vascular aberrancies in the temporal region should be considered as potential sources of tinnitus. While acupuncture and related techniques will not alter venous connections within the skull, neuromodulation and myofascial work may alleviate intracranial pressure and venous flow by means of extracranial treatment (with acupuncture and manual therapy) as well as transcranial laser therapy. The transverse and sigmoid cerebral venous sinuses appear through the semi-translucent skull in Figure 10-48.

For the more common condition of migraine, medical acupuncturists should remain vigilant to the role extracranial (scalp) arteries can play in headache generation.[8] Myofascial trigger points and associated structural dysfunction compress not only nerves and but also vessels, making both unhappy and irritable. Afferents from irritated nerve produce algogenic peptides following compressive forces. Treatment with cryotherapy and/or other physical medicine approaches such as acupuncture, massage, and laser therapy may address neuropathic pain from these sources.

Indications and Potential Point Combinations

- **Ear problems, deafness:** TH 17, SI 19, trigger points in the SCM.
- **Ear pain:** Consider source and location of pain; i.e., whether the otalgia has an otologic etiology or arose as a result of referred pain.1 TH 17, TH 16, TH 20 for local pain, plus appropriate points related to pain generator. For orofacial pain referring to the ear, consider myofascial trigger points in the masseter (ST 6), ST 5, and SCM trigger points. For TMJ pain, consider adding SI 18, SI 19, TH 21, GB 2.
- **TMJ pain or dysfunction:** TH 17, TH 16, LI 18, SI 19, GB 21, GB 20.
- **Facial nerve injury or paralysis:** TH 17 as the central and most important stimulation target. Add points according to the nerve branch(es) affected (selecting points along their axons) and their muscular destinations.[9]
- **Toothache:** TH 17, temporalis trigger points that may refer to the teeth, including TH 20, TH 21, TH 22. For odontologic sources of odontalgia, add LI 4, LU 7.
- **Blepharospasm:** TH 17, GB 1, GB 2, TH 23, Yintang, BL 2. Add acupressure at ST 2.

Evidence-Based Applications

- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[2]

- Acupuncture at LI 4, ST 6, ST 7, and TH 17 was superior to placebo for the prevention of **postoperative dental pain.**[3]
- **Peripheral facial nerve paralysis** treatment based on randomized controlled trials, includes TH 17, ST 2, ST 4, ST 6, ST 7, LI 4, LI 20, GB 14, GB 20, GV 26, Yuyao (mid-eyebrow), SI 18, and CV 24.[10]

References

1. Wazen JJ. Referred otalgia. *Otolaryngologic Clinics of North America*. 1989;22(6):1205-1215.
2. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.
3. Lao L, Bergman S, Hamilton GR, Langenberg P, and Berman B. Evaluation of acupuncture for pain control after oral surgery: a placebo-controlled trial. *Arch Otolaryngol Head Neck Surg*. 1999; 125(5):567-572.
4. Diamond M, Wartmann CT, Tubbs RS, et al. Peripheral facial nerve communications and their clinical implications. *Clin Anat*. 2011;24:10-18.
5. Diamond M, Wartmann CT, Tubbs RS, et al. Peripheral facial nerve communications and their clinical implications. *Clin Anat*. 2011;24:10-18.
6. Ozveren MF, Ture U, Ozek MM, et al. Anatomic landmarks of the glossopharyngeal nerve: a microsurgical anatomic study. *Neurosurgery*. 2003;52(6):1400-1410.
7. Choi JH and Woo HY. The neglected emissary vein in mastoidectomy; persistent petrosquamosal sinus in the laterally located sigmoid sinus. *Am J Otolaryngol* 2013; http://dx.doi.org/10.1016/j.amjoto.2012.11.014
8. Cianchetti C, Ledda MG, Serci MC, et al. Painful scalp arteries in migraine. *J Neurol*. 2010;257:1642-1647.
9. Zheng H, Li Y, and Chen M. Evidence based acupuncture practice recommendations for peripheral facial paralysis. *Am J Chin Med*. 2009;37(1):35-43.
10. Zheng H, Li Y, and Chen M. Evidence based acupuncture practice recommendations for peripheral facial paralysis. *Am J Chin Med*. 2009;37(1):35-43.

TH 18

Qi Mai "Spasm Vessel", "Convulsion Vessel", "Tugging Vessel"

On the center of the mastoid process, in a small depression that lies at the junction of the middle and lower thirds of a curve that connects TH 17 and TH 20 and follows the outline of the helix.

Muscles

- **Posterior auricular muscle:** The posterior auricular muscle wiggles the ear.

Clinical Relevance: TH 18 abuts the posterior, or caudal auricular muscle. As such, neuromodulation at this site may benefit myofascial pathology not only in this muscle but fibers from the attachment of the sternocleidomastoid (SCM) muscle as well, shown in Figure 10-51.

Nerves

- **Posterior auricular nerve (CN VII):** A branch of CN VII, the posterior auricular nerve supplies the posterior auricular muscle and the occipital belly of the occipitofrontalis, or epicranius, muscle.
- **Intermediate nerve, or nervus intermedius (CN VII):** The cutaneous sensory component of CN VII, named the "intermediate" nerve mainly for its position between the cerebellopontine angle and the internal auditory canal.[1] However, it also lies between the motor fibers of the facial nerve and the eighth cranial nerve. Furthermore it. The intermediate nerve carries taste, parasympathetic, and somatic sensory fibers and travels in a distinct fascial sheath from the motor root. While the motor root emerges through the stylomastoid foramen, the intermediate nerve heads elsewhere, supplying visceral motor fibers to the lacrimal, submandibular, and sublingual glands and the mucous membranes of the nose, soft palate, and hard palate. The intermediate nerve also carries sensation from the skin of the concha (which is the deepest depression in the auricle) and a small area of skin behind the ear, including TH 18. It will, at times, assist the mandibular nerve (CN V_3) in supplying the wall of the acoustic meatus and external tympanic membrane. The intermediate nerve provides special sensory fibers to the anterior two-thirds of the tongue and palates to carry taste. The cell bodies of the sensory fibers comprising the intermediate nerve reside in the geniculate ganglion, housed within the petrous temporal bone. Sensory impulses travel to the brainstem by through the intermediate nerve and descend in the spinal tract of the trigeminal nerve; fibers from the intermediate nerve synapse in the spinal portion of the trigeminal nucleus in the rostral medulla.[2]
- **Great auricular nerve (C2, C3), posterior branch:** This nerve provides sensation to the skin over the parotid gland, the posterior portion of the auricle, and the area of skin between the angle of the mandible and the mastoid process. Its anterior branch communicates with the facial nerve (CN VII) inside the substance of the parotid gland. The posterior branch communicates with the lesser occipital nerve, the auricular branch of the vagus, and the posterior auricular branch of the facial nerve.
- **Lesser occipital nerve (C2):** This nerve provides innervation to the skin of the neck and the scalp lying posterior and superior to the auricle.

Clinical Relevance: The nervus intermedius (or intermediate nerve) has received substantial attention as a major neural culprit causing cluster headache. The parasympathetic connec-

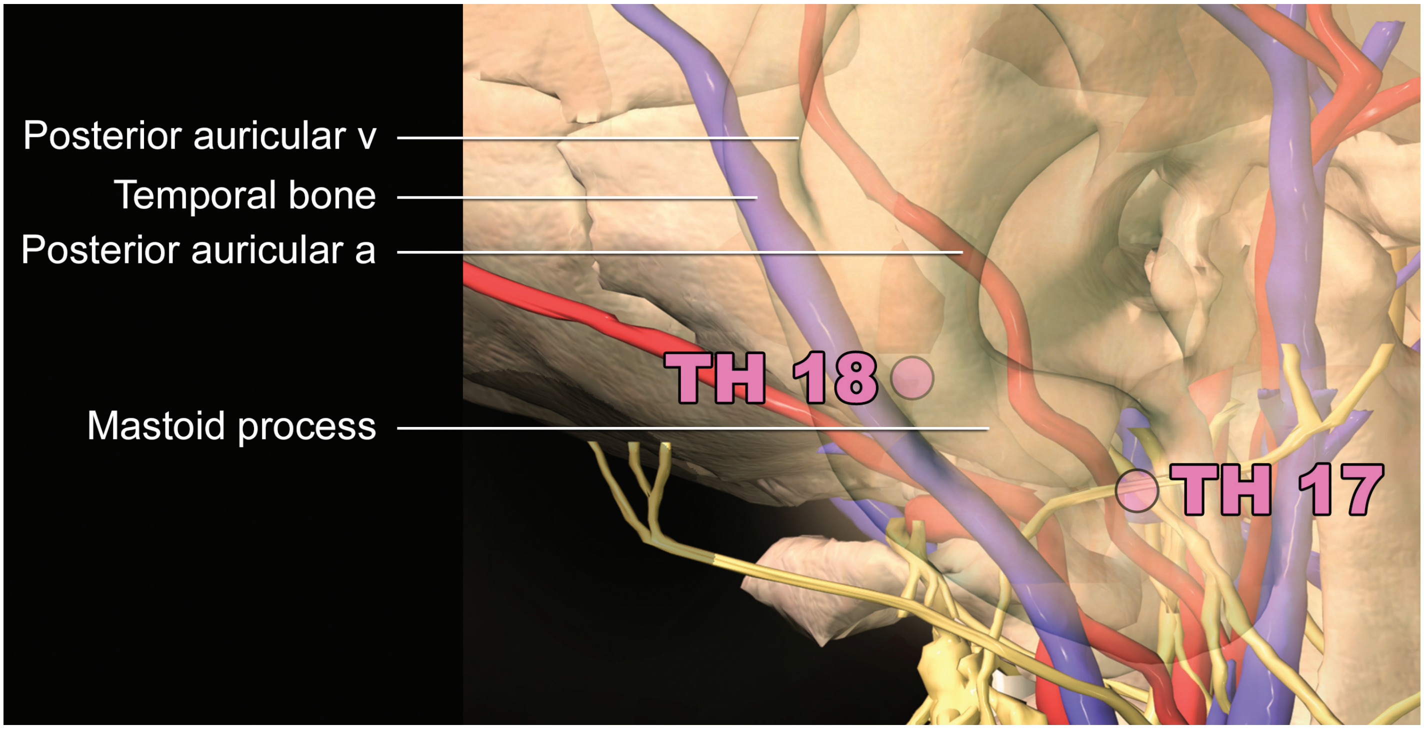


Figure 10-50. As the TH line travels up and around the ear where it attaches to the head, it follows the posterior auricular artery, the vessel alluded to by the term "Spasm Vessel" for TH 18. This suggests that vascular headaches and vasospastic diseases, likely even vasculitides, date back to ancient China.

tions made by the nervus intermedius explain the tearing and redness in the ipsilateral eye as well as nasal congestion and rhinorrhea. However, the migraine-like pain relates to vasodilatory stimuli affecting the internal carotid artery, its medium-sized branches, and the pial arteries. (On the head, vessels dilate after parasympathetic nervous system activation rather than inhibition of vasoconstrictor sympathetic tone.) As the internal carotid artery swells, the periarterial sympathetic nerves (nervi vasorum) supplying the artery can become compressed between the artery and the bony carotid canal. A partial Horner's syndrome may result.[11]

In addition to cluster headache, a neuropathic nervus intermedius can cause deep ear pain.[12] This needs to be differentiated from glossopharyngeal and trigeminal neuralgic sources in order to successfully isolate the etiology.[13] Infections of the middle ear can irritate the nerve due to its position within or near the tympanic cavity.[14] Geniculate neuralgia, or irritation of the nervus intermedius is often idiopathic. It leads to brief paroxysms of stabbing pain deep within the auditory canal.[15] Pain lasts from seconds to minutes; a trigger locus in the caudal wall of the auditory canal points to involvement of the nervus intermedius. While one approach to treat geniculate neuralgia includes transection, a nonsurgical method of neuromodulation by means of acupuncture, massage, and laser applied to the caudal auricular zone at TH 18 and TH 19 should be tried first.

Nervus intermedius dysfunction occurs in almost one quarter of patients undergoing modern Gamma Knife surgery for vestibular Schwannoma.[16] The nerve carries no perineurium within the skull, only a thin layer arachnoid membrane. Thus, it can more readily suffer mechanical damage than other portions of the facial nerve. Radiosurgery thus risks injuring this portion of the facial nerve and causing disturbances in lacrimation, salivation, nasal secretion, and/or taste. Patients reporting this unfortunate result of radiosurgery may benefit from acupuncture. Direct treatment to TH 18, TH 19, and the groove behind the ear, i.e., cutaneous sites of nervus intermedius innervation, with acupuncture, laser, and/or massage may aid in reducing the neuropathic activity of this nerve.

Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[17]

One of the risks of having a facelift performed involves nerve damage; injury to the great auricular nerve happens in about 7% of patients.[18] This nerve courses over the mid-body of the SCM where it bifurcates into anterior and posterior (or rostral and caudal) branches and its terminal arborization. Rhytidectomy surgery involving revision of cervical folds may damage the great auricular nerve and cause loss of sensation caudal to the ear at TH 18 and TH 19. Nerve stimulation in this zone may facilitate return of sensation, depending on the type of nerve damage induced. Include TH 16 and LI 18.

Vessels

- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.
- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, which is one of the dural venous sinuses.
- **Mastoid emissary vein:** Emissary veins communicate between the dural venous sinuses and the external skull veins. The mastoid foramen transmits the mastoid emissary vein, connecting directly to the sigmoid sinus within the skull and a caudal auricular plexus wherein the posterior auricular vein communicates with tributaries of the occipital and superficial temporal veins.

Clinical Relevance: True to its name as "spasm vessel" or "tugging vessel", the posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization represents one alternative to pharmacotherapy,[19] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear, inhabited by TH 18 and TH 19. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites. The spatial relationships between TH 18, the posterior auricular vein, the mastoid bone (housing mastoid air cells), and the sigmoid sinus show clearly in Figure 10-52.

Indications and Potential Point Combinations

- **Ear problems:** Pain, hearing loss, tinnitus: TH 18, TH 17, TH 20, TH 21, local temporalis trigger points bilaterally. Consider the neuroanatomical connections between somatic afferents, the descending spinal trigeminal tract, and the solitary tract that can complicate the diagnosis in cases of ear pain. Nerves involved include the auriculotemporal nerve (CN V), posterior auricular nerve (CN VII), anastomotic branches to CN IX, the auricular branch of the vagus nerve (CN X), and the great auricular nerve from C2 and C3.7 The pain of nervus intermedius otalgia can elude diagnosis; it causes a severe, piercing, shock-like pain deep within the ear.[8]
- **Dizziness:** TH 18, TH 19, SCM trigger points, LR 3, GV 20. Laser, if appropriate, TH points around the ear and GB 20.
- **Motion sickness:** Neuromodulation applied to TH 18, PC 6, and CV 8.[20]

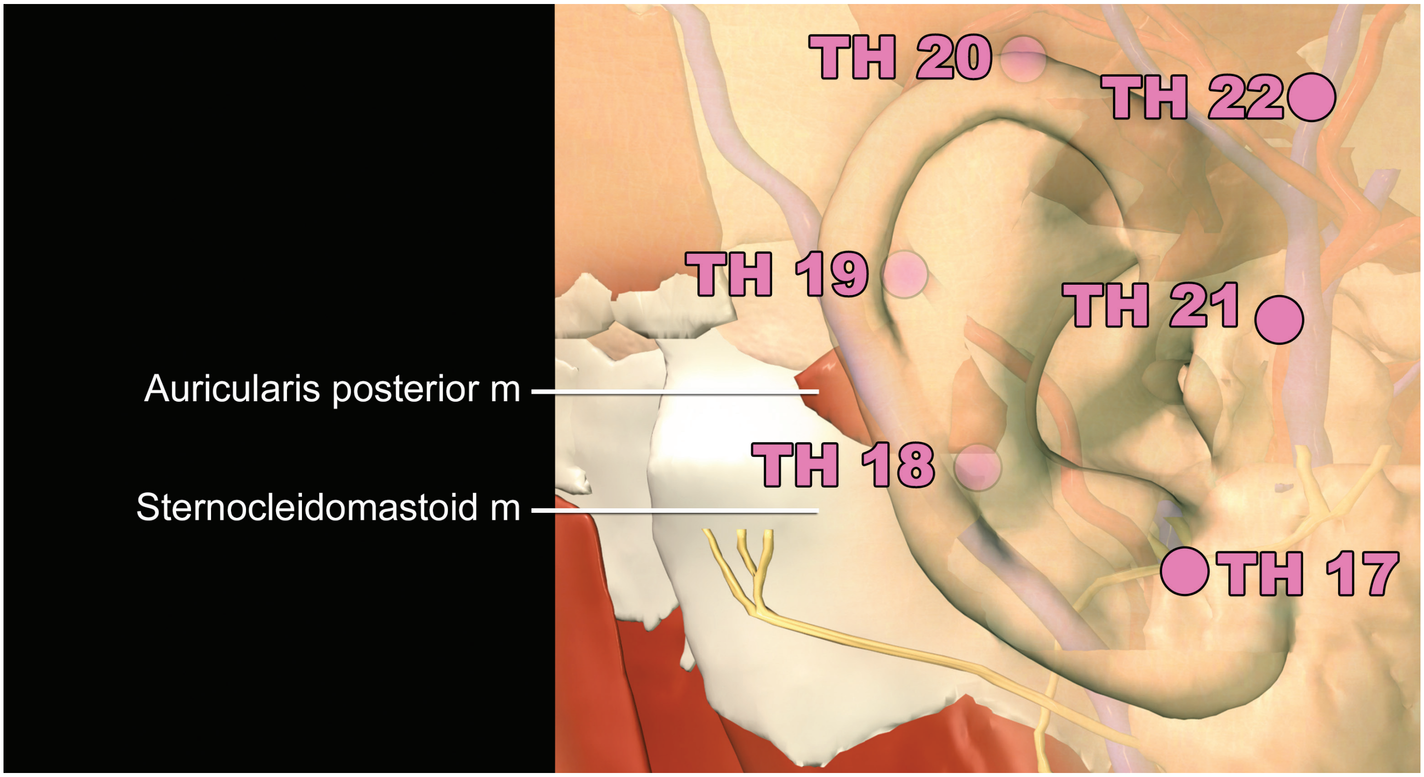


Figure 10-51. Myofascial restriction in the posterior auricular and SCM muscles, both depicted here, can issue pain in the vicinity of TH 18.[21]

- **Headache:** TH 18, GV 20, BL 10, relevant trigger points depending on the distribution of head pain. Consider adding the "Groove Behind the Ear Point" for cluster headache.
- **Seizures:** TH 18, ST 36, GV 20, Yintang (GV 24.5), LR 3.
- **Hypertension:** TH 18, LI 5, ST 36, LR 3, GV 20, "Groove Behind the Ear Point".[9]
- **Nervus intermedius neuralgia (patients feel an intense, stabbing pain deep within the canal of the ear):**[10] TH 18, TH 17, GB 12, "Groove Behind the Ear" point.

References

1. Ashram Y. Intraoperative electrophysiologic identification of the nervus intermedius. *Otology & Neurotology: an international forum.* 2005;26(2):274-279.
2. Wilson-Pauwels L, Akesson EJ, and Stewart PA. *Cranial Nerves, Anatomy and Clinical Comments.* Hamilton: BC Decker, Inc., 1988. P. 92.
3. Rowed DW. Chronic cluster headache managed by nervus intermedius section. *Headache.* 1990;30(7):401-406.
4. Solomon S. Cluster headache and the nervus intermedius. Headache. 1986;26(1):3-8.
5. Monkhouse WS. The anatomy of the facial nerve. *Ear, Nose and Throat Journal.* 1990;69:677-687.
6. Williams T, Mueller K, and Cornwall MW. Effect of acupuncture-point stimulation on diastolic blood pressure in hypertensive subjects: a preliminary study. *Physical Therapy.* 1991;71:523-529.
7. Bruyn GW. Nervus intermedius neuralgia. Cephalalgia. 1984;4:71-78.
8. Sharan R, Isser DK, and Narayan HP. Clinical records. Juvenile nervus intermedius otalgia. *The Journal of Laryngology and Otology.* 1980;94:1069-1073.
9. Williams T, Mueller K, and Cornwall MW. Effect of acupuncture-point stimulation on diastolic blood pressure in hypertensive subjects: a preliminary study. *Physical Therapy.* 1991;71:523-529.
10. Figueiredo R, Vazquez-Delgado E, Okeson JP, et al. Nervus intermedius neuralgia: a case report. *Journal of Craniomandibular Practice.* 2007;25(3):213-217.
11. Solomon S. Cluster headache and the nervus intermedius. *Headache.* 1986;26:3-8.)
12. Smith JH, Robertson CE, Garza I, et al. Trigger less neuralgic otalgia: a case series and systematic literature review. *Cephalalgia.* 2013;33(11):914-923.
13. Guinto G and Guinto Y. Nervus intermedius. *World Neurosurg.* 2013;79(5-6):653-654.
14. Tubbs RS, Steck DT, Mortazavi, MM, et al. The nervus intermedius: a review of its anatomy, function, pathology, and role in neurosurgery. *World Neurosurg.* 2013;79(5-6):763-767.
15. Nanda A and Khan IS. Nervus intermedius and geniculate neuralgia. *World Neurosurg.* 2013;79(5-6):651-652.
16. Park S-H, Lee K-Y, and Hwang S-K. Nervus intermedius dysfunction following Gamma Knife surgery for vestibular schwannoma. *J Neurosurg.* 2013;118:566-570.
17. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine.* 1998;23:1435-1441.
18. Lefkowitz T, Hazani R, Chowdhry S, et al. Anatomical landmarks to avoid injury to the great auricular nerve during rhytidectomy. *Aesthet Surg J.* 2013;33(1):19-23.
19. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.
20. Pei J, Yang T, and Liu Z. Study on effect of acupoint sticker of TTS-ST93-1 in treating motion sickness. *Zhongguo Zhong Xi Yi Jie He Za Zhi.* 1998;18(8):464-467.
21. Min SH, Chang S-H, Jeon SK, et al. Posterior auricular pain caused by the trigger points in the sternocleidomastoid muscle aggravated by psychological factors – a case report. *Korean J Anesthesiol.* 2010;59(Suppl):5229-5232.

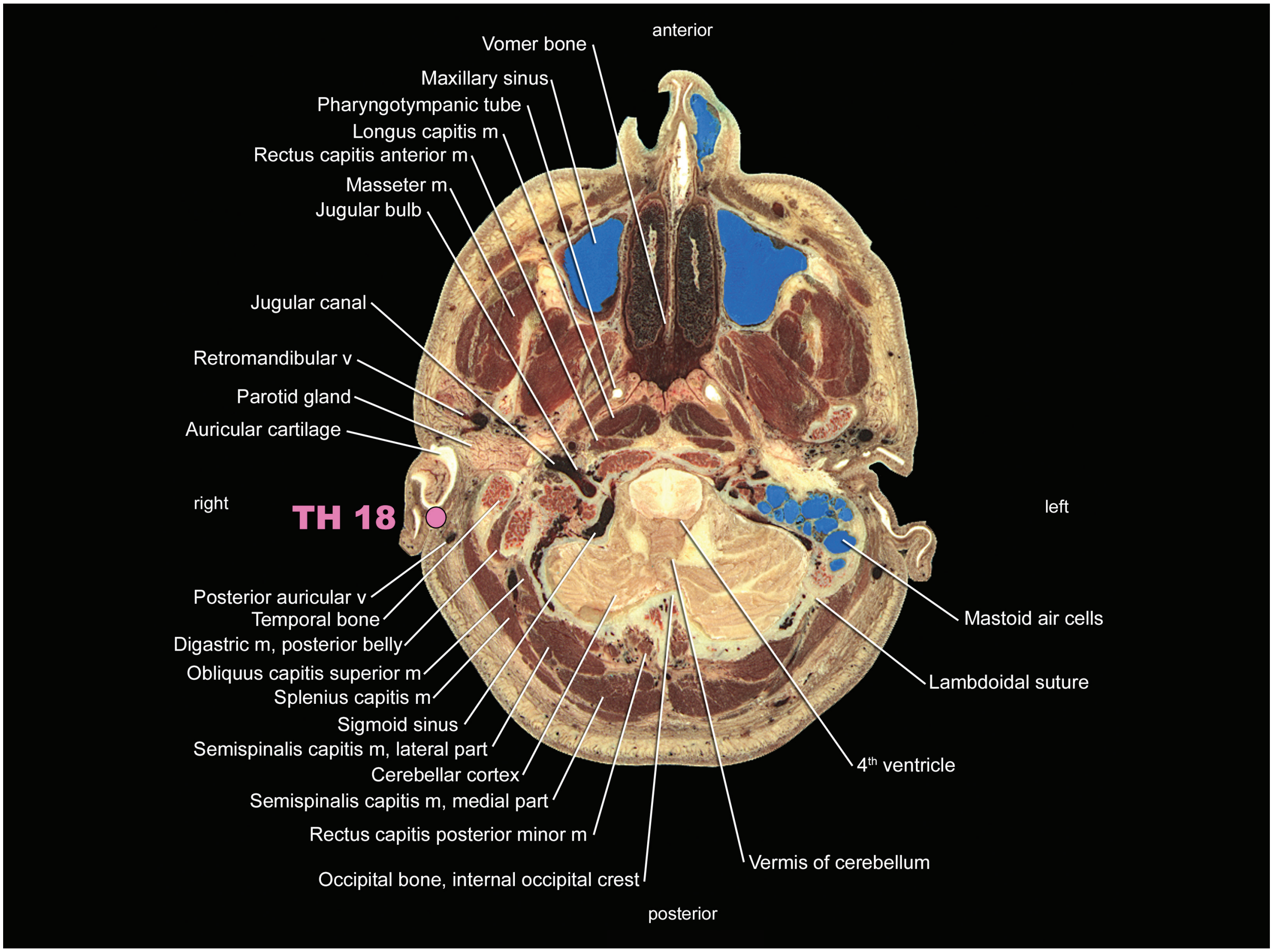

anterior
Vomer bone
Maxillary sinus
Pharyngotympanic tube
Longus capitis m
Rectus capitis anterior m
Masseter m
Jugular bulb
Jugular canal
Retromandibular v
Parotid gland
Auricular cartilage
right
TH 18
left
Posterior auricular v
Temporal bone
Digastric m, posterior belly
Obliquus capitis superior m
Splenius capitis m
Sigmoid sinus
Semispinalis capitis m, lateral part
Cerebellar cortex
Semispinalis capitis m, medial part
Rectus capitis posterior minor m
Occipital bone, internal occipital crest
posterior
Vermis of cerebellum
4th ventricle
Lambdoidal suture
Mastoid air cells

Figure 10-52. The intermediate nerve, or nervus intermedius, conveys general sensory information in the small area behind the ear, near TH 18, as well as the skin in the vicinity of the concha of the external ear. Crosstalk between this facial nerve branch and the vagus nerve provides the neuroanatomic rationale for selecting TH 18 and the nearby "Groove Behind the Ear" point in hypertensive patients with the goal of reducing blood pressure.

TH 19

Lu Xi "Skull Rest" or "Skull's Breath"

Behind the ear, in a depression at the junction of the upper and middle thirds of a curve connecting TH 17 and TH 20, following the outline of the helix.

Muscles

- **Posterior auricular muscle:** The posterior auricular muscle wiggles the ear. (See Figure 10-51).

Clinical Relevance: Some causes of otalgia may result from myofascial dysfunction in the posterior auricular muscle. Pain may also arise from neuropathic nerves in the vicinity or trigger points in the sternocleidomastoid (SCM) muscle. Neuromodulation at TH 19 and TH 18 can provide relief in many cases.

Nerves

- **Posterior auricular nerve (CN VII):** A branch of CV VII, the posterior auricular nerve supplies the posterior auricular muscle and the occipital belly of the occipitofrontalis, or epicranius, muscle.
- **Lesser occipital nerve (C2):** This nerve provides innervation to the skin of the neck and the scalp lying posterior and superior to the auricle.
- **Great auricular nerve (C2, C3), posterior branch:** This nerve provides sensation to the skin over the parotid gland, the posterior portion of the auricle, and the area of skin between the angle of the mandible and the mastoid process. Its anterior branch communicates with the facial nerve (CN VII) inside the substance of the parotid gland. The posterior branch communicates with the lesser occipital nerve, the auricular branch of the vagus, and the posterior auricular branch of the facial nerve.

Clinical Relevance: Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[1]

One of the risks of having a facelift performed involves nerve damage; injury to the great auricular nerve happens in about 7% of patients.[2] This nerve courses over the mid-body of the SCM where it bifurcates into anterior and posterior (or rostral and caudal) branches and its terminal arborization. Rhytidectomy surgery involving revision of cervical folds may damage the great auricular nerve and cause loss of sensation caudal to the ear at TH 18 and TH 19. Nerve stimulation in this zone may facilitate return of sensation, depending on the type of nerve damage induced. Include TH 16 and LI 18.

Vessels

- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby

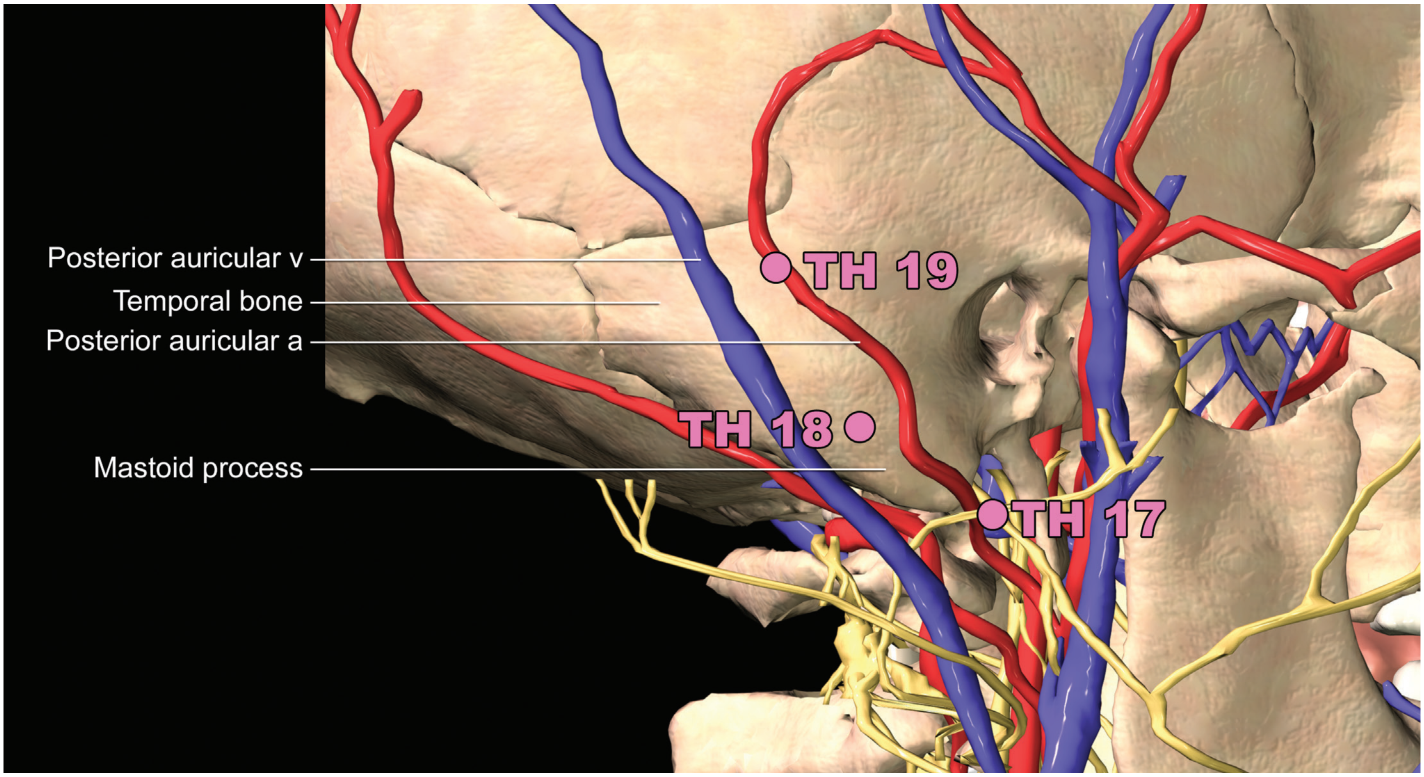


Figure 10-53. TH 19 continues the neurovascular relationship with the posterior auricular vessels (shown) and accompanying nerve (not shown) initiated by TH 17 and TH 18. Note, too, the proximity of TH 19 to the temporoparietal suture. Cranial sutures frequently exhibit tenderness to palpation. As such, TH 19 can assist in alleviating headache pain arising from cranial suture restriction and temporal bone dysfunction. When palpating TH 19, take care not to press too often or too firmly on only one temporal bone without supporting the contralateral temporal bone. Doing so may offset the patient's vestibular system and cause them to feel dizzy or unbalanced. Osteopathic physicians refer to the temporal bones as "troublemakers of the skull" with good reason; musculoskeletal maladies upset them easily.

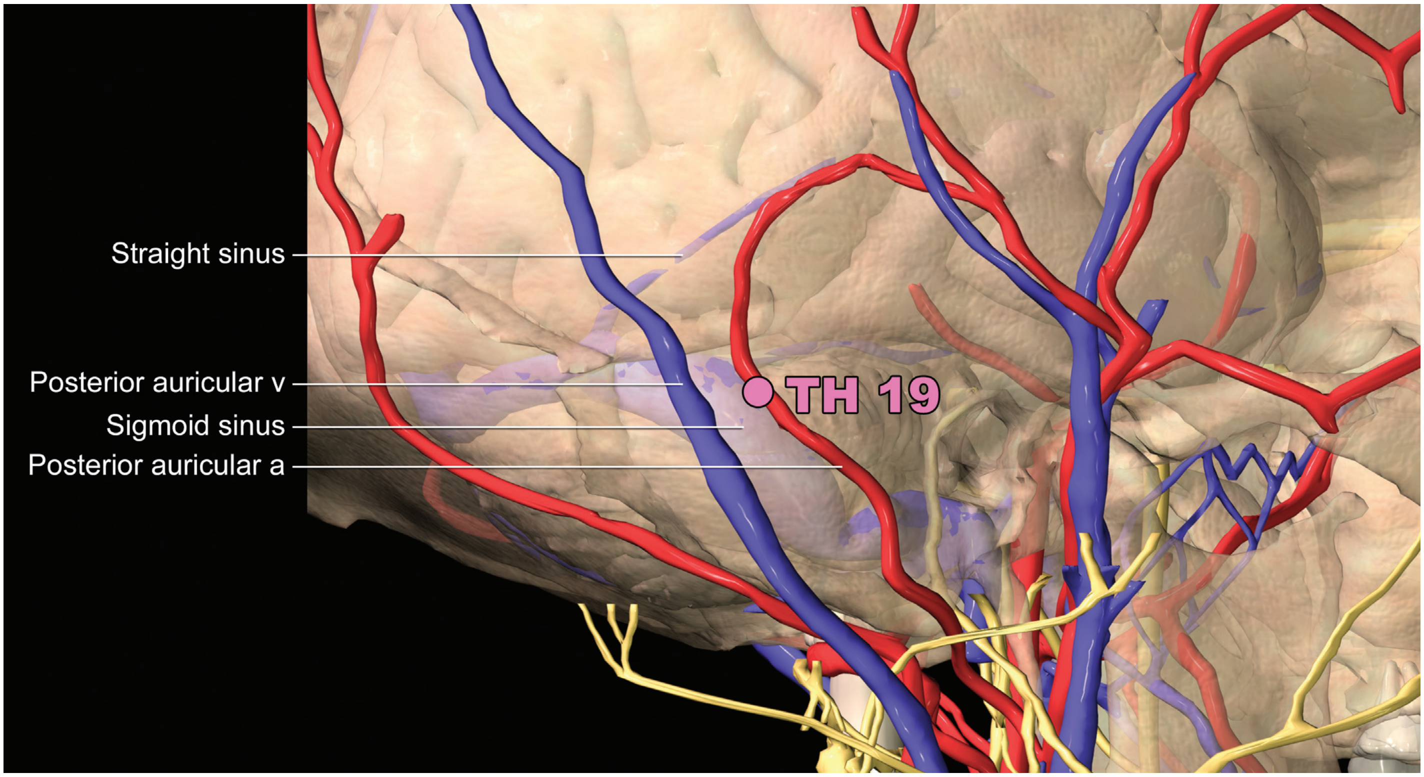


Figure 10-54. The term "Skull Rest" for TH 19 implies its clinical value for seizures. Neuromodulation for epilepsy involves invoking vagal stimulation, usually by means of nerves that crosstalk with the vagus nerve. Upper cervical spinal nerves make these connections, as through the great auricular nerve that supplies TH 19. Although the great auricular nerve does not appear in this image, the posterior auricular vessels do. Stimulating nervi vasorum associated with these structures may induce autonomic neuromodulation that benefits brain function. Furthermore, the fact that the posterior auricular vein receives an emissary vein from the sigmoid sinus anatomically argues that treating this region could influence venous drainage from the brain. To wit, an additional implication of the Chinese name, Lu Xi, refers to the treatment of a "clouded head" or "stuffiness" of the brain that connotes a disturbance in brain drainage or activity.

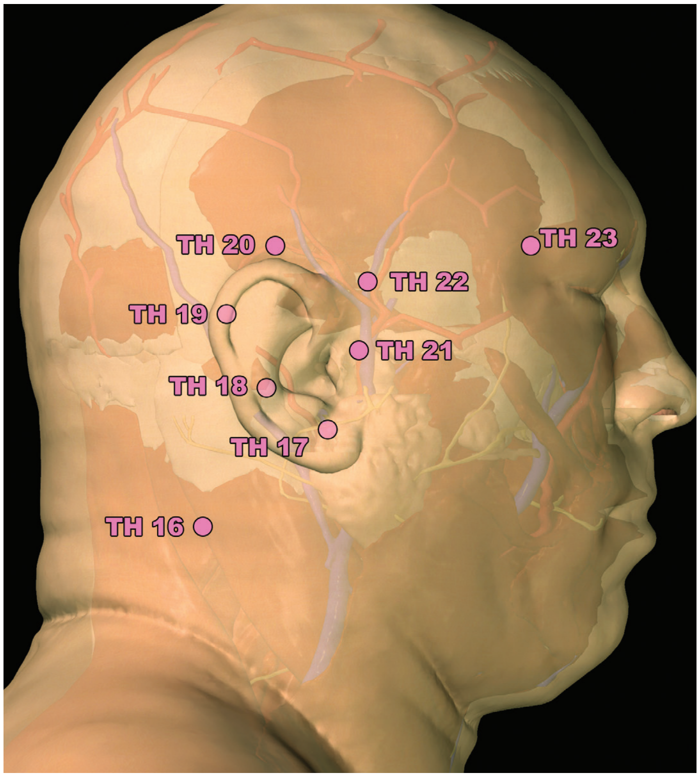


Figure 10-55. This image illustrates the context of TH 19 amid other TH point locations on the lateral head and neck.

muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.

- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, which is one of the dural venous sinuses.

Clinical Relevance: The posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization offers one alternative to pharmacotherapy,[3] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear, inhabited by TH 18 and TH 19. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean

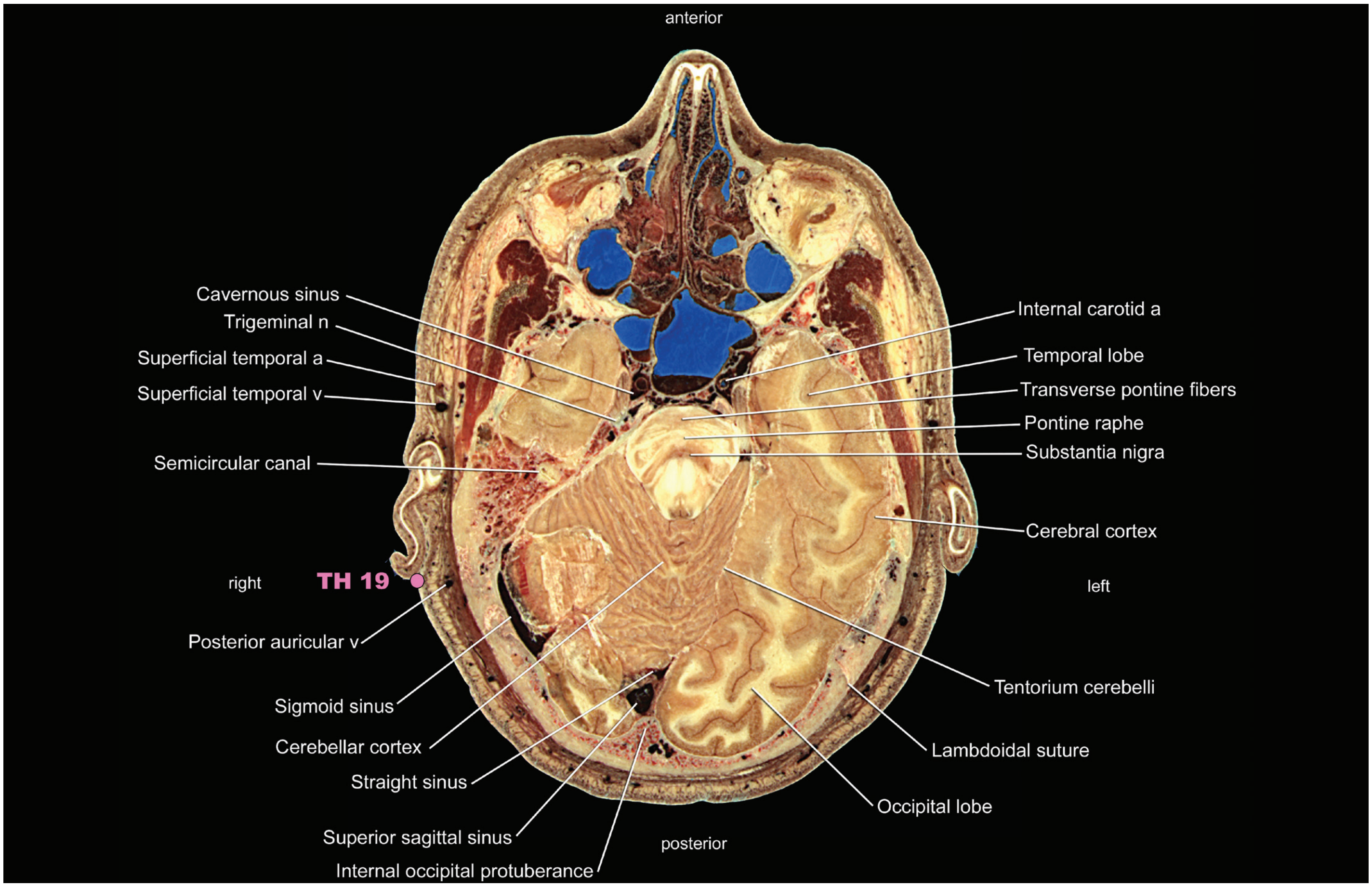

anterior
Cavernous sinus
Trigeminal n
Superficial temporal a
Superficial temporal v
Semicircular canal
right
TH 19
Posterior auricular v
Sigmoid sinus
Cerebellar cortex
Straight sinus
Superior sagittal sinus
Internal occipital protuberance
posterior
Internal carotid a
Temporal lobe
Transverse pontine fibers
Pontine raphe
Substantia nigra
Cerebral cortex
left
Tentorium cerebelli
Lambdoidal suture
Occipital lobe

Figure 10-56. This cross section through TH 19 reveals its proximity to both the extracranial posterior auricular vein and the intracranial sigmoid venous sinus. The emissary venous connection between the two is implied, but not apparent here. Note, too, the relationship between TH 19 and the semicircular canal, located deep to the right ear and housed within the temporal bone. This anatomic proximity suggests that neuromodulation of the vestibular system by means of appropriately implemented laser therapy may benefit balance when delivered to TH points surrounding the auricle. Osteopathic cranial manipulative therapy also affects vestibular function. Apply treatment to both sides in order to provide even vestibular afferent input to the brainstem.

needling practices and to avoid deep scalp insertion as well as traversing infected sites. The spatial relationships between TH 19, the posterior auricular vein, the mastoid bone, and the sigmoid sinus show clearly in Figure 10-56.

Indications and Potential Point Combinations

- **Ear problems:** Pain, hearing loss, tinnitus: TH 19, TH 18, TH 17, TH 20, TH 21, local temporalis trigger points bilaterally.
- **Dizziness:** TH 19, TH 18, SCM trigger points, GV 20.
- **Temporal headache:** TH 19, TH 18, GV 20, BL 10, Taiyang, relevant temporalis trigger points.
- **Seizures:** TH 19, TH 18, ST 36, GV 20, Yintang (GV 24.5), BL 10, ST 36, LR 3.

References

1. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine*. 1998;23:1435-1441.
2. Lefkowitz T, Hazani R, Chowdhry S, et al. Anatomical landmarks to avoid injury to the great auricular nerve during rhytidectomy. *Aesthet Surg J*. 2013;33(1):19-23.
3. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum*. August 2007: 73-76.

TH 20

Jiao Sun "Angle Vertex", "Small Horn", "Angle of Collaterals"

On the side of the head, directly superior to the apex of the ear, within the hairline of the temporal region. The point can also be located by folding the posterior portion of the upper helix directly over the anterior portion, thereby indicating the point at the vertex. Or, have the patient open the mouth and palpate this region for a hollow that develops directly superior to the pinna.

Muscles

- **Superior auricular muscle:** The superior auricular muscle wiggles the ear. It is larger than the rostral (anterior) and caudal (posterior) auricular muscles, but also thin and fan-shaped. The fibers of the superior auricular muscle arise from the galea aponeurotica and converge to create a flat tendon that inserts onto the upper portion of the cranial aspect of the auricle.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The superior auricular muscle, like its larger neighbor, the temporalis muscle, exhibits a fan pattern to its fibers. As such, the distribution of central trigger points in either muscle similarly arrange in a fan-like array rather than a straight line.

A common source of pain and dysfunction affecting the temporomandibular joint,[1] the temporalis muscle fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.

Nerves

- **Temporal branch of the facial nerve (CN VII):** The temporal branch of the facial nerve supplies the superior and anterior auricular muscles, the frontal belly of the occipitofrontalis (epicranius) muscle, and the superior part of the orbicularis oculi muscle.
- **Auriculotemporal nerve (CN V_3):** Supplies sensation to the skin anterior to the ear and in the posterior temporal region. Also provides innervation to the tragus and part of the helix of the auricle, the roof of the external auditory meatus and the upper tympanic membrane.

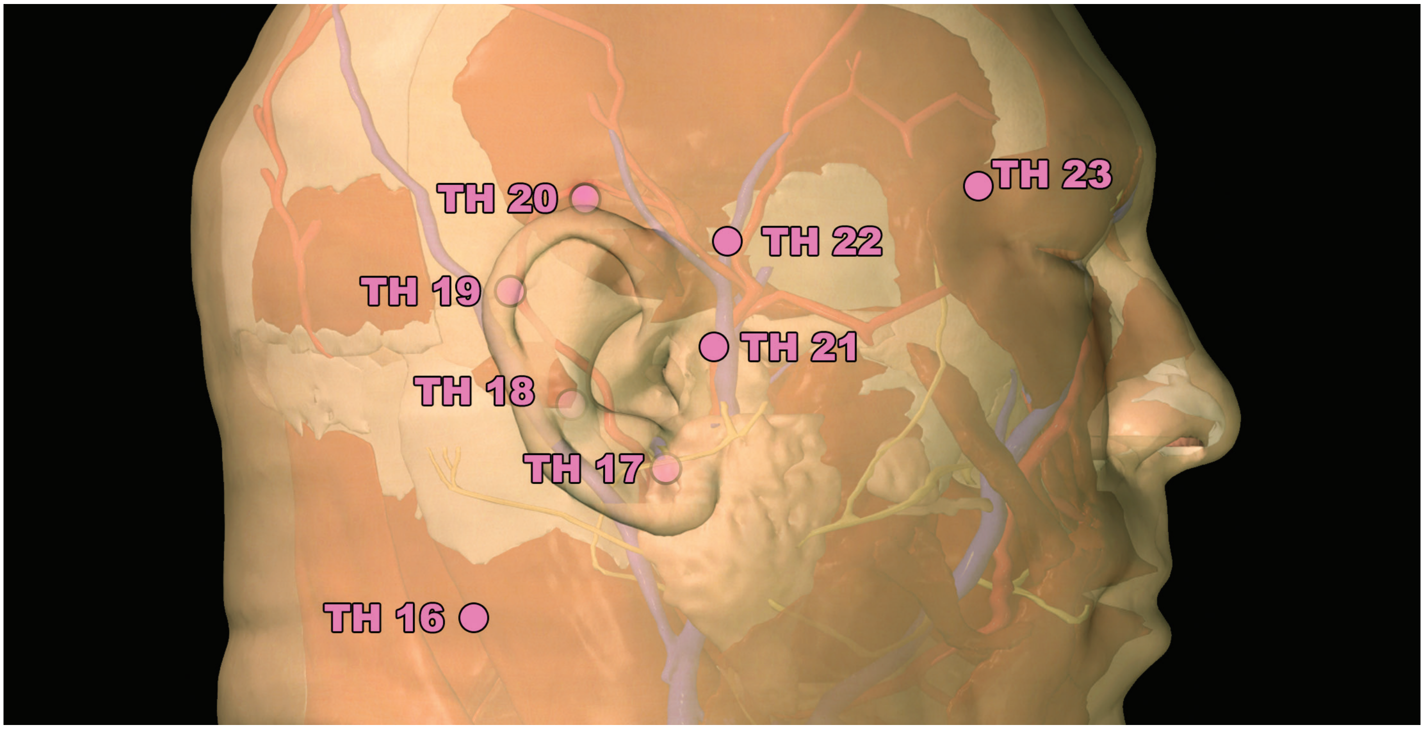


Figure 10-57. The TH line turns a corner at the vertex of the ear here at TH 20, substantiating the name "Angle Vertex". This location indicates where celestial dragon horns project from the head, justifying the alternate name, "Small Horn".

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Lesser occipital nerve (C2):** This nerve provides innervation to the skin of the neck and the scalp lying posterior and superior to the auricle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[2] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck should thus constitute a differential diagnosis for pain in the ear and TMJ.

Occipital neuralgia often affects the greater occipital nerve, but the lesser occipital may also produce the paroxysmal jabbing pain that nerve irritation induces.[3] Neuromodulation delivers effective treatment for occipital neuralgia.

Vessels

- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.
- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, which is one of the dural venous sinuses.
- **Superficial temporal artery:** Arises from the external carotid artery and ascends anterior to the ear, to the temporal region; ends in the scalp. Provides blood circulation to the facial muscles and the skin of the frontal and temporal regions.
- **Superficial temporal vein:** This vein arises from the widespread plexus of veins on the scalp's lateral aspect and along the zygomatic arch. The superficial temporal vein drains blood from the side of the scalp, the superficial portions of the temporal muscle, and the external ear.
- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: The posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization offers one alternative to pharmacotherapy,[4] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

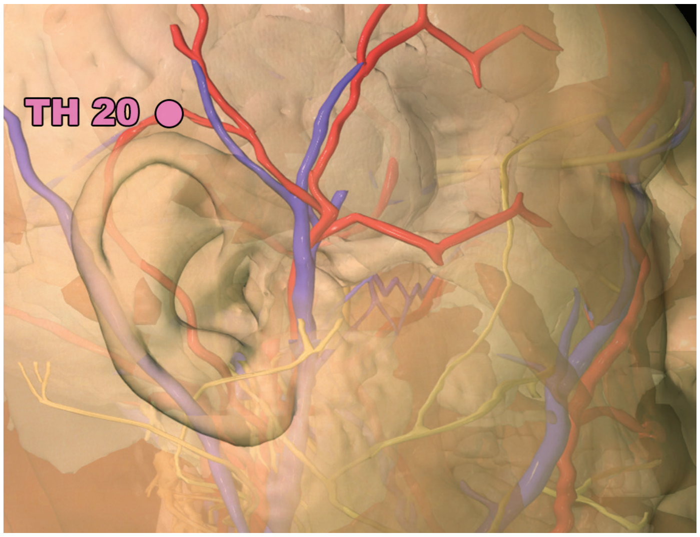


Figure 10-58. This image reveals the nearby anastomosis of the posterior auricular and a branch of the superficial temporal arteries rostral to TH 20. Hence the name for TH 20 of, "Angle of Collaterals" where the TH trajectory redirects toward this juncture of these vessels. The temporoparietal suture lies beneath the point, carrying a clinical significance for the treatment of headache and dizziness. In addition, the semitransparent skull near TH 20 shows the temporal lobe of the brain within reach of a suitably calibrated laser beam.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear, from TH 20 to TH 17. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Indications and Potential Point Combinations

- **Headache:** Palpate the temporalis region as well as other muscles of the head, neck, shoulders, and back for myofascial trigger points. TH 20 may help patients with headache of temporalis origin.
- **Toothache:** Evaluate source of tooth pain, i.e., whether of odontologic or referred origin. Address trigger points in the temporalis muscle in the vicinity of TH 20, TH 21, and TH 22 that refer to the teeth. Trigger points in the temporalis muscle can cause the patient to become more sensitive (hyperesthetic) to percussion, chewing, or temperature changes in any or all of the ipsilateral upper teeth.

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.

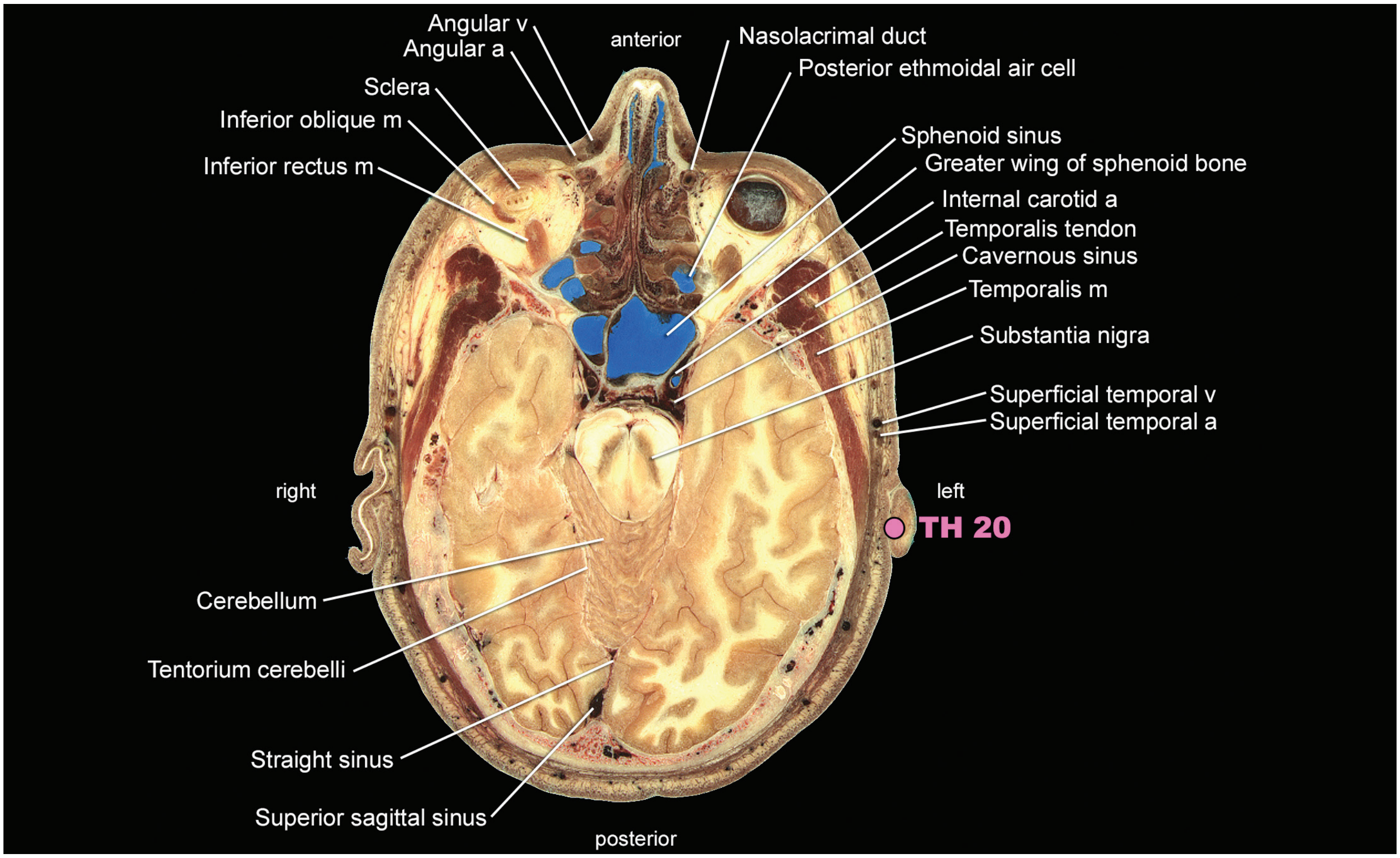

Angular v
Angular a
anterior
Nasolacrimal duct
Posterior ethmoidal air cell
Sclera
Inferior oblique m
Inferior rectus m
Sphenoid sinus
Greater wing of sphenoid bone
Internal carotid a
Temporalis tendon
Cavernous sinus
Temporalis m
Substantia nigra
Superficial temporal v
Superficial temporal a
right
left
TH 20
Cerebellum
Tentorium cerebelli
Straight sinus
Superior sagittal sinus
posterior

Figure 10-59. The temporalis muscle and temporal lobe of the brain relate to TH 20 as becomes apparent in this cross section. Functional magnetic resonance imaging (fMRI) studies of the brain have compared the effects of scalp acupuncture versus limb acupuncture on signal activation. Findings illustrate unique signal activations between the two groups, most likely resulting from the different afferent endings stimulated by each approach.[5] The scalp acupuncture group (needled at left-side only TH 20, GB 18, GB 9, and Sishencong) demonstrated more activity in the contralateral somatosensory association cortex, the postcentral gyrus, and the parietal lobe as compared to the limb acupuncture group, who received treatment at right-side only LI 1, LI 10, LR 3, and ST 36. Perhaps unsurprisingly, the latter points produced activation in the right occipital lobe, lingual gyrus, visual association cortex, right parahippocampal gyrus, limbic lobe, hippocampus, left anterior lobe, culmen, and cerebellum.

[2] Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.

[3] Choi HJ, Oh IH, Choi SK, et al. Clinical outcomes of pulsed radiofrequency neuromodulation for the treatment of occipital neuralgia. *J Korean Neurosurg Soc.* 2012;51:281-285.

[4] Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.

[5] Park SU, Shin AS, Jahng GH, et al. Effects of scalp acupuncture versus upper and lower limb acupuncture on signal activation of blood oxygen level dependent (BOLD) fMRI of the brain and somatosensory cortex. *J Altern Complement Med.* 2009;15(11):1193-2000.

TH 21

Er Men "Ear Gate"

In a depression located anterior to the supratragic notch, at the "Ear Gate", posterior and slightly superior to the condylar process of the mandible when the mouth is open. Opening the mouth allows the mandible to slide forward to reveal the depression.

Gland

- **Parotid gland:** The largest of the three, paired salivary glands. The facial nerve courses through the parotid gland, as does the retromandibular vein, and the external carotid artery (ECA) and its nerve plexus. The gland contains parotid lymph nodes both within the gland and on its tough fascial capsule, the parotid sheath. These lymph nodes drain lymphatic fluid from the forehead, lateral eyelids, temporal region, lateral auricular surface, anterior wall of the external acoustic meatus, and the middle ear.

Clinical Relevance: A number of tumors, both benign and malignant, as well as infections can enlarge the parotid gland. Tumor growth within the gland can induce facial pain (mediated by the trigeminal nerve) and facial nerve dysfunction, leading to paresis or paralysis of the muscles of facial expression. Remain cognizant of the possible presence of salivary gland tissue at or near TH 21. Avoid needling tumorous or other abnormal tissue.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: A common source of pain and dysfunction affecting the temporomandibular joint,[1] the temporalis muscle fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.

Nerves

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Auriculotemporal nerve (CN V_3):** Supplies sensation to the skin anterior to the ear and in the posterior temporal region. Also provides innervation to the tragus and part of the helix of the auricle, the roof of the external auditory meatus and the upper tympanic membrane.
- **Deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle.
- **Temporal branch of the facial nerve (CN VII):** The temporal branch of the facial nerve supplies the superior and anterior auricular muscles, the frontal belly of the occipitofrontalis (epicranius) muscle, and the superior part of the orbicularis oculi muscle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[2] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck should thus constitute a differential diagnosis for pain in the ear and TMJ.

Vessels

- **Superficial temporal artery:** Arises from the external carotid artery and ascends anterior to the ear, to the temporal region; ends in the scalp. Provides blood circulation to the facial muscles and the skin of the frontal and temporal regions.
- **Superficial temporal vein:** This vein arises from the widespread plexus of veins on the scalp's lateral aspect and along the zygomatic arch. The superficial temporal vein drains blood from

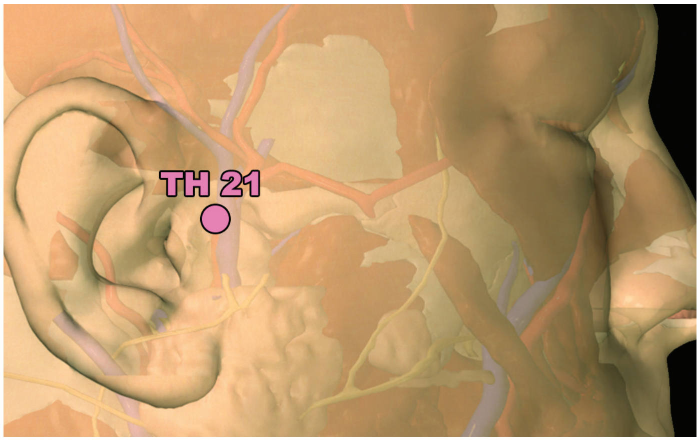


Figure 10-60. TH 21, as the "Ear Gate", is located in a depression anterior to the supratragic notch, at the gateway to the ear.

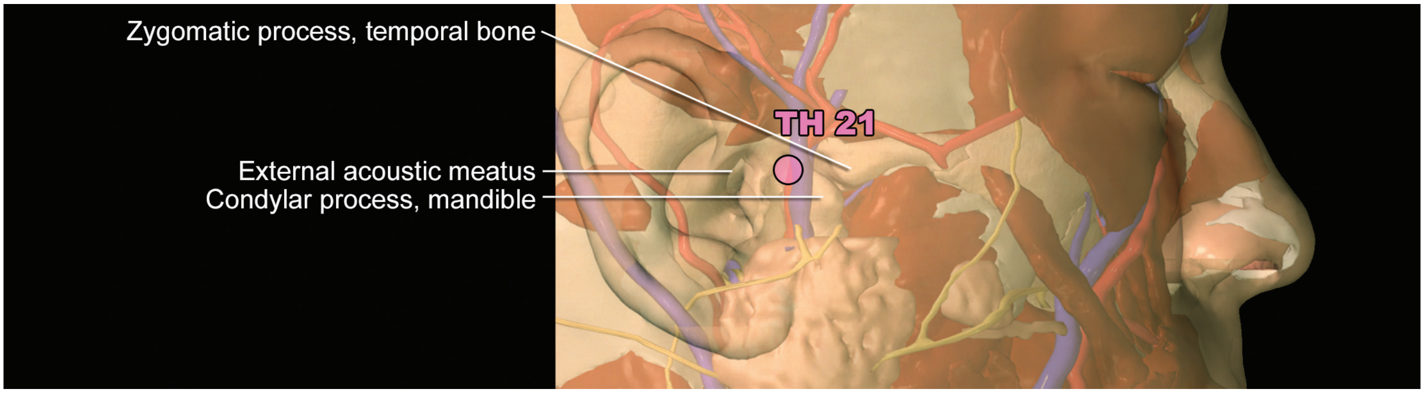


Figure 10-61. TH 21 sits directly over the TMJ, a complex source of local and referred pain.

the side of the scalp, the superficial portions of the temporal muscle, and the external ear.

- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near TH 21, considering the limited responses to conventional methods often seen.[3]

Indications and Potential Point Combinations

- **Ear problems such as deafness, tinnitus, otitis media:** TH 21, TH 16, GB 20, GB 21, GV 20, GB 34. Examine myofascia of the head, neck, and torso for myofascial restrictions leading to tension on the temporal bone.
- **TMJ pain or dysfunction:** TH 21, SI 19, GB 2, TH 16, relevant and tender trigger points.
- **Headache:** Palpate the temporalis region as well as other muscles of the head, neck, shoulders, and back for myofascial trigger points. TH 21 may help patients with headache of temporalis origin.
- **Toothache:** Evaluate source of tooth pain, i.e., whether of odontologic or referred origin. Address trigger points in the temporalis muscle in the vicinity of TH 20, TH 21, and TH 22 that refer to the teeth.
- **Xerostomia:** TH 21, ST 7, ST 6, LI 4, ST 36.

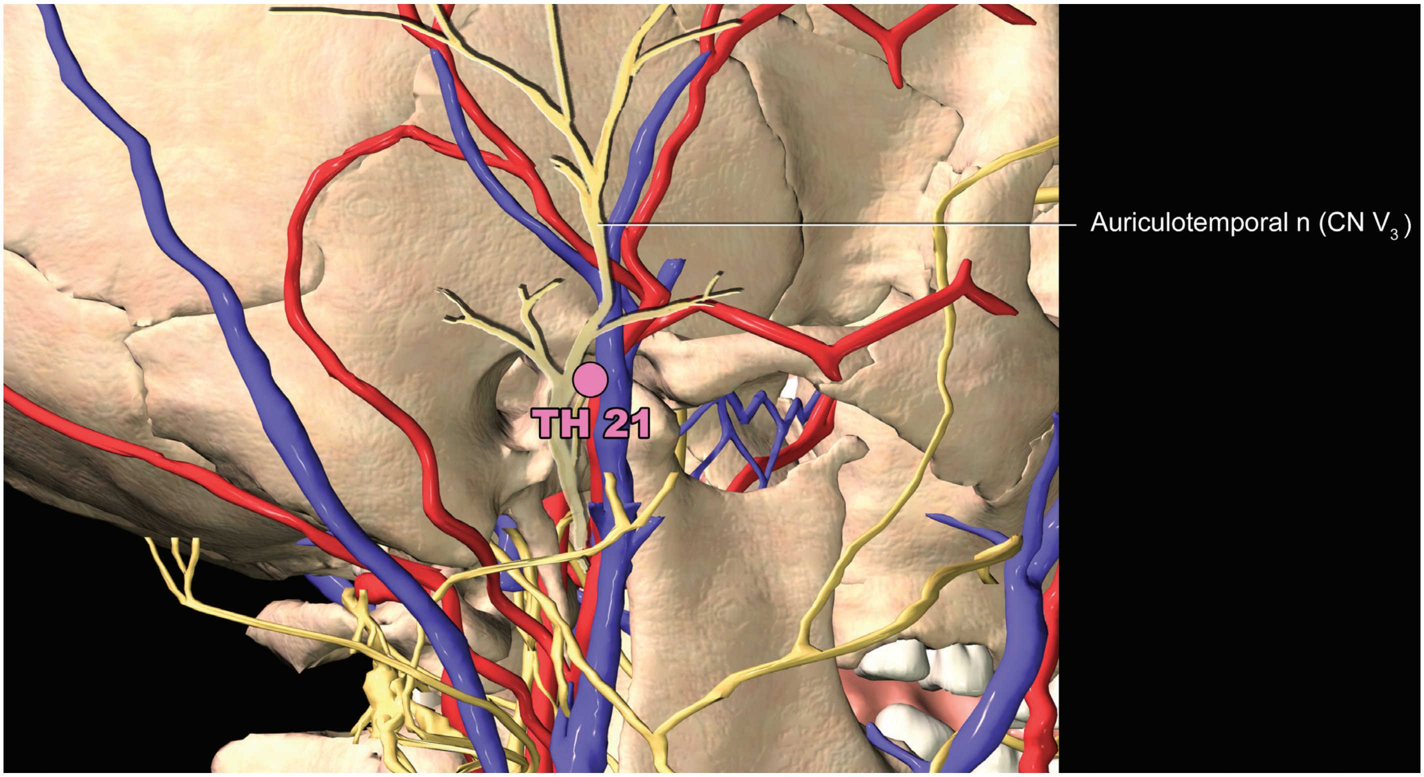


Figure 10-62. TH 21 relates closely to the superficial temporal vessels and their neural partner, the auriculotemporal nerve. This branch of the mandibular nerve (CN V_3) supplies the TMJ with articular fibers, fortifying its significance in treating TMJ pain. It communicates sensation from the auricle and temporal region. Finally, fibers from the auriculotemporal nerve join parasympathetic secretomotor fibers of glossopharyngeal origin (CN IX) to supply the parotid gland. These varied activities explain the clinical multifaceted applications associated with TH 21.

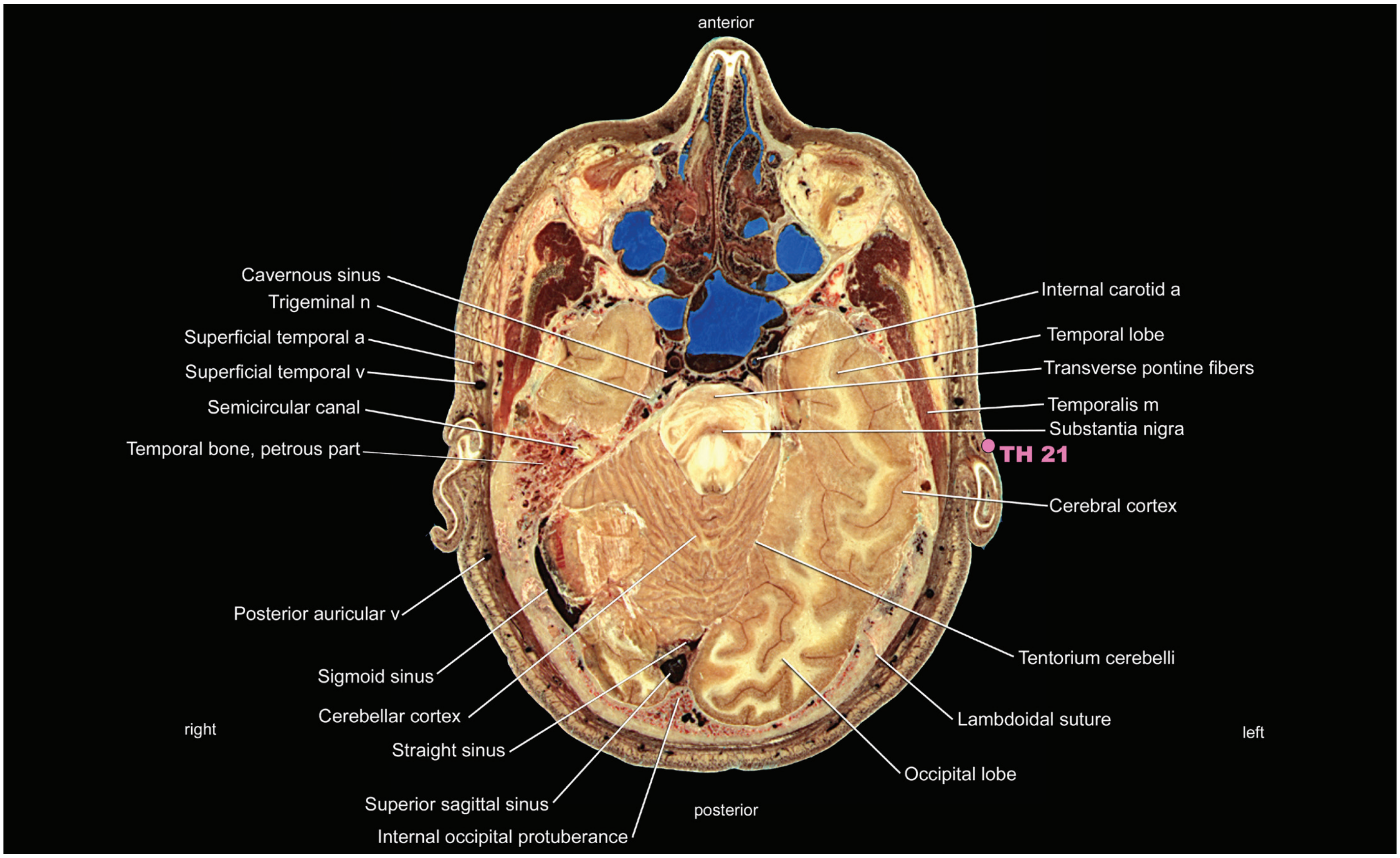

anterior
Cavernous sinus
Trigeminal n
Superficial temporal a
Superficial temporal v
Semicircular canal
Temporal bone, petrous part
Internal carotid a
Temporal lobe
Transverse pontine fibers
Temporalis m
Substantia nigra
TH 21
Cerebral cortex
Posterior auricular v
Sigmoid sinus
Cerebellar cortex
Straight sinus
Superior sagittal sinus
Internal occipital protuberance
right
Tentorium cerebelli
Lambdoidal suture
Occipital lobe
left
posterior

Figure 10-63. In addition to treating TMJ pain, needling at TH 21 can impact myofascial restriction in the temporalis muscle, as illustrated in this cross section. Transcranial laser therapy may affect the temporal lobe and the vestibular system, illustrated here by the semicircular canal, visible on the right side of the cross section. Otalgia and ear problems that cause it could be affected through laser and local stimulation of TH 21, at this “gateway to the ear”.

Evidence-Based Application

- Applying acupressure to trigger points at TH 21, GB 20, GV 20, BL 2, and GB 5 outperformed muscle relaxant medication for patients with **chronic headache** in a randomized controlled trial.[4]
- Acupuncture at TH 21 following cisplatin administration with “purple bamboo salt (PBS)-pharmaceutical acupuncture” significantly suppressed interleukin (IL)-6 production and caspase-3 activation induced by **cisplatin** in the cochlea. PBS also significantly inhibited cisplatin-induced apoptosis and IL-6 production in auditory cell lines, reduced cytochrome c release and caspase-3 activation. These cells also demonstrated inhibition of extracellular signal-related kinase and nuclear factor-kappa B activation.[5]
- Laser therapy delivered to TH 21, SI 19, GB 2, and auricular points liver, kidney, endocrine, and others, along with laser irradiation of the external auditory canal improved audition in patients with **moderate and severe sudden deafness.**[6]

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
3. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
4. Hsieh LL, Liou HH, Lee LH, et al. Effect of acupressure and trigger points in treating headache: a randomized controlled trial. *Am J Chin Med.* 2010;38(1):1-14.
5. Myung NY, Choi IH, Jeong HJ, et al. Ameliorative effect of purple bamboo salt-pharmaceutical acupuncture on cisplatin-induced ototoxicity. *Acta Otolaryngol.* 2011;131(1):14-21.
6. Zhou GY. Moderate and severe sudden deafness treated with low-energy laser irradiation combined with auricular acupoint sticking. *Zhongguo Zhen Jiu.* 2012;32(5):413-416.

TH 22

Er He Liao "Ear Harmony Crevice", "Holes Regularization", "Harmony Bone-Hole", "Grain Bone-Hole", "Harmony Hollow"

On the temporal region, anterior to the auricle and approximately 0.5 cun anterior (rostral) to the upper border of the root of the ear. In a small depression on the border of the natural hairline, level with the lateral canthus of the eye. As with all other acupuncture points, palpate the area for the best location for the patient; i.e., is the site tender or tense? Does it issue referred pain or reproduce the patient's pain? In this case the pain produced would likely include head pain, ear pain, or facial discomfiture.

Muscles

- **Superior auricular muscle:** The superior auricular muscle wiggles the ear.
- **Anterior auricular muscle:** The anterior auricular muscle wiggles the ear.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The auricular muscles respond to emotional sites and sounds; their vestigial motor responses create enough activity for researchers to record but usually not sufficient in amplitude to move the pinna.[2] Usually, the posterior auricular muscle, also called the postauricular muscle or caudal auricular, displays the most consistent activation for both emotional images and sounds. As such, myofascial dysfunction and trigger points may arise due to chronic activation during highly charged emotional states, especially when turbulence affects the mind for long periods of time. Metaphorically, perhaps, the innervation of the auricular muscles by branches of the same nerve (i.e., CN VII), reflects inner struggle. That is, the anterior and superior auriculares receive motor supply from the temporal branch while the posterior auricular muscle receives the postauricular branch. In non-human animals, emotional reflexes remain distinct and expressive. Fear and anxiety pin the ears toward the back, while curiosity and affection bring them forward. These opposing "ear motions" thus reflect opposing "emotions". With regard to headaches and neuropathic pain generated by tension around the ears, a possible link could connect dysfunction in the posterior auricular muscle to traction and pulls on nervus intermedius territory, responsible in part for cluster headaches.

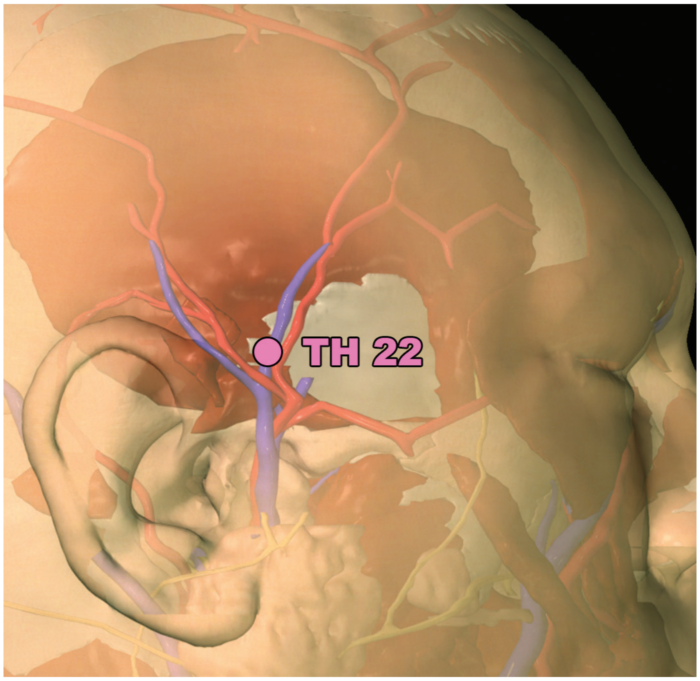


Figure 10-64. "Harmony Hollow" refers to the palpable "hollow" or depression in the temporalis muscle at TH 22, accentuated here to illustrate contour. The auriculotemporal nerve supplies the skin in this region as well as portions of the ear, including the roof of the external auditory meatus. The term "harmony" refers to the way in which the auriculotemporal nerve influences sensations of the ear canal and external auditory meatus, portals through which "harmonious sounds" travel toward the brain.

As a common source of pain and dysfunction affecting the temporomandibular joint,[1] the temporalis muscle fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.

Nerves

- **Auriculotemporal nerve (CN V_3):** Supplies sensation to the skin anterior to the ear and in the posterior temporal region. Also provides innervation to the tragus and part of the helix of the auricle, the roof of the external auditory meatus and the upper tympanic membrane. A sensory branch of an otherwise predominantly motor portion (i.e., the mandibular division) of the trigeminal nerve.
- **Temporal branch of the facial nerve (CN VII):** The temporal branch of the facial nerve supplies the superior and anterior auricular muscles, the frontal belly of the occipitofrontalis (epicranius) muscle, and the superior part of the orbicularis oculi muscle.

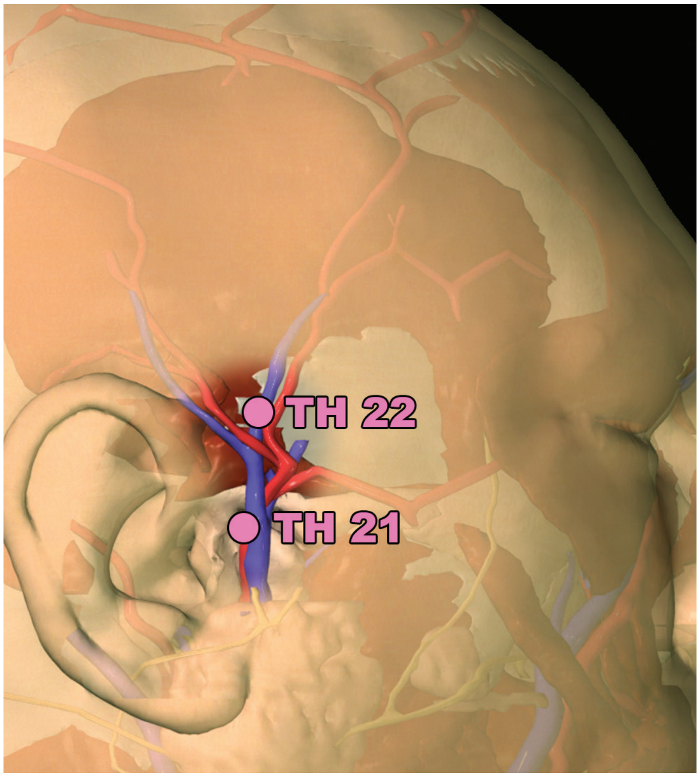


Figure 10-65. TH 21 and TH 22 line up along the superficial temporal artery and vein; both impact the temporalis muscle as well, shown here deep to the vessels. The auriculotemporal nerve (not shown) accompanies the superficial temporal vessels near the surface, while the deep temporal nerves (CN V_3, also not shown) follow close to the bone to supply the temporalis muscle.

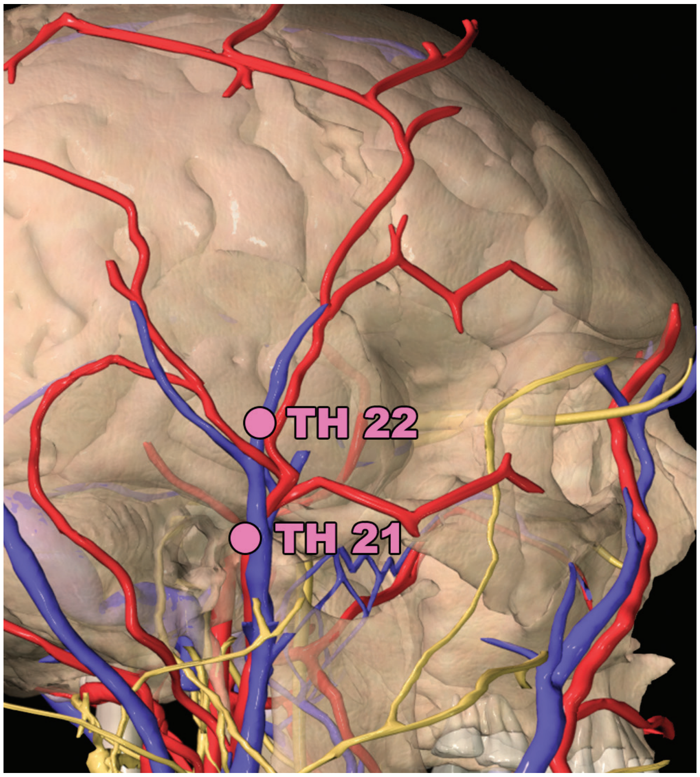


Figure 10-66. The wind-dispelling action of TH 22 according to Chinese medicine suggests that the point benefits patients with nervous system injury. This metaphorical "wind" referred either to facial nerve injury (both central and peripheral), vestibular system problems, and stroke affecting the temporal lobe, seen here deep to TH 22 and TH 21. GB points in the temporal region will continue this association. See, for example, Figure 11-12.

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[3] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck should thus constitute a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[4] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Vessels

- **Superficial temporal artery:** Arises from the external carotid artery and ascends anterior to the ear, to the temporal region; ends in the scalp. Provides blood circulation to the facial muscles and the skin of the frontal and temporal regions.
- **Superficial temporal vein:** This vein arises from the widespread plexus of veins on the scalp's lateral aspect and along the zygomatic arch. The superficial temporal vein drains blood from the side of the scalp, the superficial portions of the temporal muscle, and the external ear.
- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near TH 22, considering the limited responses to conventional methods often seen.[5]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[6]

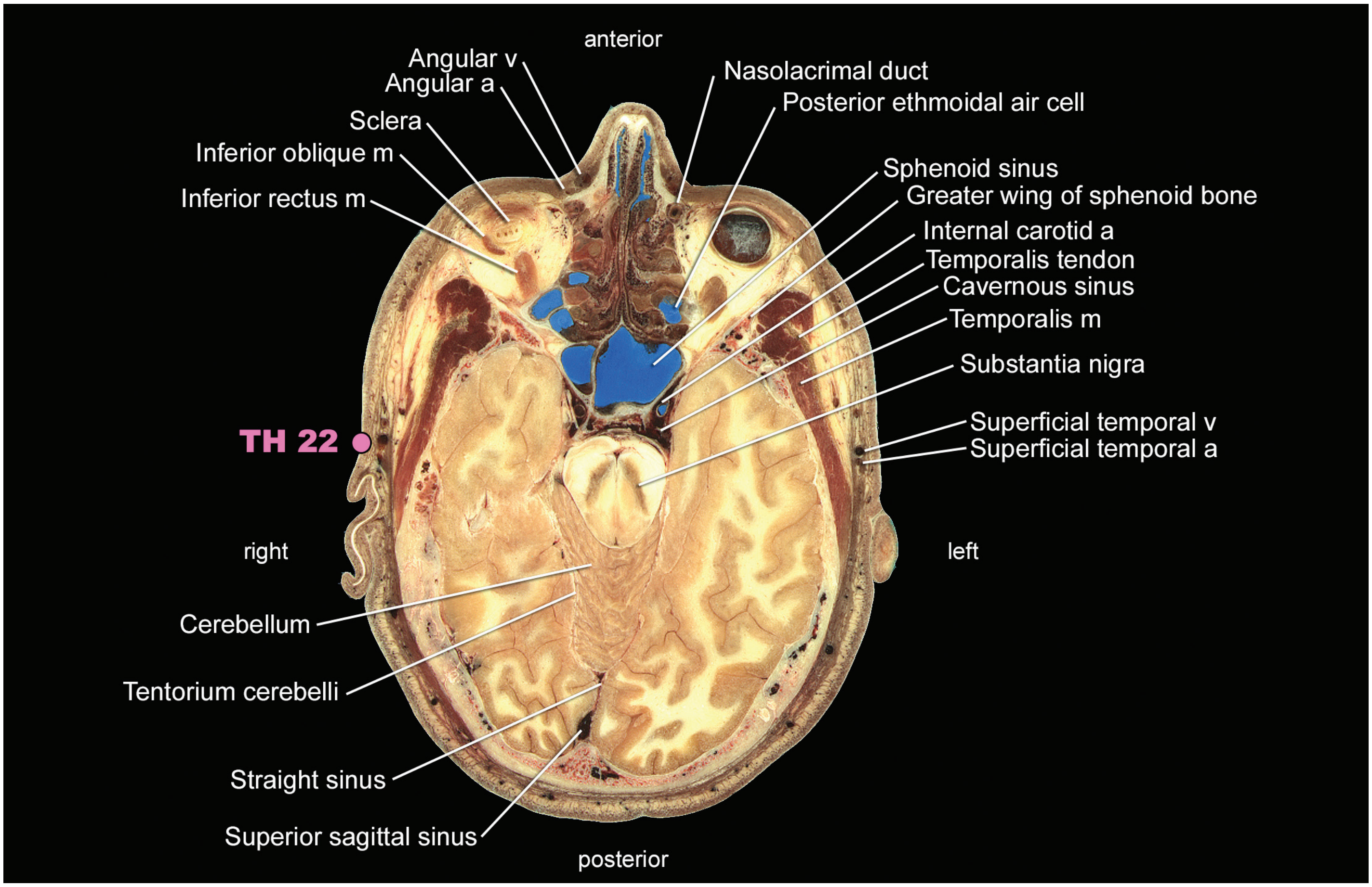

anterior
Angular v
Angular a
Sclera
Inferior oblique m
Inferior rectus m
Nasolacrimal duct
Posterior ethmoidal air cell
Sphenoid sinus
Greater wing of sphenoid bone
Internal carotid a
Temporalis tendon
Cavernous sinus
Temporalis m
Substantia nigra
TH 22
Superficial temporal v
Superficial temporal a
right
left
Cerebellum
Tentorium cerebelli
Straight sinus
Superior sagittal sinus
posterior

Figure 10-67. The close association TH 22 has with the superficial temporal vessels and the temporalis muscle appears in this cross section. It reinforces the need to envision the three-dimensional anatomy beneath a point before vigorously stimulating it. This point-vessel relationship provides a clear-cut illustration of the vascular underpinnings of most acupuncture points and channels.

Pressure applied to TH 22 and ST 7 can lead to significant and reversible intracranial pressure (ICP) elevations in patients with already elevated ICP.[7] This finding suggests that if one chooses to treat acupuncture points on the head in patients with increased ICP, avoid adding pressure to the skull and instead select acupuncture or other forms of noninvasive neuromodulation.

Indications and Potential Point Combinations

- **TMJ pain or dysfunction:** TH 22, TH 21, SI 19, GB 2, TH 16, relevant and tender trigger points.
- **Headache:** Palpate the temporalis region as well as other muscles of the head, neck, shoulders, and back for myofascial trigger points. TH 22, TH 21, and TH 20 may help patients with headache of temporalis origin.
- **Toothache:** Evaluate source of tooth pain, i.e., whether of odontologic or referred origin. Address trigger points in the temporalis muscle in the vicinity of TH 20, TH 21, and TH 22 that refer to the teeth.

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Benning SD. Postauricular and superior auricular reflex modulation during emotional pictures and sounds. *Psychophysiology.* 2011;48(3):410-414.
3. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
4. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
5. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
6. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.
7. Litscher G, Wang L, Schwarz G, et al. Increases of intracranial pressure and changes of blood flow velocity due to acupressure, needle and laser needle acupuncture. *Forsch Komplementarmed Klass Naturheilkd.* 2005;12(4):190-195.

TH 23

Si Zhu Kong “Silken Bamboo Hollow”, “Bambooleaf Depression”

In the depression at the lateral end of the eyebrow, along the supraorbital margin.

Muscles

- **Orbicularis oculi muscle:** Closes the eyelids.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: Trigger points in the orbicularis oculi at and around TH 23 refer pain to the nose. Some pain may reach that portion of the cheek adjacent to the nose as far caudal as the upper lip.

The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

Nerves

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Supraorbital nerve (CN V_1):** Innervates the mucous membranes of the frontal sinus and upper eyelid (i.e., the palpebral conjunctiva). Supplies the skin and subcutaneous tissue over the forehead and scalp, to the vertex. The frontal nerve consists of the conjoined supraorbital and supratrochlear nerves, which then is joined by a small sensory twig supplying the frontal sinus.[2] As the frontal nerve heads toward the superior orbital fissure along the roof of the orbit, it receives the lacrimal and nasociliary nerves.
- **Zygomatic nerve, which splits into the zygomaticofacial and**

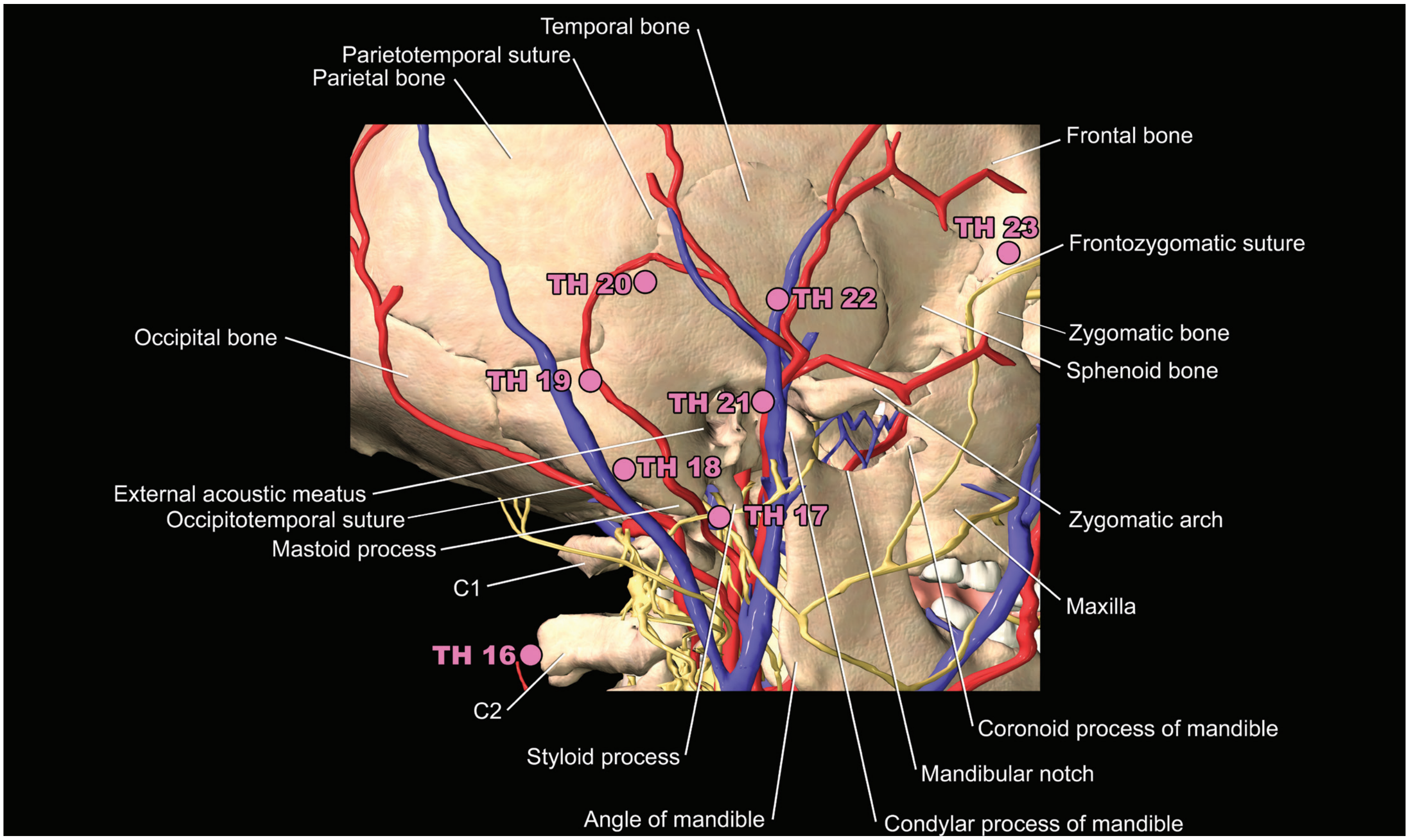

Temporal bone
Parietotemporal suture
Parietal bone
Frontal bone
TH 23
Frontozygomatic suture
TH 20
TH 22
Occipital bone
Zygomatic bone
Sphenoid bone
TH 19
TH 21
TH 18
External acoustic meatus
Occipitotemporal suture
TH 17
Zygomatic arch
Mastoid process
C1
Maxilla
TH 16
C2
Coronoid process of mandible
Styloid process
Mandibular notch
Angle of mandible
Condylar process of mandible

Figure 10-68. TH points on the head relate to cranial sutures as well as a variety of other motor, sensory, and autonomic nerves.

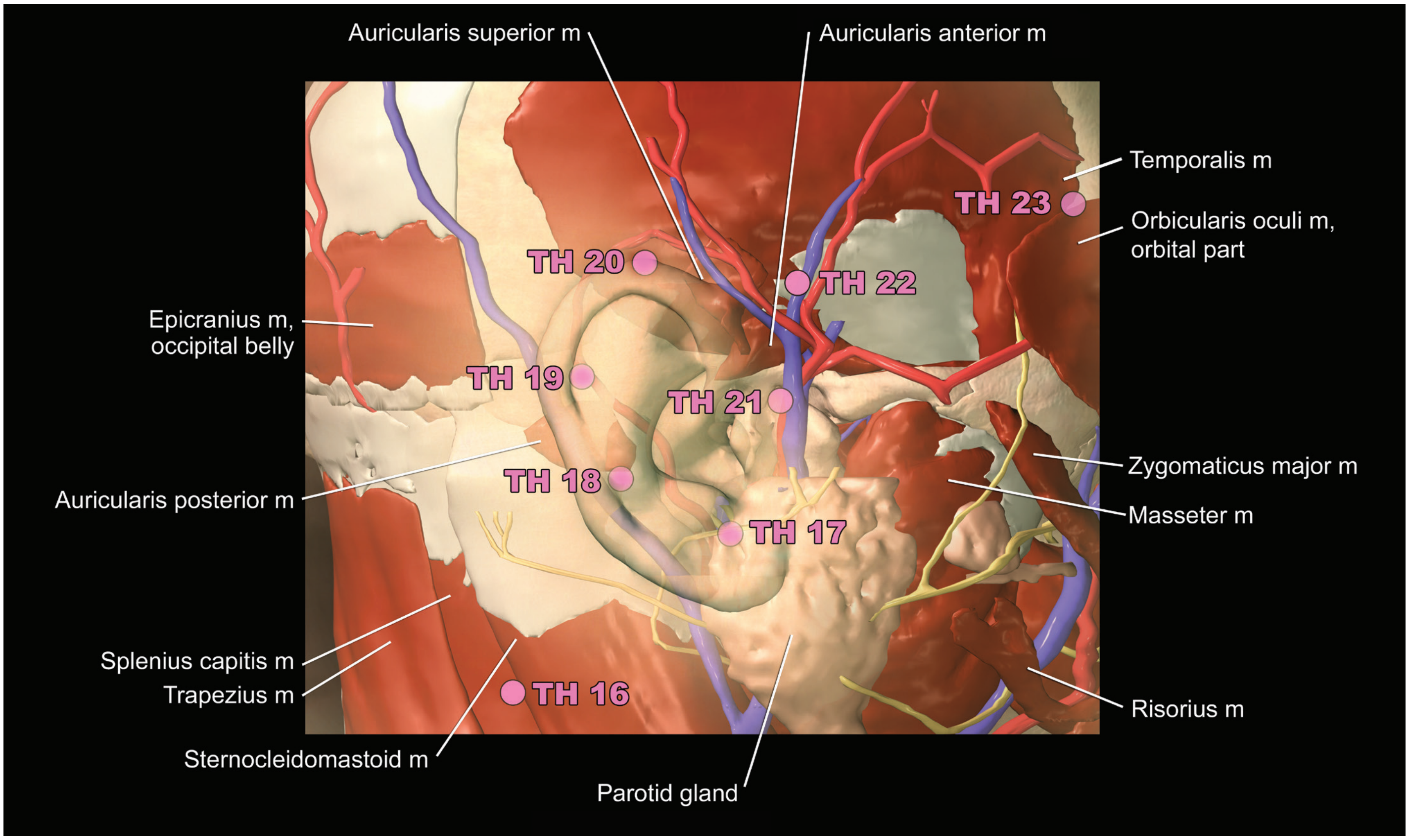

Auricularis superior m
Auricularis anterior m
Temporalis m
TH 23
Orbicularis oculi m, orbital part
TH 20
TH 22
Epicranius m, occipital belly
TH 19
TH 21
Zygomaticus major m
TH 18
Masseter m
Auricularis posterior m
TH 17
Splenius capitis m
Trapezius m
TH 16
Risorius m
Sternocleidomastoid m
Parotid gland

Figure 10-69. TH 23 borders both the temporalis and orbicularis oculi muscles. Neuromodulation at TH 23 can deactivate myofascial trigger points in each.

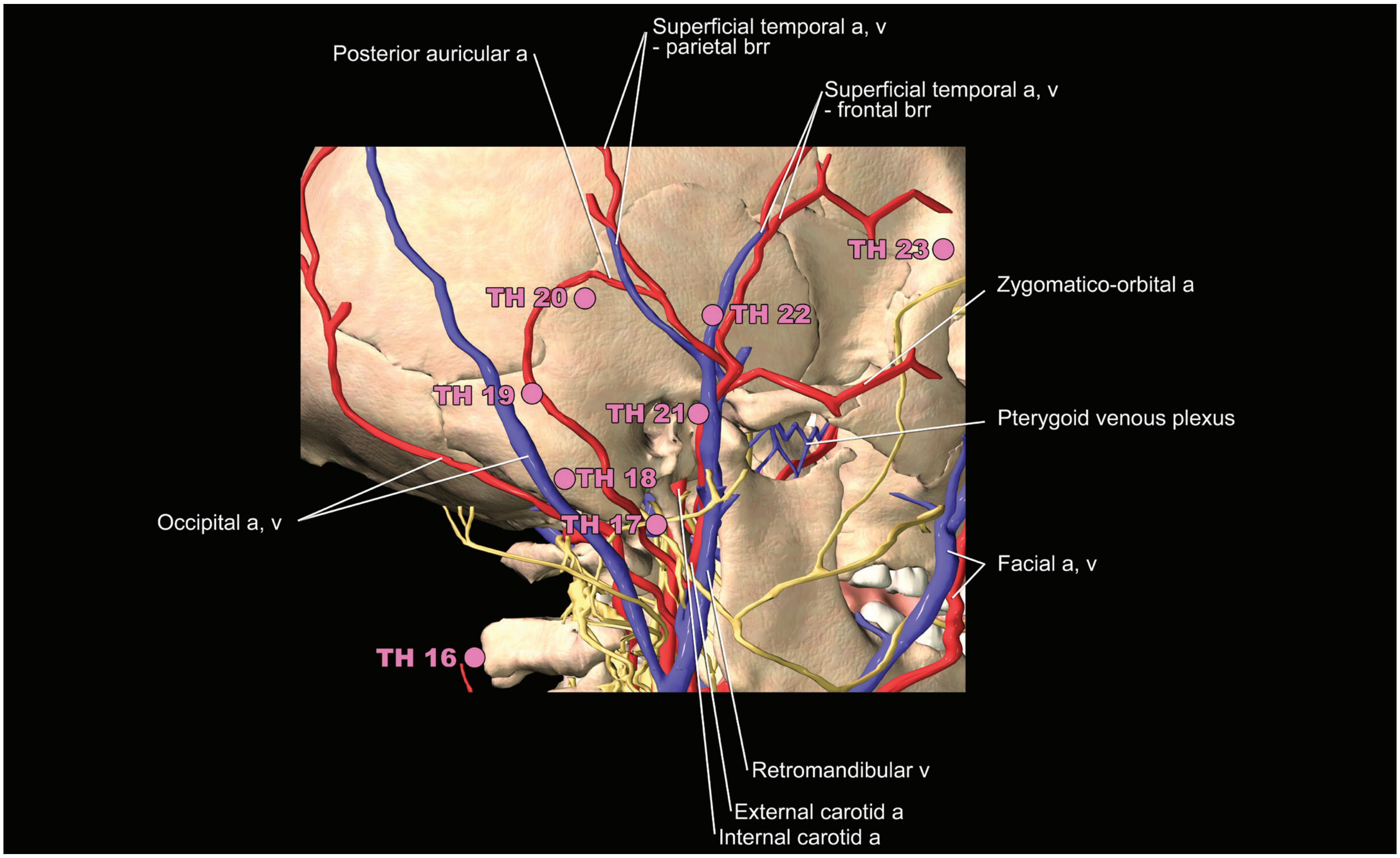

Superficial temporal a, v
- parietal brr
Posterior auricular a
Superficial temporal a, v
- frontal brr
TH 23
Zygomatico-orbital a
TH 20
TH 22
TH 19
TH 21
Pterygoid venous plexus
TH 18
Occipital a, v
TH 17
Facial a, v
TH 16
Retromandibular v
External carotid a
Internal carotid a

Figure 10-70. The TH channel encircles the ear as it accompanies the posterior auricular and the superficial temporal artery until the channel's end at TH 23.

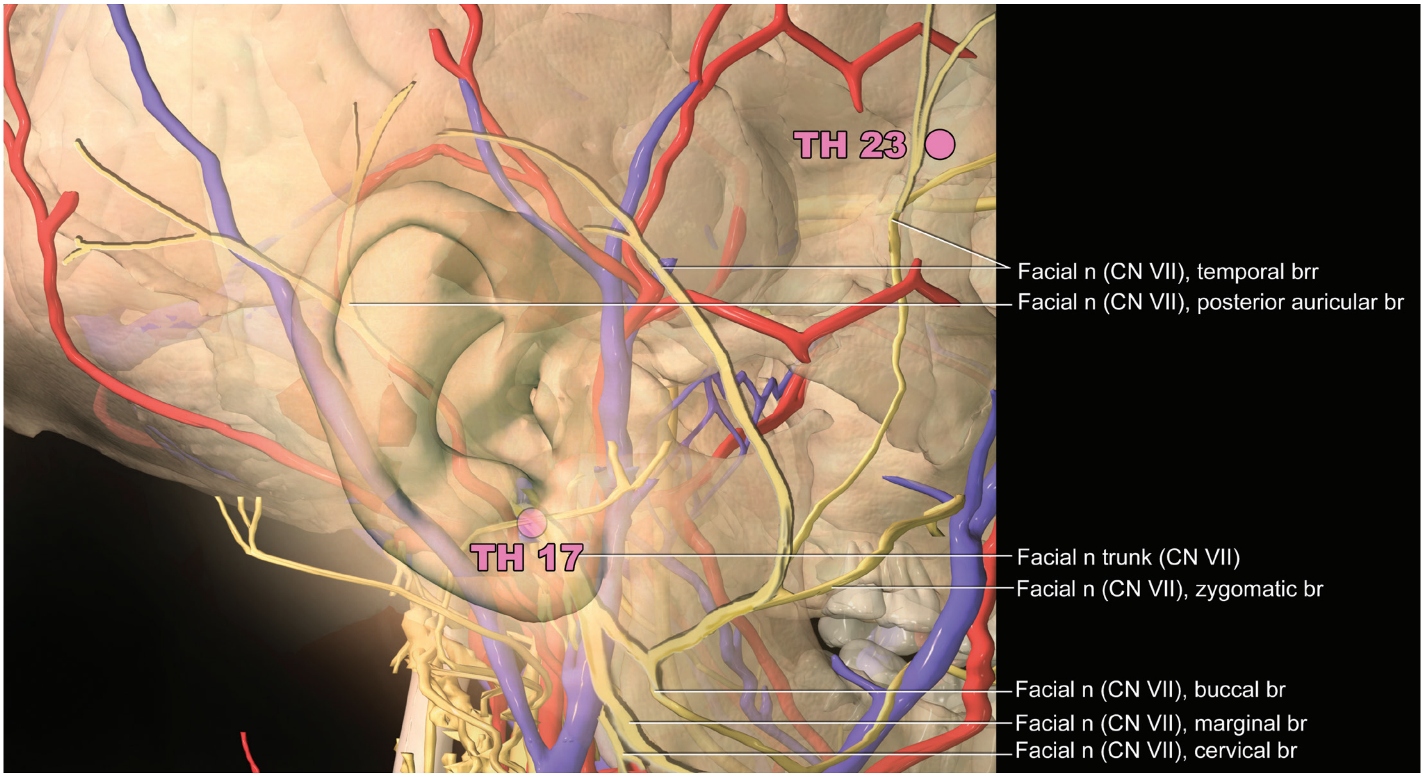

TH 23
Facial n (CN VII), temporal brr
Facial n (CN VII), posterior auricular br
TH 17
Facial n trunk (CN VII)
Facial n (CN VII), zygomatic br
Facial n (CN VII), buccal br
Facial n (CN VII), marginal br
Facial n (CN VII), cervical br

Figure 10-71. Facial nerve injury of the temporal branch can rob the dorsal portion of the orbicularis muscle of its motor supply, at least temporarily. Treatment with acupuncture and related techniques may target the axon of this nerve branch that connects TH 17 to TH 23..

zygomaticotemporal nerves (CN V_2): Supplies sensation to the skin over the zygomatic arch and over the anterior temporal region. The zygomatic nerve transmits postsynaptic parasympathetic fibers that arise from the pterygopalatine ganglion to the lacrimal nerve. The zygomaticotemporal nerve provides the lacrimal gland with secretomotor function. Like the zygomaticotemporal nerve, the zygomaticofacial nerve emerges through a foramen that bears its name.

- **Lacrimal nerve (CN V_1):** The lacrimal nerve provides sensation to the lacrimal gland and a small area of skin and conjunctiva in the lateral part of the upper eyelid. Certain individuals lacks a lacrimal nerve; when this happens, the zygomaticotemporal nerve supplies sensation to the lacrimal gland.[7] A small branch of the zygomaticotemporal nerve may communicate with the auriculotemporal nerve from the mandibular division of the trigeminal nerve (CN V_3) and/or with the facial nerve.[7]
- **Temporal branch of the facial nerve (CN VII):** The temporal branch of the facial nerve supplies the superior and anterior auricular muscles, the frontal belly of the occipitofrontalis (epicranius) muscle, and the superior part of the orbicularis oculi muscle.
- **Zygomatic branch of the facial nerve (CN VII):** The zygomatic branch of the facial nerve supplies the orbicularis oculi muscle (mainly inferior portions) and other facial muscles inferior to the orbit.

Clinical Relevance: The pain that refers from an orbicularis oculi trigger point at TH 23 highlights communication between the facial nerve and the ophthalmic division of the trigeminal nerve. In this case, the referall of discomfort to the nose is explained by crosstalk with the nasociliary nerve and its terminal branches. These branches include the infratrochlear nerve that sends sensation from the medial eyelids and sides of the nose, and the external nasal nerve from the skin over the nostrils and nasal bridge.

TH 23 identifies a site of much crosstalk between nerves, involving branches from the ophthalmic and maxillary divisions of the trigeminal nerve and the zygomatic and temporal branches of the facial nerve. Review these intersections in Figure 10-72.

Specifically, the lacrimal nerve, a branch of the ophthalmic division (V1) conveys sensation from the lateral upper lid, conjunctiva, and lacrimal gland. Secretomotor (postganglionic, parasympathetic) fibers from the facial nerve (CN VII) travel briefly with the lacrimal nerve in its distal portion. The nerve then enters the orbit between the lateral rectus muscle and the orbital roof to join the nasociliary and frontal nerves at the superior orbital fissure. The lacrimal nerve communicates with the zygomaticotemporal nerve, which also travels in the company of postganglionic parasympathetic fibers from the facial nerve, destined for the lacrimal gland. The zygomaticotemporal nerve joins with the zygomaticofacial nerve to form the zygomatic nerve that courses along the orbit's floor to join the maxillary nerve after it enters the inferior orbital fissure. These interneural connections illustrate why TH 23 occupies a key location for stimulation in conditions involving impaired lacrimal secretion, such as dry and itching eyes.[3]

Communication between the facial and trigeminal nerve's zygomaticotemporal branches takes place between TH 23 and TH 22.[4] HIstochemical analyses of these connections suggest that the communicating branches contain myelinated fibers that could supply proprioceptive function, motor control, or both to periocular anatomy. These findings highlight the importance of sites on the face where such communications exist for recovery of facial nerve function following injury.

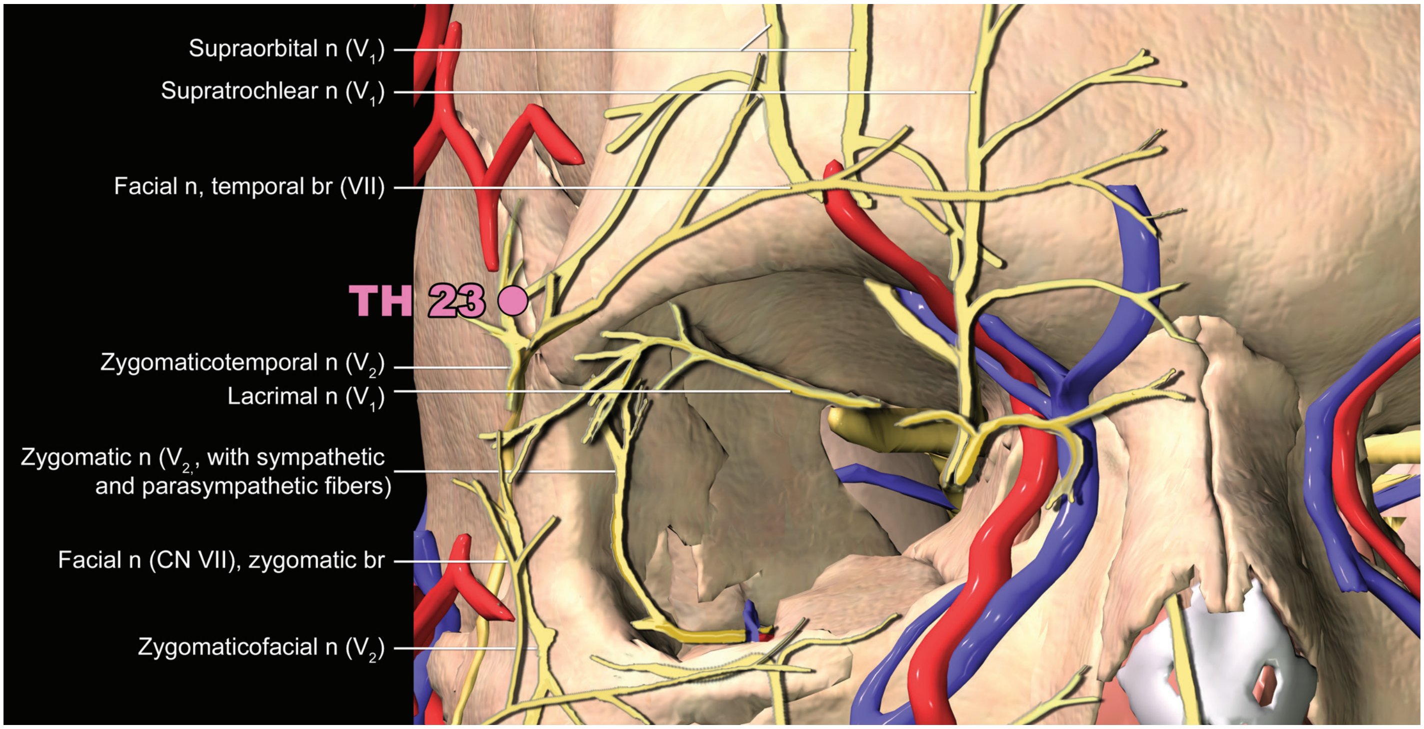

Supraorbital n (V_1)
Supratrochlear n (V_1)
Facial n, temporal br (VII)
TH 23
Zygomaticotemporal n (V_2)
Lacrimal n (V_1)
Zygomatic n ($V_{2,}$, with sympathetic and parasympathetic fibers)
Facial n (CN VII), zygomatic br
Zygomaticofacial n (V_2)

Figure 10-72. Nerves of several types intersect at TH 23, highlighting the point's clinical indications for ophthalmic disorders and craniofacial discomfort.

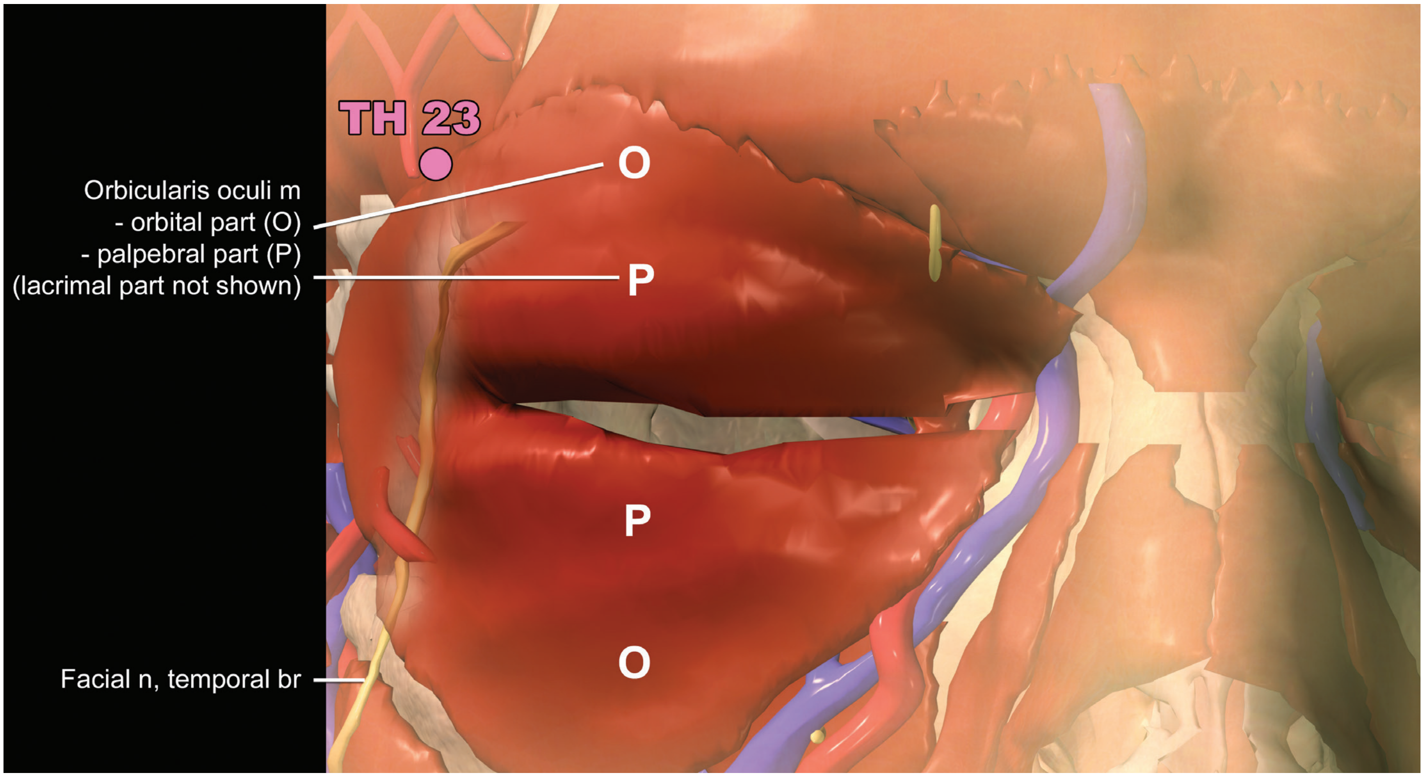

TH 23
Orbicularis oculi m
- orbital part (O)
- palpebral part (P)
(lacrimal part not shown)
O
P
P
O
Facial n, temporal br

Figure 10-73. This image illustrates the course of the temporal branch of the facial nerve as it ascends the temporal zone to supply the dorsal orbicularis oculi m. Nerve axons provide their own trajectories along which to target neuromodulation. As noted previously, treatment of an injured temporal branch could include the site where the nerve exits the skull at TH 17, its destination in and around TH 23, and point in-between.

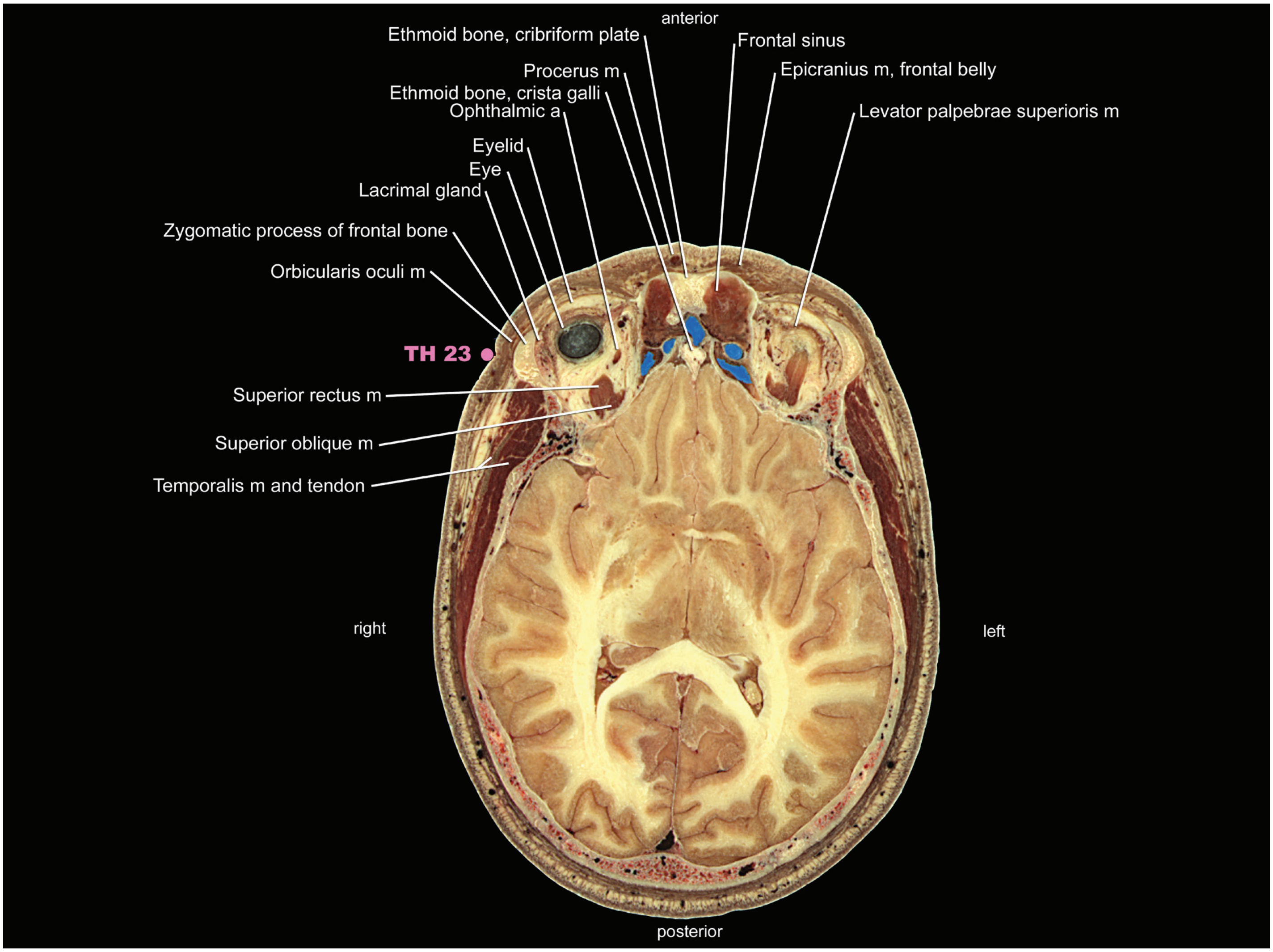

anterior
Ethmoid bone, cribriform plate
Frontal sinus
Procerus m
Epicranius m, frontal belly
Ethmoid bone, crista galli
Ophthalmic a
Levator palpebrae superioris m
Eyelid
Eye
Lacrimal gland
Zygomatic process of frontal bone
Orbicularis oculi m
TH 23
Superior rectus m
Superior oblique m
Temporalis m and tendon
right
left
posterior

Figure 10-74. For TH 23, the name "Silken Bamboo Hollow" refers to the depression at the end of the eyebrow, metaphorically described as a "bamboo leaf". Note how as one courses laterad along the leaf, one hops off the steep cliff of the lateral orbit and lands in the lush temporalis muscle. Feel this on your own face and assess the tenderness to palpation here.

Entrapment or compression of the zygomaticotemporal branch of the trigeminal nerve appears to cause frontal migraine headaches.[5] Entrapment can occur due to pressure from the temporalis muscle because part of the nerve's journey takes it through the temporalis muscle or at least beneath its fascia. Treating trigger points with botulinum toxin type A injection may cause diplopia if it affects the lateral rectus muscle. Visual disturbances can last several months or more. Thus, safer means of deactivating trigger points in the zygomaticotemporal region would substitute acupuncture, laser therapy, and soft tissue manual treatment for pharmaceuticals and harsher methods.

Vessels

- **Zygomatico-orbital artery:** Arises from the superficial temporal artery and distributes to the orbicularis oculi muscle and parts of the orbit. The zygomatico-orbital artery anastomoses with branches of the ophthalmic artery.

Clinical Relevance: Scalp arteries with neuropathic vasa nervorum include the zygomatico-orbital, occipital, and posterior auricular vessels. Pressure on these vessels may lead to migraines. Patients with nociceptively charged arterial walls on their scalp exhibit tenderness to palpation both during headache and between migraines. Acupuncture and related techniques aid in reducing pressure on these vessels by neuromodulating nerve networks supplying vessels and allowing relaxation of compressive overlying soft tissues.

This new view of migraine etiology has been named the "trigeminovascular hypothesis of headache generation", suggesting a shift of perspective and treatments to target a extracranial as well as intracranial problems.[6]

Indications and Potential Point Combinations

- **Temporal headache:** TH 23, TH 22, tender GB and TH points as well as local temporalis trigger points, GB 21, BL 10.
- **Migraine (frontal):** TH 23, GB 14, BL 2, LI 4, LR 3, GV 20, and pertinent trigger points.
- **Dizziness, vertigo:** TH 23, TH 21, GB 20, BL 10, GV 20.
- **Eye problems: pain, inflammation, dryness, blepharospasm:** TH 23, GB 1, GB 20, BL 1, ST 36, LR 3, GV 20.

- **Facial paralysis:** Identify facial nerve branches involved. Begin with TH 17, follow the course of the affected facial nerve pathway(s) both along the axon and to the muscular destination.

TH 23 comes into play for problems closing the eye, when trauma or other pathology impairs the function of facial nerve branches supplying the orbicularis oculi muscle. BL 2 and GB 1 would be good adjunctive points.

- **Facial pain:** A trigger point at TH 23 refers pain that extends in a medial direction along the eyebrow, down the nose and to the surrounding cheek and upper lip. TH 23, BL 2, LI 20 follow this pain pattern.

Evidence-Based Applications

- Treatment with acupuncture at TH 23, GB 14, BL 2, Taiyang, ST 1, GB 20, LI 4, LI 11, and GV 23 improved **dry eye** patients' ocular surface disease index (OSDI), lessened pain, and increased tear film break up time significantly after eight weeks of treatment.[7]
- Acupuncture at TH 23, BL 2, and Taiyang stimulated **lacrimal gland secretion and improved protein levels** in tear of rabbits receiving acupuncture.[8]

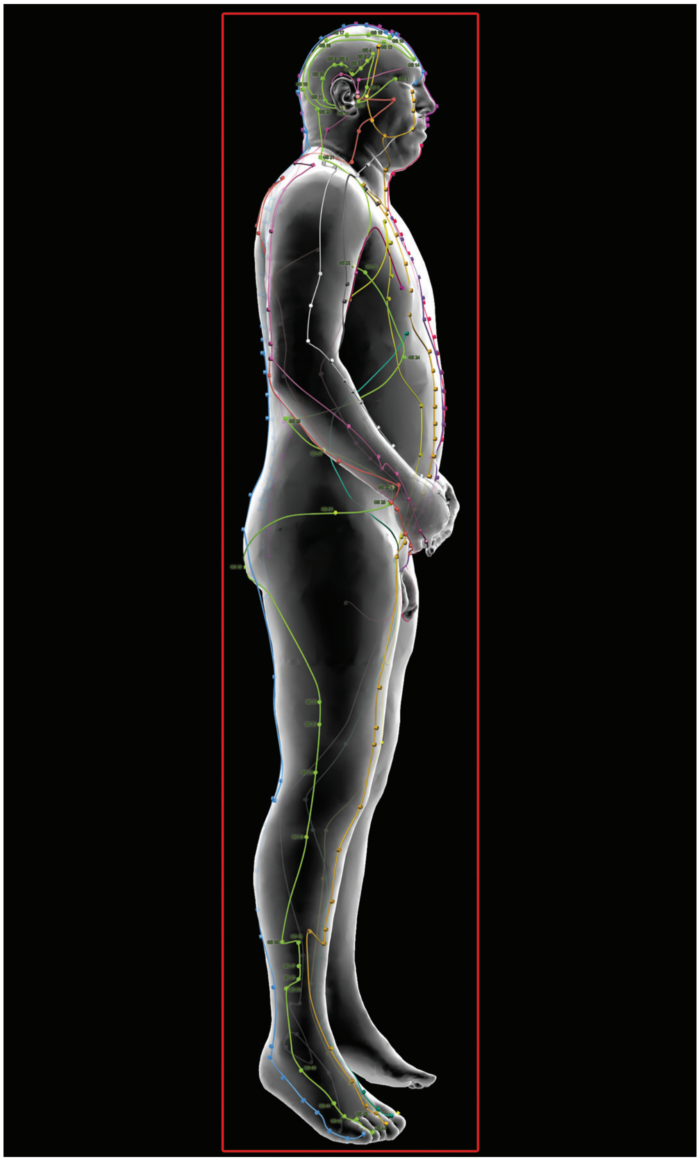
References

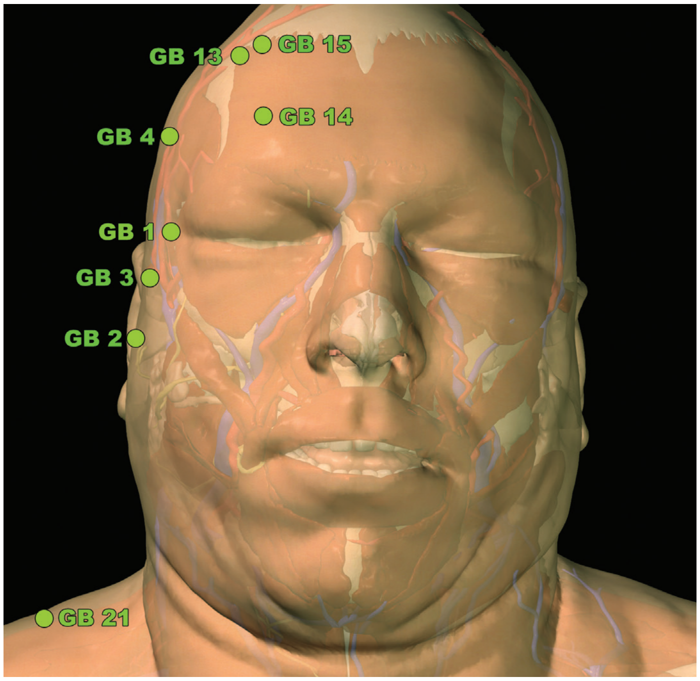
1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Wilson-Pauwels L, Akesson EJ, and Stewart PA. *Cranial Nerves. Anatomy and Clinical Comments*. Hamilton: BC Decker, Inc., 1988. P. 60.
3. Wilson-Pauwels L, Akesson EJ, and Stewart PA. Cranial Nerves. *Anatomy and Clinical Comments*. Hamilton: BC Decker, Inc. 1988.)
4. Odobescu A, Williams HB, and Gilardino MS. Description of a communication between the facial and zygomaticotemporal nerves. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2012;65:1188-1192.
5. Janis JE, Hatef DA, Thakar H, et al. The zygomaticotemporal branch of the trigeminal nerve: Part II. Anatomical variations. *Plast Reconstr Surg.* 2010;126:435-442.
6. Cianchetti C. The role of the neurovascular scalp structures in migraine. *Cephalalgia.* 2012;32(10):778-784.
7. Kim T-H, Kang JW, Kim KH, et al. Acupuncture for the treatment of dry eye: a multicenter randomised controlled trial with active comparison intervention (artificial teardrops). PLoS ONE. 2012; 7(5): e36638. doi:10.1371/journal.pone.0036638
8. Qiu X, Gong L, Sun X, et al. Efficacy of acupuncture and identification of tear protein expression changes using iTRAQ quantitative proteomics in rabbits. *Curr Eye Res.* 2011;36(10):886-894.

Channel 11:: The Gallbladder (GB)

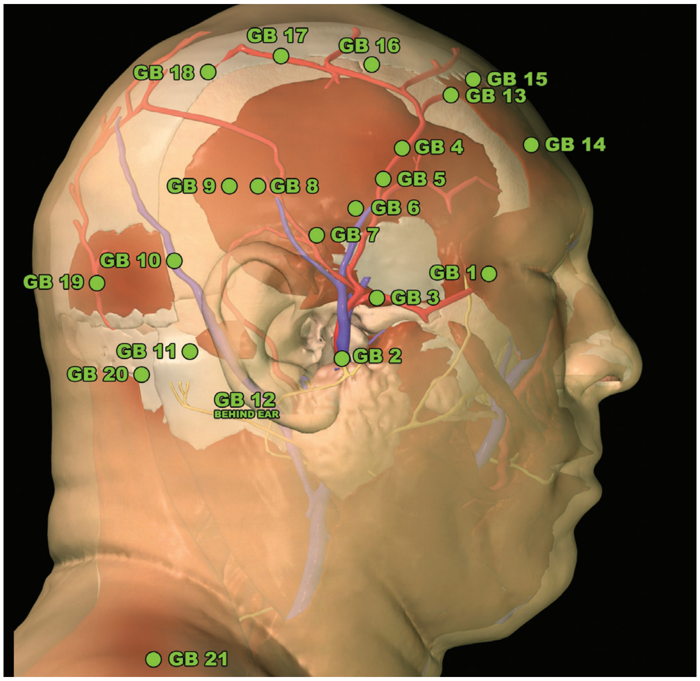
The GB line embarks on its long voyage just lateral to the lateral canthus of the eye. It zigzags from head to foot over the lateral aspect of the body until it reaches the foot and the 4th toe. Together with the TH line, the GB channel travels along that aspect of the body that acts to turn a cartwheel.

The GB channel trajectory overlies areas primarily involved with structural problems and associated pain.

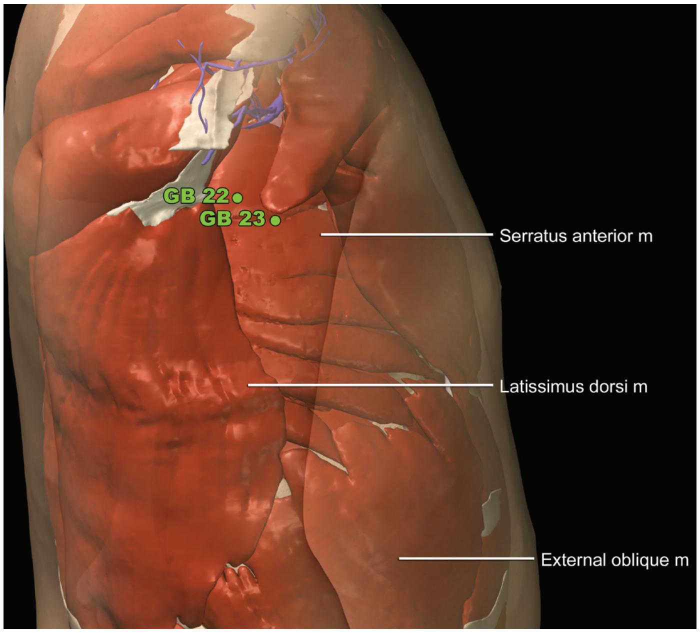



GB 13
GB 15
GB 14
GB 4
GB 1
GB 3
GB 2
GB 21

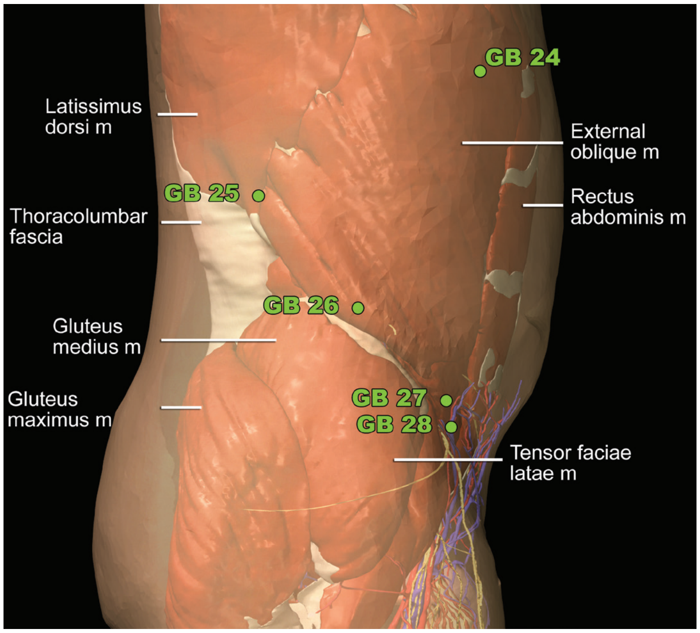
Tension in the extracranial musculature can cause chronic pain, headaches, and visual or vestibular disturbance. The GB points depicted in this anterior view illustrate connections between muscles on the head and local GB points. GB points on the face also appear in "acupuncture facelift" protocols because unabated underlying muscle tension can cause unwelcome "crow's feet" (GB 1) and "frown lines" (GB 14).


GB 17
GB 16
GB 18
GB 15
GB 13
GB 4
GB 14
GB 9
GB 8
GB 5
GB 6
GB 7
GB 10
GB 19
GB 1
GB 3
GB 11
GB 2
GB 20
GB 12
BEHIND EAR
GB 21

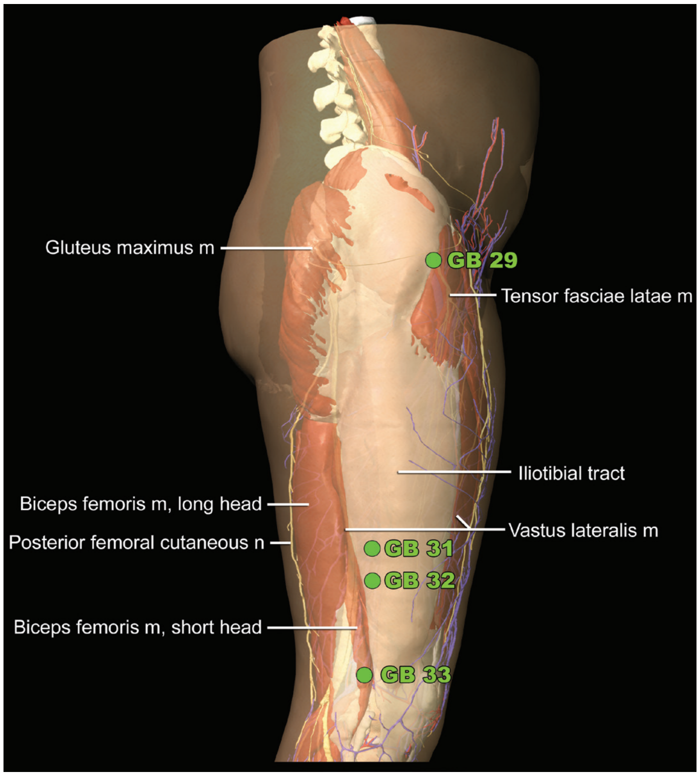
Most human adults and many children harbor tension in the trapezius trigger point at GB 21. Pain issued from GB 21 typically follows the GB trajectory over the head. It may also produce pain at the angle of the mandible at SI 17. This lateral perspective of the extracranial and neck/shoulder musculature outlines the GB pathway traversed by referred pain from GB 21.


GB 22
GB 23
Serratus anterior m
Latissimus dorsi m
External oblique m

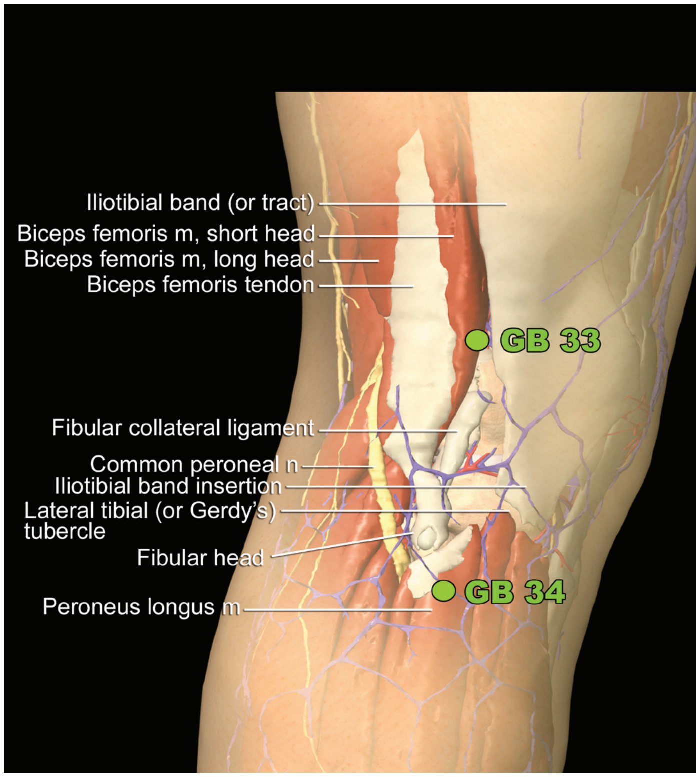
This image of the upper lateral thorax shows GB 22, GB 23 and the latissimus dorsi and serratus anterior muscles respectively. Trigger points in the latissimus dorsi muscle produce pain in the mid thorax at the caudal end of the scapula. This pain may extend down the SI and TH lines of the thoracic limb. Trigger points in the serratus anterior produce painful, paresthetic, and possibly pruritic patterns that create diagnostic enigmas. "Notalgia paresthetica" denotes long thoracic nerve irritation and myofascial dysfunction of the serratus anterior muscle. Referred pain pattern from trigger points in the serratus anterior overlaps considerably with that of notalgia paresthetica, suggesting a common pathophysiology. Pain may extend along the HT and PC lines of the thoracic limb.


GB 24
Latissimus dorsi m
External oblique m
GB 25
Rectus abdominis m
Thoracolumbar fascia
GB 26
Gluteus medius m
Gluteus maximus m
GB 27
GB 28
Tensor faciae latae m

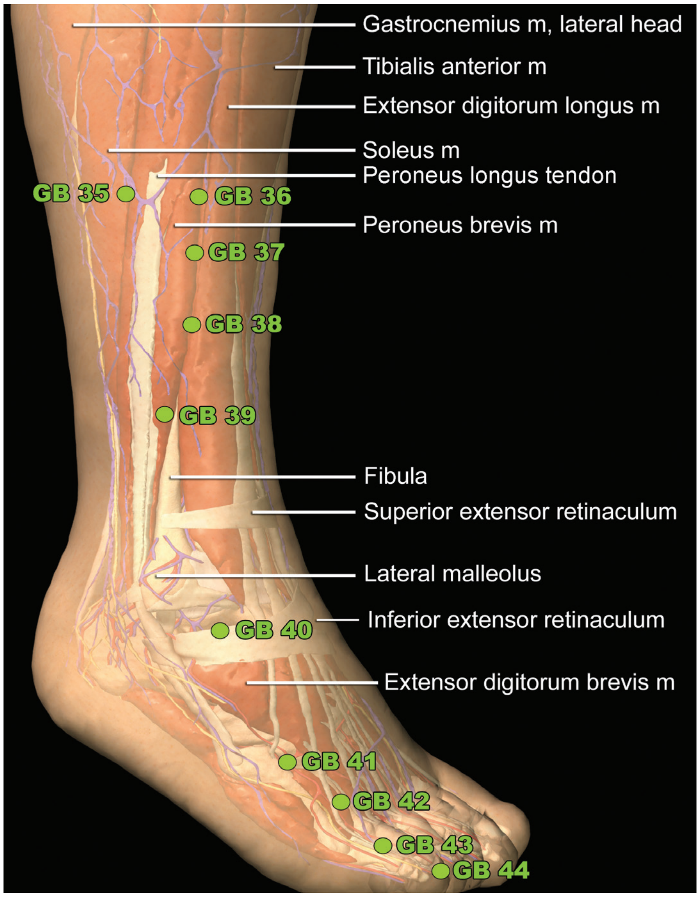
GB points (GB 24 to GB 28) encircle the abdomen and ride over the rim of the pelvis. Myofascial trigger points in the oblique and transverse abdominal muscles cause abdominal wall pain plus or minus visceral dysfunction. Trigger point pathology in the external oblique muscle at GB 24 may induce heartburn-like pain. GB 25 identifies the location of the "belch button", associated with eructation and projectile vomiting. Trigger points at GB 26, GB 27, and GB 28 provoke groin or testicular pain and diarrhea.


Gluteus maximus m
GB 29
Tensor fasciae latae m
Iliotibial tract
Biceps femoris m, long head
Vastus lateralis m
Posterior femoral cutaneous n
GB 31
GB 32
Biceps femoris m, short head
GB 33

The fascia lata on the pelvic limb forms a "veritable stocking" or "ectoskeleton" for the muscles it embraces. The iliotibial band (ITB) constitutes a thickening of this fascia on the lateral thigh. The ITB functions as a tendon for the tensor fasciae latae and gluteus maximus muscles. It also acts as a brace for the knee by providing lateral stability. Palpate the ITB for trigger point pathology and deactivate accordingly. The convergence of the GB line and the ITB denotes the value of GB points (i.e., GB 29 through GB 33) for ITB syndrome.


Iliotibial band (or tract)
Biceps femoris m, short head
Biceps femoris m, long head
Biceps femoris tendon
GB 33
Fibular collateral ligament
Common peroneal n
Iliotibial band insertion
Lateral tibial (or Gerdy's) tubercle
Fibular head
GB 34
Peroneus longus m

This image illustrates how GB 33 and GB 44 interface with stabilizers of the knee, including the fibular (lateral) collateral ligament and the peroneus (fibularis) muscles.


Gastrocnemius m, lateral head
Tibialis anterior m
Extensor digitorum longus m
Soleus m
Peroneus longus tendon
GB 35
GB 36
Peroneus brevis m
GB 37
GB 38
GB 39
Fibula
Superior extensor retinaculum
Lateral malleolus
Inferior extensor retinaculum
GB 40
Extensor digitorum brevis m
GB 41
GB 42
GB 43
GB 44

The GB line from knee to foot follows the peroneus (now called fibularis) muscles and both superficial and deep branches of the peroneal (fibular) nerve. In keeping with the motif set by more proximal pelvic limb GB points, those on the distal limb, ankle, and foot also impact stabilizing structures.

GB 1

Tong Zi Liao "Pupil Crevice", "Pupil Bone Hole"

In a small depression on the lateral rim of the orbit, 0.5 cun lateral to the outer canthus of the eye.

Muscles

- **Orbicularis oculi muscle:** Closes the eye and wrinkles the overlying skin.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: Mechanical or emotional strain in the orbicularis oculi muscle may lead to "twitching" or fasciculation around the eye. Acupressure applied to GB 1 often stops the twitch. The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

Nerves

- **Anterior and posterior deep temporal nerves (CN V$_3$):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Lacrimal nerve (CN V$_1$):** Supplies the skin over the lateral upper eyelid, the conjunctiva deep to this region, and the lacrimal gland.
- **Zygomatic nerve, which splits into the zygomaticofacial and zygomaticotemporal nerves (CN V$_2$):** Supplies sensation to the skin over the zygomatic arch and over the anterior temporal region. The zygomatic nerve transmits postsynaptic parasympathetic fibers that arise from the pterygopalatine ganglion to the lacrimal nerve. The zygomaticotemporal nerve provides the lacrimal gland with secretomotor function. Like the zygomaticotemporal nerve, the zygomaticofacial nerve emerges through a foramen that bears its name.
- **Zygomatico-facial nerve (CN V$_2$):** Supplies the skin over the zygomatic arch and the anterior temporal zone. Carries postsynaptic parasympathetic fibers from the pterygopalatine ganglion to the lacrimal nerve.

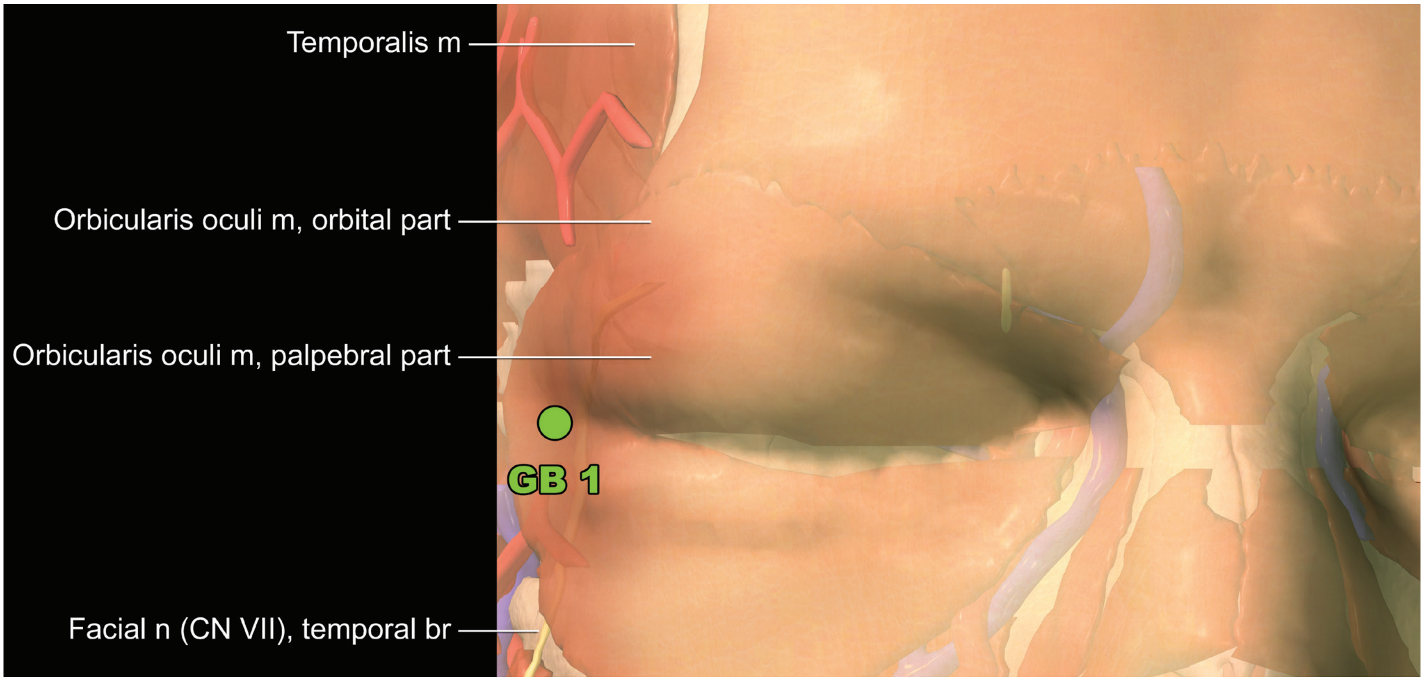

Temporalis m
Orbicularis oculi m, orbital part
Orbicularis oculi m, palpebral part
GB 1
Facial n (CN VII), temporal br

Figure 11-1. GB 1, "Pupil Crevice", denotes the opening through which the pupil peers. The orbicularis oculi muscle forms the sphincter that creates this crevice. The muscle receives its motor supply from the facial nerve, temporal branch (shown here) and the zygomatic branch (not shown). GB 1 coincides with the motor point of the orbicularis oculi muscle. Chronic activation of this ocular sphincter cultivates skin folds known as "crow's feet". Emotional or somatic overstimulation can produce an "eye tic".

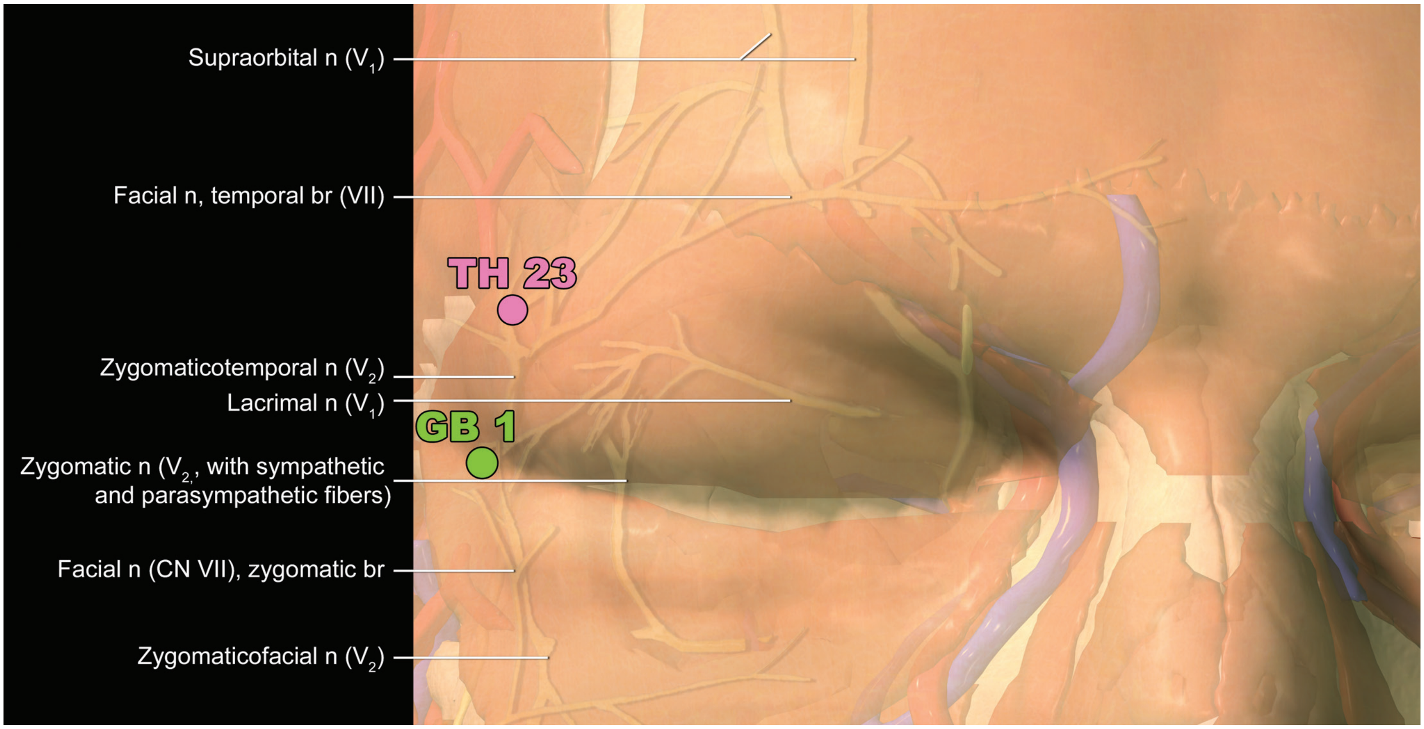

Supraorbital n (V_1)
Facial n, temporal br (VII)
TH 23
Zygomaticotemporal n (V_2)
Lacrimal n (V_1)
GB 1
Zygomatic n (V_2, with sympathetic and parasympathetic fibers)
Facial n (CN VII), zygomatic br
Zygomaticofacial n (V_2)

Figure 11-2. Neural input from the trigeminal and facial nerves converges at GB 1. These intersecting nerves provide effective opportunities by which to address ophthalmic disorders such as impaired lacrimation and ocular pain

- **Facial nerve (CN VII), temporal and zygomatic branches:** Innervate the superior and inferior parts of the orbicularis oculi muscle, respectively. The temporal branch also supplies the auricularis superior and auricularis anterior muscles, as well as the frontal belly of the occipitofrontalis muscle. The zygomatic branch supplies muscles inferior to the orbit, in addition to the orbicularis oculi muscle. GB 1 is the motor point for the orbicularis oculi muscle.[2]

Clinical Relevance: The lacrimal, supraorbital, and zygomaticotemporal, and zygomaticofacial nerves supply sensation to the skin of the lateral canthus at and around GB 1. The latter two (zygomaticotemporal and zygomaticofacial) communicate with the auriculotemporal nerve (from V3) through a small branch, neuroanatomically linking GB 1 to GB 2. Stimulation of trigeminal nerve branches near the orbit causes reflex activation of autonomic ganglia, leading to reflex vasodilation of vessels

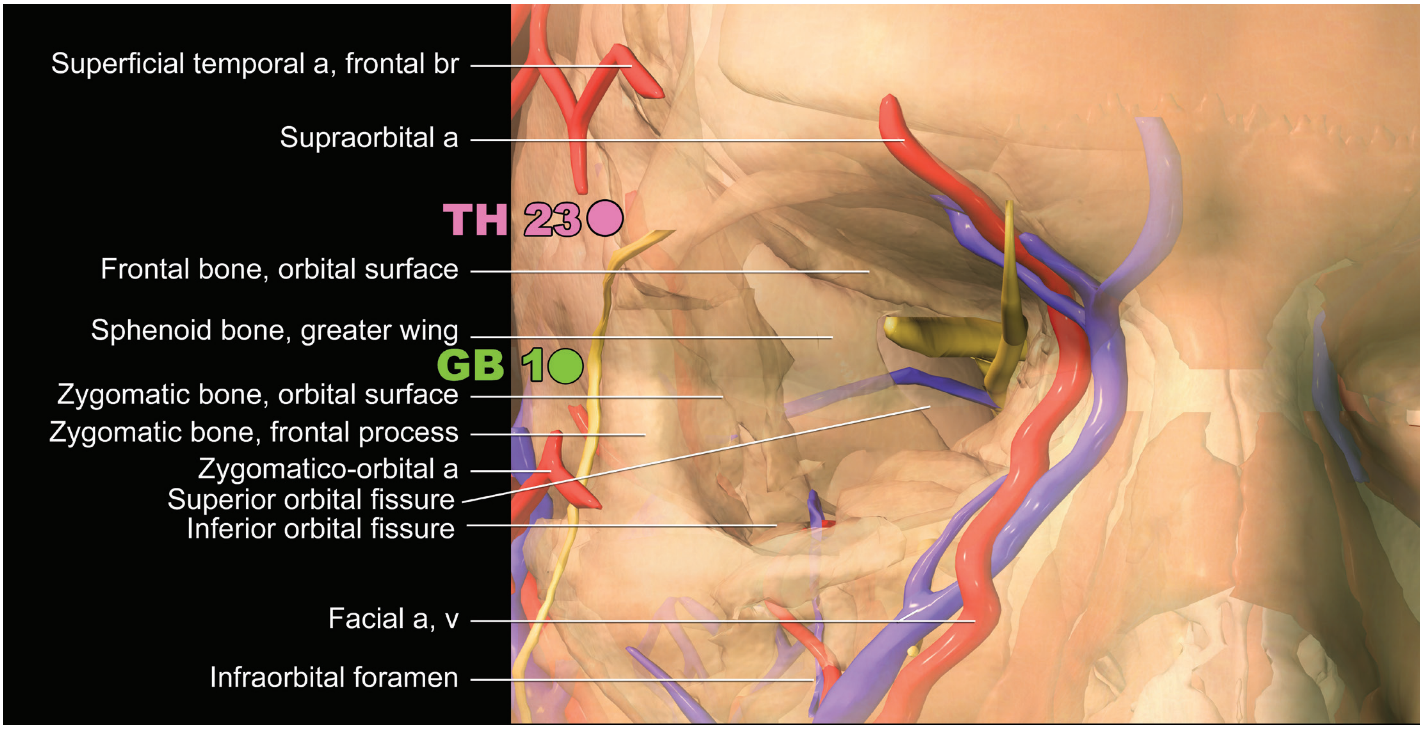

Superficial temporal a, frontal br
Supraorbital a
TH 23
Frontal bone, orbital surface
Sphenoid bone, greater wing
GB 1
Zygomatic bone, orbital surface
Zygomatic bone, frontal process
Zygomatico-orbital a
Superior orbital fissure
Inferior orbital fissure
Facial a, v
Infraorbital foramen

Figure 11-3. A semitransparent skull allows visualization of the course of intracranial neurovascular structures proximal to their egress through bony foramina and fissures.

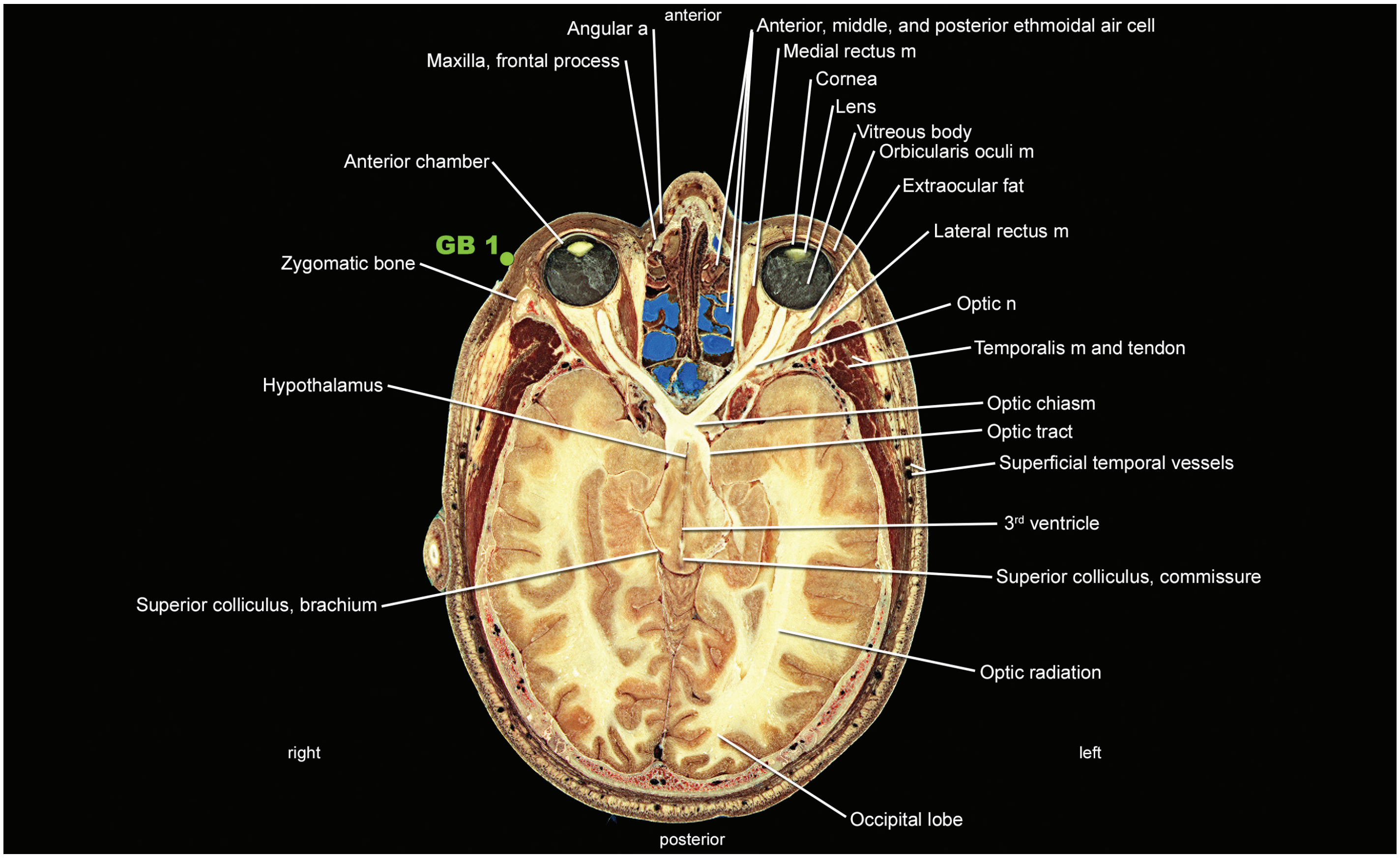

anterior
Angular a
Maxilla, frontal process
Anterior, middle, and posterior ethmoidal air cell
Medial rectus m
Cornea
Lens
Vitreous body
Orbicularis oculi m
Anterior chamber
Extraocular fat
GB 1
Lateral rectus m
Zygomatic bone
Optic n
Temporalis m and tendon
Hypothalamus
Optic chiasm
Optic tract
Superficial temporal vessels
3rd ventricle
Superior colliculus, commissure
Superior colliculus, brachium
Optic radiation
right
left
Occipital lobe
posterior

Figure 11-4. GB 1, also called "Pupil Bone Hole" lands level with the pupil when the patient looks forward, as shown here.

leading to the eye. Trigeminal stimulation also invokes release of the vasoactive neuropeptides, calcitonin gene-related peptide (cGRP) and substance P. This reflex arc induces the release of vasoactive intestinal polypeptide (VIP) and nitric oxide (NO).[8,9] Crosstalk between periocular trigeminal nerve branches (most notably the lacrimal and zygomatic nerves) carries parasympathetic, postganglionic secretomotor fibers from the facial nerve to the lacrimal gland. These aspects of the neuroanatomy supplying GB 1 speaks to its frequent inclusion in acupuncture protocols for dry eye conditions.[10]

Vessels

- **Zygomatico-orbital and zygomatico-temporal arteries:** Provide blood flow to this small region of the face.

Clinical Relevance: Scalp arteries that develop neuropathic vasa nervorum include the zygomatico-orbital, occipital, and posterior auricular vessels. Pressure on these vessels may lead to migraines. Patients with nociceptively charged arterial walls on their scalp exhibit tenderness to palpation both during and between migraines. Acupuncture and related techniques aid in reducing pressure on these vessels by neuromodulating nerve networks that supply cranial vessels and by allowing relaxation of overlying soft tissues.

This new view of migraine etiology has been named the "trigeminovascular hypothesis of headache generation", suggesting an expanded perspective that targets extracranial sources in conjunction with intracranial abnormalities.[11]

Indications and Potential Point Combinations

- **Conjunctivitis, dry eye (keratoconjunctivitis sicca):** GB 1, TH 23, BL 2, ST 2, GV 20, ST 36, LR 3.
- **Headache radiating to the eye:** GB 1, BL 10, temporalis trigger points, GV 14, GV 20.
- **Facial tic, eye twitch:** GB 1, follow facial nerve from TH 17 along zygomatic branch and temporal branch (also consider ST 6, SI 18)
- **"Crow's feet" wrinkles:** GB 1, temporalis trigger points.
- **Optic nerve atrophy:** GB 1, GB 20, BL 1, LI 4, KI 7, SP 6, and LR 3.

Evidence-Based Applications

- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with **keratoconjunctivitis sicca (KCS, or dry eye).**[3]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **KCS.**[4]
- Electroacupuncture at GB 1/LR 14 and LR 3/ LR 8, along with dry needling at LR 14, GB 41, and ST 1 led to statistically significant improvement in **dry eye symptoms** in 88% of patients.[5]
- GB 1 and ST 4 successfully resolved **idiopathic Horner's syndrome** in a dog after two treatments.[6]
- By employing "commonly used points": BL 1, GB 1, GB 20, LI 4, KI7, SP6, and LR3, along with "reserve points" (BL 2, ST 2, TH 5,

GB 37, ST 36, KI3, KI 6, LR 8, PC 6, BL 13, BL 18, BL 21, GV4, BL 10, SI 6, BL 58, and BL 23 produced improvement in patients suffering from **optic nerve atrophy or optic neuritis.**[7]

- Acupuncture at GB 1, GB 14, and BL 1 lowered **intraocular pressure** in healthy subjects but was not significantly different from sham points, showing the need for a neuroanatomically based selection of sham points that produce no neurophysiologic overlap.[12]

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Liu YK, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med.* 1975;3(4):347-358.
3. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand.* 2004;82:283-290.
4. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2.* New York: Plenum Press, 1998. pp. 1011-1016.
5. Eliason KJ, Richards SC, and Schaumaun GT. Acupuncture treatment for dry eye. *Medical Acupuncture.* 2007;19(1):25-28.
6. Cho SJ and Kim O. Acupuncture treatment for idiopathic Horner's syndrome in a dog. *J Vet Sci.* 2008;9(1):117-119.
7. Huang SY and Zeng Y. Clinical observation on treatment of disorders of the optic nerve by acupuncture. *Journal of Traditional Chinese Medicine.* 1985;5(3):187-190.
8. Raval P, Bingham S, Aiyar N, et al. Trigeminal nerve ganglion stimulation induced neurovascular reflexes in the anaesthetized cat: role of endothelin B receptors in carotid vasodilatation. *British Journal of Pharmacology.* 1999;126:485-493.
9. Goadsby PJ. Trigeminal autonomic cephalalgias. Pathophysiology and classification. *Rev Neurol.* 2005;161(6-7):692-695.
10. Robinson NG, Pederson J, Burghardt T et al. Neuroanatomic structure and function of acupuncture points around the eye. *American Journal of Traditional Chinese Veterinary Medicine.* 2007;2(1):33-44.
11. Cianchetti C. The role of the neurovascular scalp structures in migraine. *Cephalalgia.* 2012;32(10):778-784.
12. Meira-Freitas D, Cariello AJ, Vita RC, et al. Short-term effect of acupuncture on intraocular pressure in healthy subjects. *Acupunct Med.* 2010;28(1):25-27.

GB 2

Ting Hui "Auditory Convergence"

Anterior to the intertragic notch of the auricle and posterior to the condylar process of the mandible. Directly below SI 19. Locate with the patient's mouth open.

Gland

- **Parotid gland:** The largest of the three, paired salivary glands. The facial nerve courses through the parotid gland, as does the retromandibular vein, and the external carotid artery (ECA) and its nerve plexus. The gland contains parotid lymph nodes both within the gland and on its tough fascial capsule, the parotid sheath. These lymph nodes drain lymphatic fluid from the forehead, lateral eyelids, temporal region, lateral auricular surface, anterior wall of the external acoustic meatus, and the middle ear.

Clinical Relevance: A number of tumors, both benign and malignant, along with infections can amplify the size of the parotid gland. Tumor growth within the gland can induce facial pain (mediated by the trigeminal nerve) and facial nerve dysfunction, leading to paresis or paralysis of the muscles of facial expression. Surgical procedures affecting the parotid gland may injure the facial nerve and/or the retromandibular vein.[6]

Remain cognizant of the possible presence of salivary gland tissue at or near GB 2. Avoid needling tumorous or otherwise abnormal tissue.

Nerves

- **Glossopharyngeal nerve (CN IX):** Supplies secretory fibers to the parotid gland, carried by the auriculotemporal nerve to the parotid, from the otic ganglion.
- **Sympathetic nerve fibers (T1-T5):** These fibers reach the parotid gland after leaving the cervical sympathetic ganglia and coursing along the external carotid nerve plexus on the external carotid artery.
- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve trunk (CN VII):** The facial nerve trunk forms the parotid plexus, engulfed by the parotid gland. The parotid plexus forms the five terminal branches of the facial nerve – temporal, zygomatic, buccal, mandibular, and cervical.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[7] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

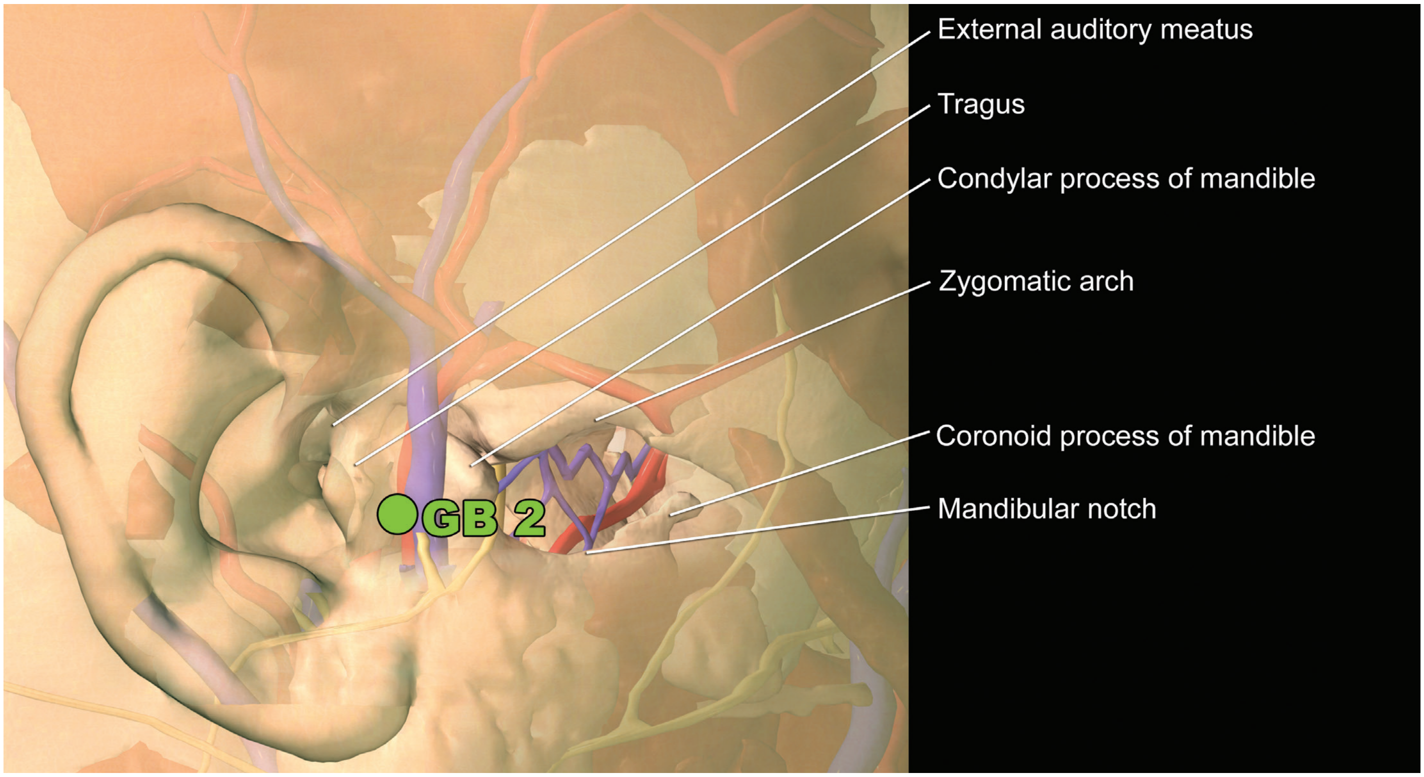


Figure 11-5. GB 2 earns the name "Auditory Convergence" by dint of its close connection with the ear and structures that supply it.

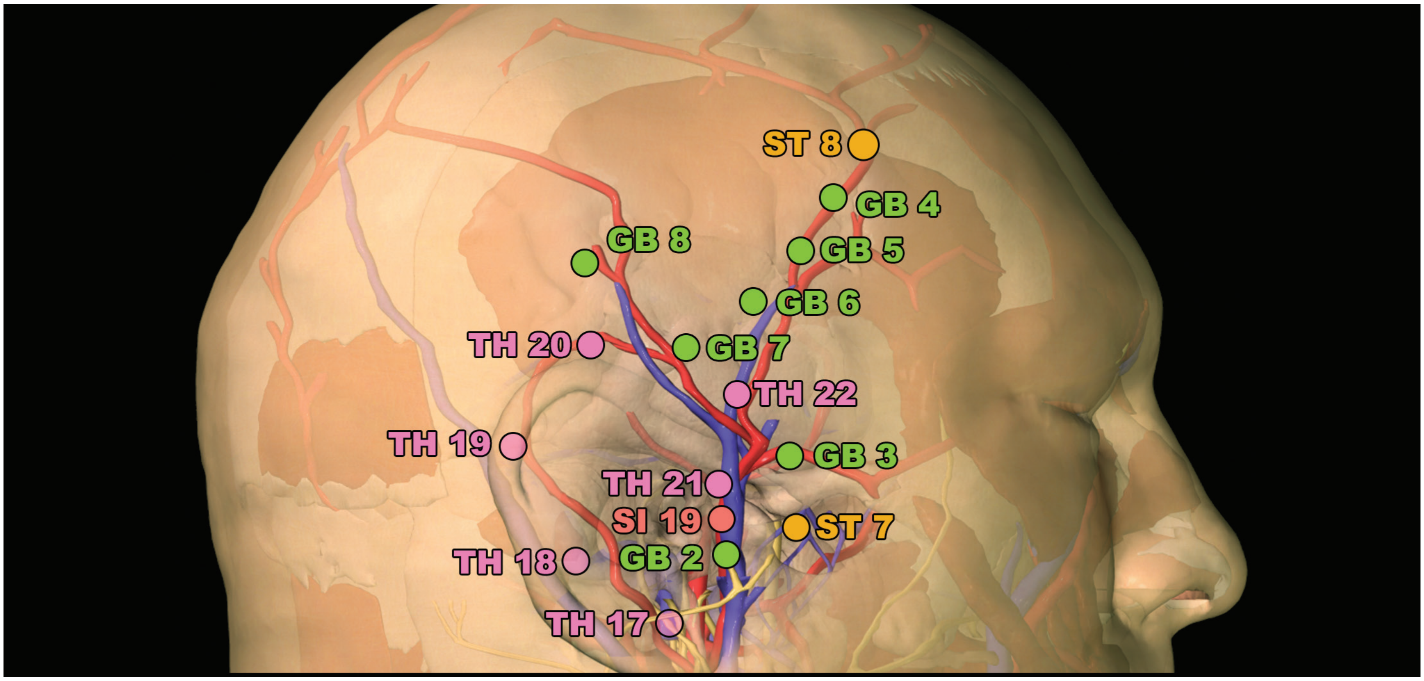


Figure 11-6. Acupuncture points map out a busy neurovascular traffic pattern that surrounds the ear and courses from TMJ to the temple. A neuropathic auriculotemporal nerve, which would follow the vessels shown here mapped out by the GB points, would precipitate or worsen TMJ pain and balance disturbances.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[8] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a “perfect storm” for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersection with the superficial temporal vessels can occur at GB 2 and elsewhere along the nerve pathway. This may induce migraine and acts as an anatomical trigger zone.[9]

Dysfunction in the auriculotemporal nerve can disturb gait and balance, as the visual, vestibular, skeletal, and stomatognathic (dental) systems all coordinate to allow an individual to maintain equilibrium, balance, proper posture and normal gait.[1] The neuroanatomic connection between somatic structures and vestibular function provides a structure-function explanation that supports the treatment of this region either with acupuncture or manipulative therapy for balance disorders. The auriculotemporal nerve communicates with the buccal, zygomatic, temporal, and upper divisions of the facial nerve suggesting that GB 2 may assist in facial nerve recovery after injury.[2] The auriculotemporal nerve accompanies branches from the masseteric nerve to supply sensation to the TMJ, the articular element of this oft-referred to source of face and head pain.

Vessels

- **Zygomatico-orbital artery:** Provides blood flow to this small area of the face.
- **Transverse facial artery:** A branch of the superficial temporal artery that originates within the parotid gland. It supplies the parotid gland and duct, the masseter muscles, and the skin in that vicinity. It anastomoses with the facial artery.
- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.
- **Retromandibular vein:** The retromandibular vein forms from the union of the maxillary and superficial temporal veins, rostral to the ear. It later joins with the posterior auricular vein to create the external jugular vein. The retromandibular vein drains the parotid gland and masseter muscle.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 2, considering the limited responses to conventional methods often seen.[10]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[11]

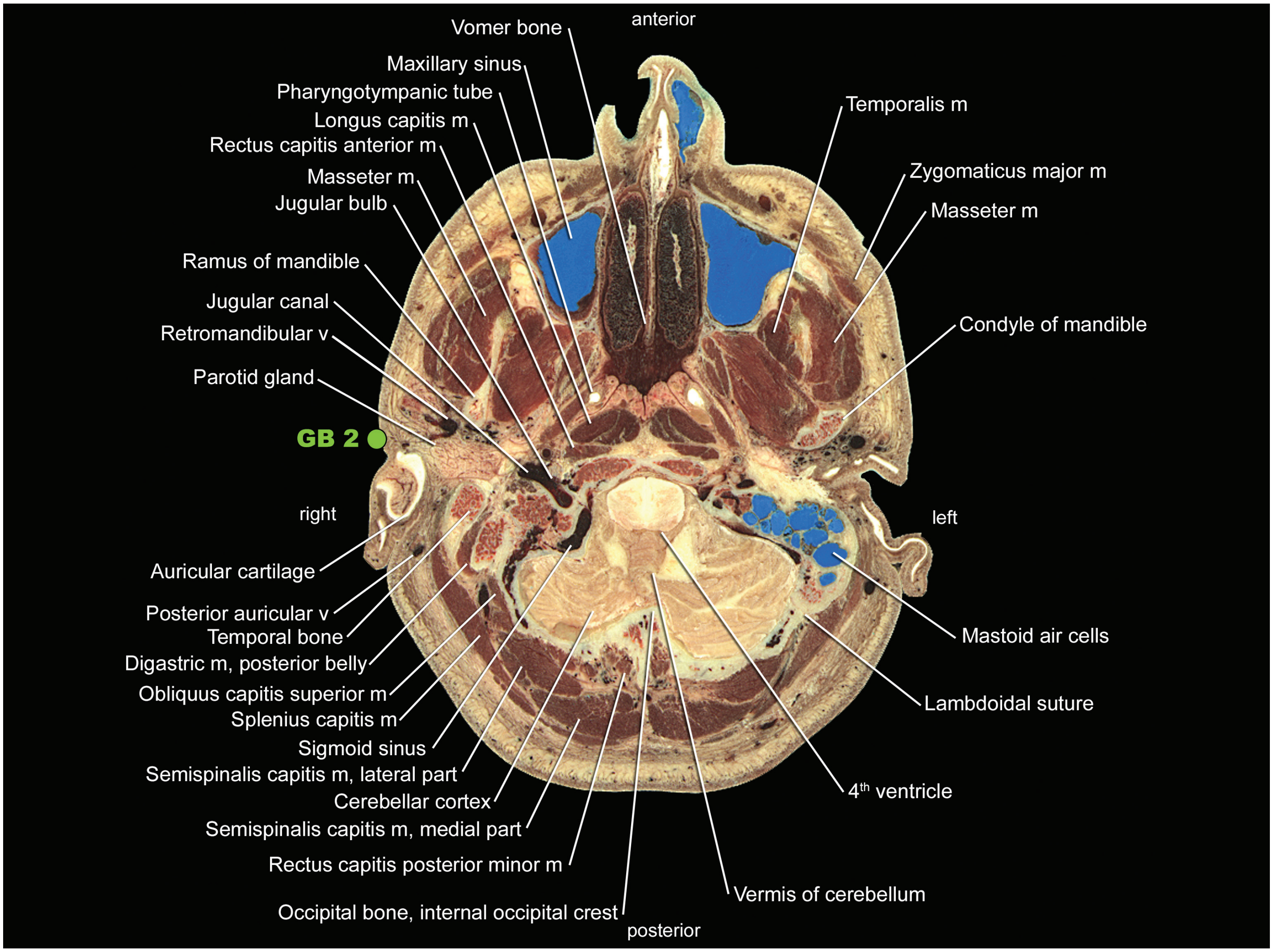

Vomer bone
anterior
Maxillary sinus
Pharyngotympanic tube
Longus capitis m
Rectus capitis anterior m
Masseter m
Jugular bulb
Ramus of mandible
Jugular canal
Retromandibular v
Parotid gland
GB 2
right
Auricular cartilage
Posterior auricular v
Temporal bone
Digastric m, posterior belly
Obliquus capitis superior m
Splenius capitis m
Sigmoid sinus
Semispinalis capitis m, lateral part
Cerebellar cortex
Semispinalis capitis m, medial part
Rectus capitis posterior minor m
Occipital bone, internal occipital crest
posterior
Temporalis m
Zygomaticus major m
Masseter m
Condyle of mandible
left
Mastoid air cells
Lambdoidal suture
4th ventricle
Vermis of cerebellum

Figure 11-7. This cross section exhibits the structures within reach of a needle entering GB 2. These include the retromandibular vein and the parotid gland, anatomy that deep needling could injure. Remember, too, that preauricular lymph nodes reside in this region, though not shown here.[13]

Direct the acupuncture needle away from vessels and toward, but not into, the joint. Refer to Figure 11-7 for the relative location of the right retromandibular vein to GB 2.

Indications and Potential Point Combinations

- **Ear problems:** otitis media, deafness: GB 2, TH 18, TH 20.
- **Tinnitus:** GB2, SI 19, trigger points in muscles connecting to the temporal bone, tender TH points encircling the ear.
- **Facial numbness:** GB 2 plus acupuncture points in the vicinity of the numbness.
- **Facial paralysis:** Facial nerve branches afflicted, TH 17 (facial nerve trunk at its exit from the skull), and GB 2 for the crosstalk between the auriculotemporal nerve and facial nerve motor branches.
- **Toothache referred from auriculotemporal neuralgia:**[3] GB 2, temporalis trigger points.
- **TMJ disorders:** Ascertain, to the degree possible, the source of orofacial and specifically TMJ pain. Articular disorders of the TMJ may include derangement of the cranial bones or mandible, neoplasia of the TMJ or associated anatomic elements, disk disturbances, inflammation, arthritis, TMJ dislocation or fracture of the condylar process.[4] Given that the auriculotemporal nerve supplies the TMJ, GB 2 and the other points that follow this nerve come into play as potentially suitable avenues for stimulation, as shown in Figure 11-6.
- **Balance disorders, disturbances in gait, posture, and equilibrium:** Consider auriculotemporal nerve dysfunction.[5] GB 2, GB 20, BL 10, Yintang, GV 20, GV 16 (needled carefully).

Evidence-Based Application

- Laser therapy delivered to TH 21, SI 19, GB 2, and auricular points liver, kidney, endocrine, and others, along with laser irradiation of the external auditory canal improved audition in patients with moderate and severe **sudden deafness.**[12]

References

1. Stack B and Sims A. The relationship between posture and equilibrium and the auriculotemporal nerve in patients with disturbed gait and balance. *Cranio.* 2009;27(4):248-260.
2. Li C, Jiang XZ, and Zhao YF. (Chinese) Connection of trigeminal nerve and facial nerve branches and its clinical significance. *Shanghai Kou Qiang Yi Xue.* 2009;18(5):545-550.
3. Murayama RA, Stuginski-Barbosa J, Moraes NP, et al. Toothache referred from auriculotemporal neuralgia: case report. *Int Endod J.* 2009;42(9):845-851.

4. Buescher JJ. Temporomandibular joint disorders. *Am Fam Physician*. 2007;76:1477-1482.
5. Stack B and Sims A. The relationship between posture and equilibrium and the auriculotemporal nerve in patients with disturbed gait and balance. *Cranio*. 2009;27(4):248-260.
6. Alzahrani FR and Alqahtani KH. The facial nerve versus the retromandibular vein: a new anatomical relationship. *Head Neck Oncol*. 2012;4(4):82.
7. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol*. 2002;23:303-311.
8. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
9. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg*. 2012;130:336-341.
10. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
11. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn*. 2011;88(3):111-119.
12. Zhou GY. Moderate and severe sudden deafness treated with low-energy laser irradiation combined with auricular acupoint sticking. *Zhongguo Zhen Jiu*. 2012;32(5):413-416.
13. Pan W-R, Le Roux CM, and Briggs CA. Variations in the lymphatic drainage pattern of the head and neck: further anatomic studies and clinical implications. *Plast Reconstr Surg*. 2011;127; 611-620.

GB 3

Shang Guan "Above the Joint", "Upper Gate"

Rostral to the ear, on the dorsal border of the zygomatic arch, in a depression directly above ST 7. First locate ST 7 in the depression rostral to the condylar process of the mandible and ventral to the zygomatic arch. Run a palpating finger up and over the zygomatic arch to the tender site or hollow dorsal to ST 7.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

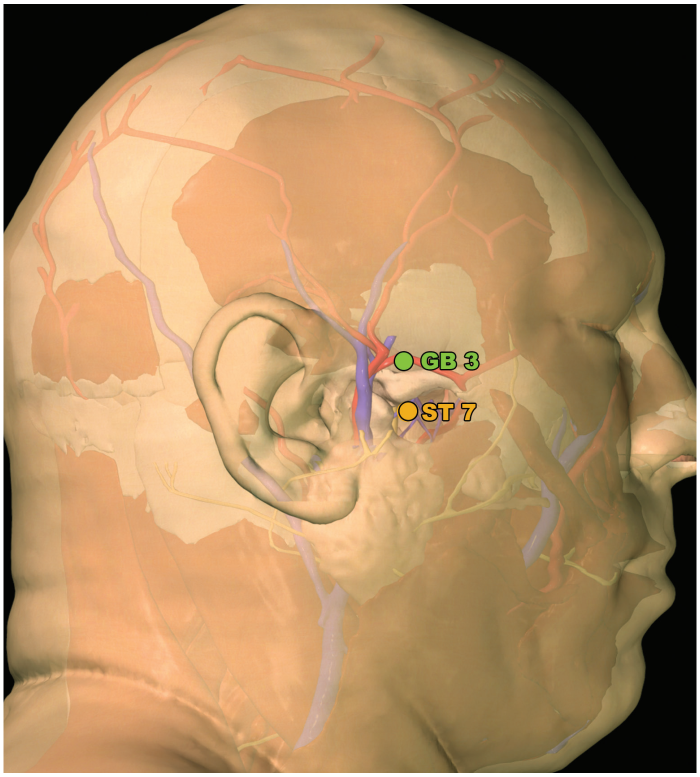


Figure 11-8. GB 3, the "Upper Gate", sits "Above the Joint", highlighting its alternate name, while ST 7, the "Lower Hinge", lies "Below the Joint". The "joint" is the temporomandibular joint (TMJ).

Nerves

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[5] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[6] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can

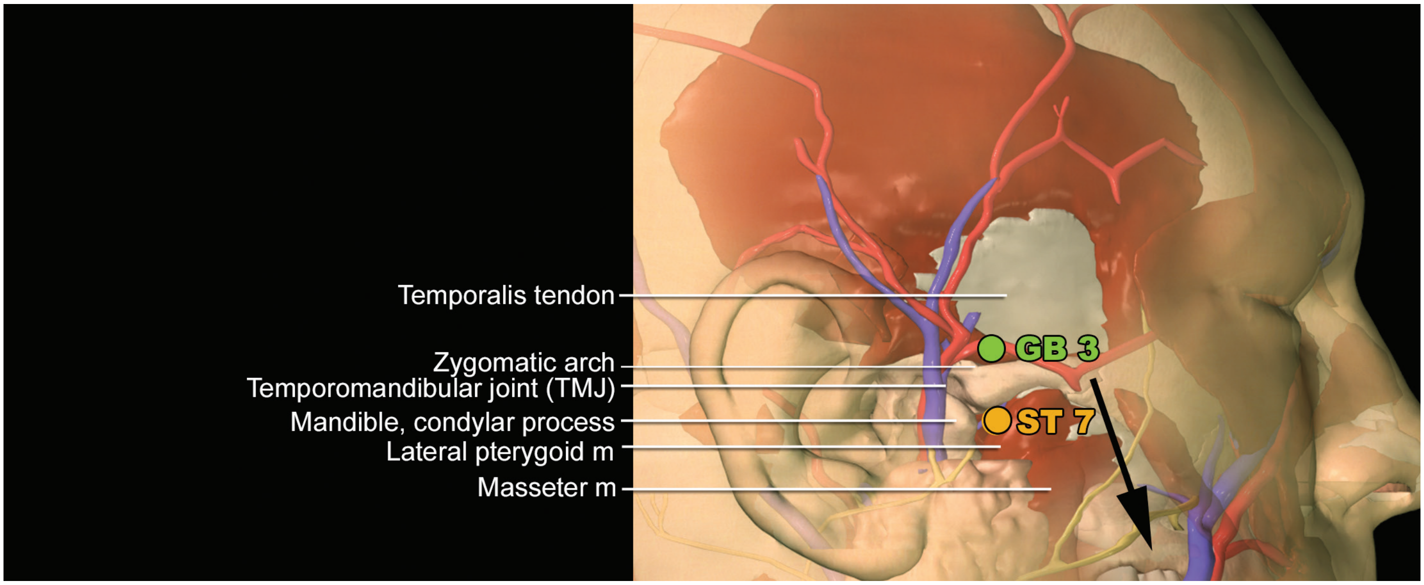


Figure 11-9. Trigger points in the vicinity of GB 3 refer pain toward the vertex or toward the teeth, mainly the maxillary molars, as indicated by the black arrow.

occur at GB 3 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[7]

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.
- **Zygomatico-orbital artery:** Provides blood flow to this small area of the face.
- **Transverse facial artery:** A branch of the superficial temporal artery that originates within the parotid gland. It supplies the parotid gland and duct, the masseter muscles, and the skin in that vicinity. It anastomoses with the facial artery.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 3, considering the limited responses to conventional methods often seen.[8]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supra-orbital, deep temporal, buccal and parotid arteries.[9]

Direct the acupuncture needle away from vessels and toward, but not into, the joint. Refer to Figure 11-11 for the relative location of the right retromandibular vein to GB 3.

Indications and Potential Point Combinations

- **Ear problems:** otitis media, deafness: GB 3, GB 2, TH 18, TH 20.
- **Tinnitus:** GB 3, GB 12, SI 19, trigger points in muscles connecting to the temporal bone, tender TH points encircling the ear.
- **Facial numbness:** GB 3, GB 2, plus acupuncture points that pertain specifically to the nerve responsible for facial sensation (usually a trigeminal nerve branch).
- **Facial paralysis:** Facial nerve branches afflicted, TH 17 (facial nerve trunk at its exit from the skull), GB 3, and GB 2 for the crosstalk between the auriculotemporal nerve and facial nerve motor branches.
- **Toothache referred from auriculotemporal neuralgia:**[2] GB 3, GB 2, temporalis trigger points.
- **TMJ dysfunction:** Ascertain, to the degree possible, the source of orofacial and specifically TMJ pain. Articular disorders of the TMJ may include derangement of the cranial bones or mandible, neoplasia of the TMJ or associated anatomic elements, disk disturbances, inflammation, arthritis, TMJ dislocation or fracture of the condylar process.[3] Given that the auriculotemporal nerve supplies the TMJ, points that lie along the trajectory of this nerve may help confer analgesia. Palpate carefully to determine which branches warrant attention.
- **Balance disorders, disturbances in gait, posture, and equilibrium:** Consider auriculotemporal nerve dysfunction.[4] GB 3, GB 2, GB 20, BL 10, Yintang, GV 20, GV 16 (needled carefully).

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd edition.* Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Murayama RA, Stuginski-Barbosa J, Moraes NP, et al. Toothache referred from auriculotemporal neuralgia: case report. *Int Endod J.* 2009;42(9):845-851.
3. Buescher JJ. Temporomandibular joint disorders. *Am Fam Physician.* 2007;76:1477-1482.
4. Stack B and Sims A. The relationship between posture and equilibrium and the auriculotemporal nerve in patients with disturbed gait and balance. *Cranio.* 2009;27(4):248-260.

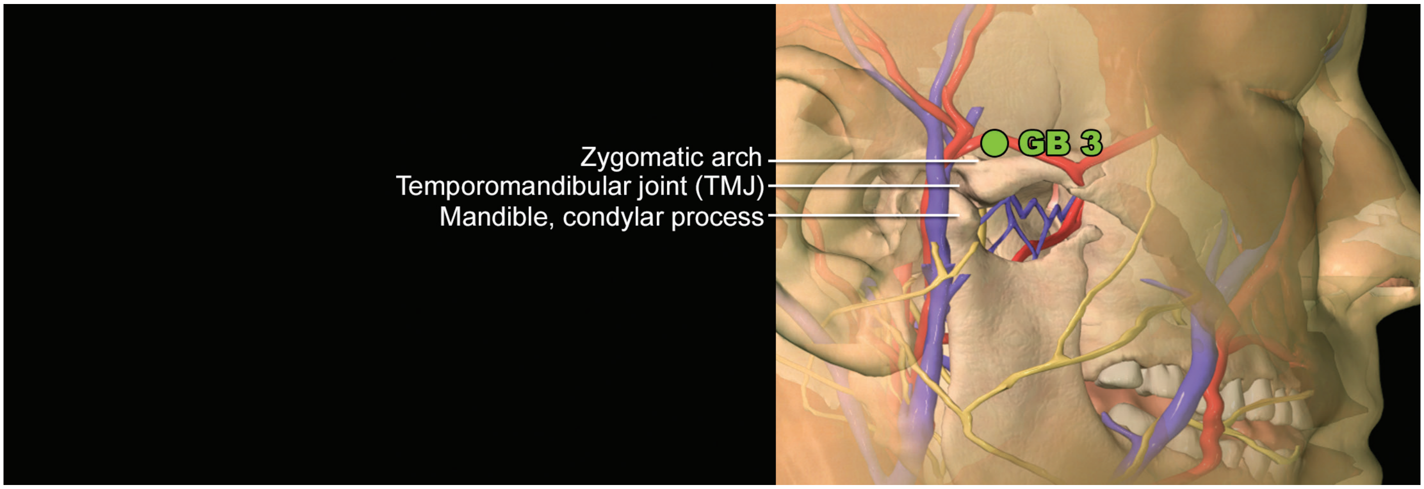


Figure 11-10A. The close proximity of GB 3 to the TMJ vouches for its relevance in treating dysfunction and pain in and around the joint.

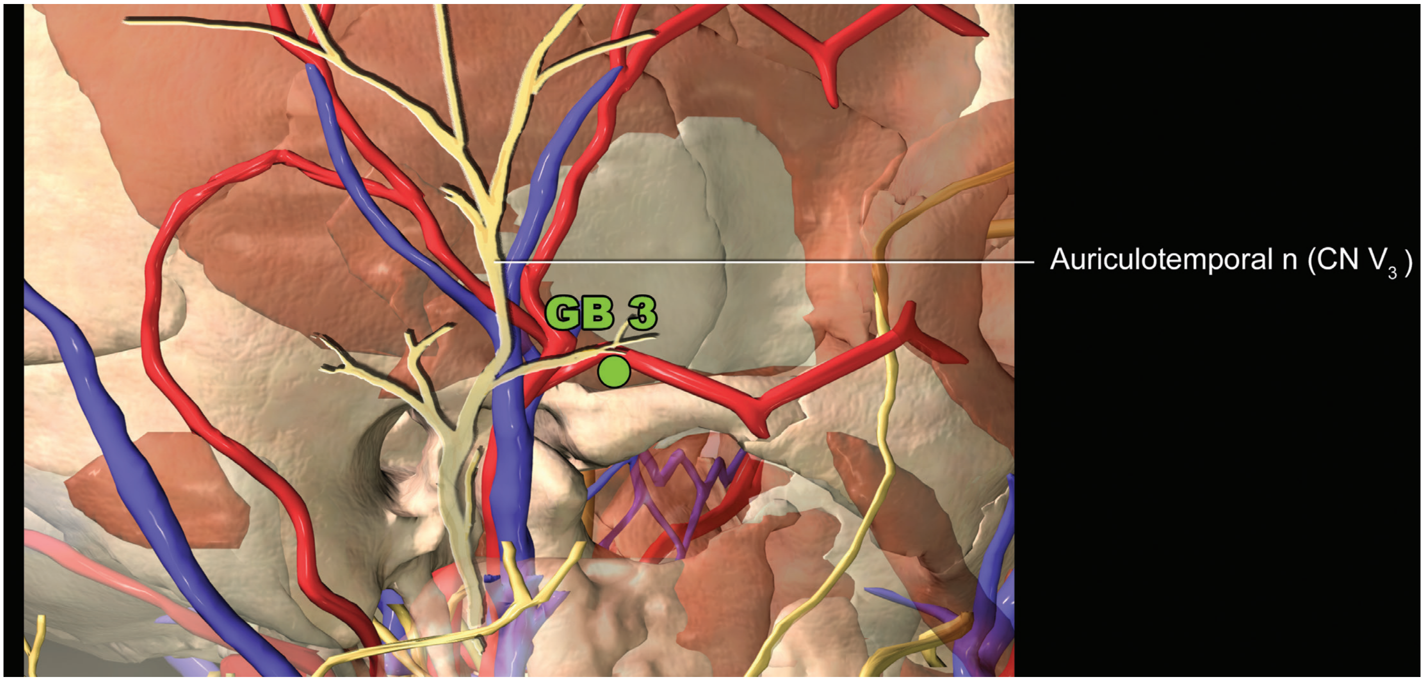


Figure 11-10B. The auriculotemporal nerve, shown here, sends an articular branch to the TMJ, suggesting an avenue for analgesia-producing neuromodulation by way of GB 3.

5. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
6. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
7. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
8. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. Z *Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
9. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

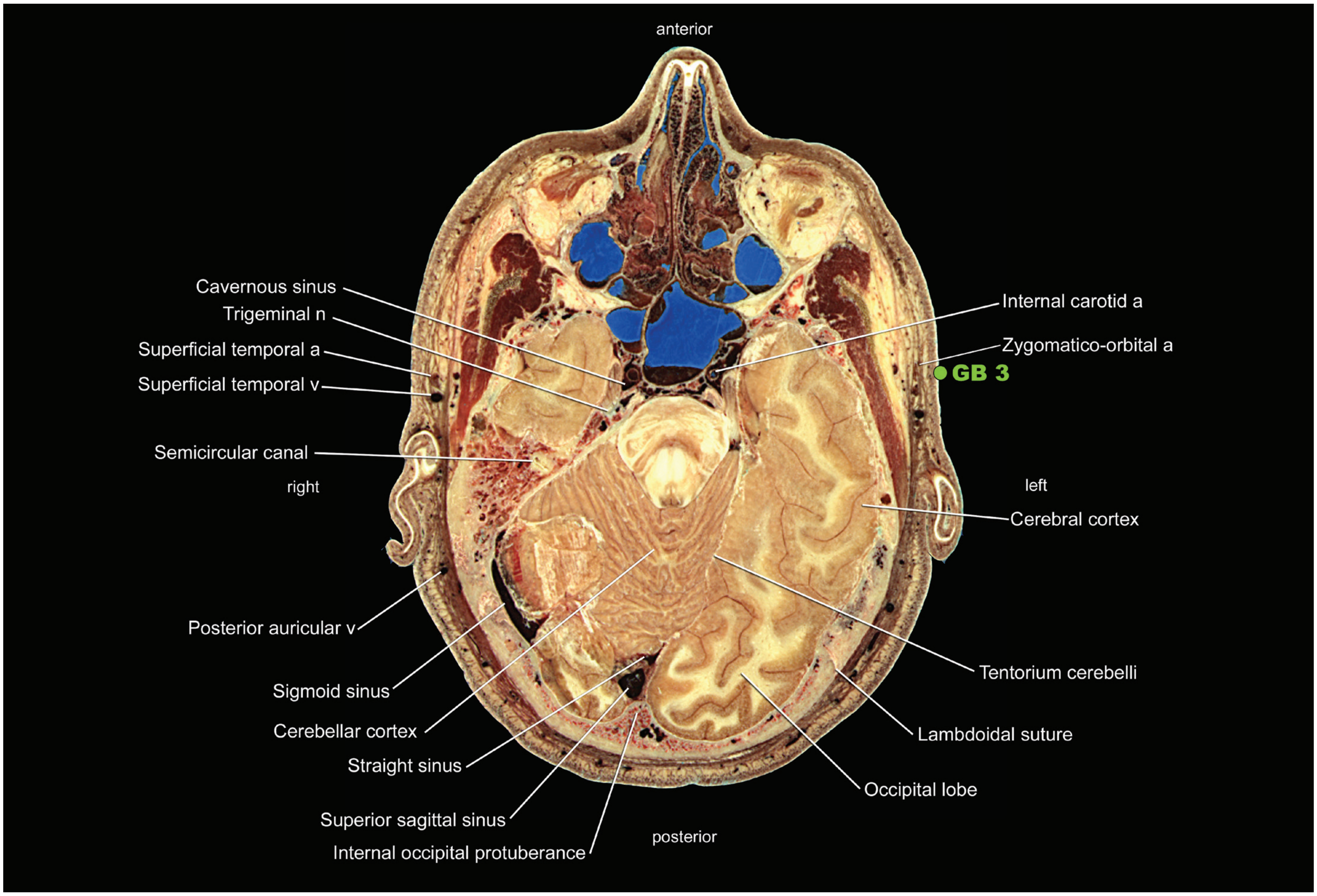

anterior
Cavernous sinus
Trigeminal n
Superficial temporal a
Superficial temporal v
Semicircular canal
right
Internal carotid a
Zygomatico-orbital a
GB 3
left
Cerebral cortex
Posterior auricular v
Sigmoid sinus
Cerebellar cortex
Straight sinus
Superior sagittal sinus
Internal occipital protuberance
posterior
Tentorium cerebelli
Lambdoidal suture
Occipital lobe

Figure 11-11. While targeting myofascial trigger points in the temporalis muscle, remember that prominent vessels reside in this region, as depicted in this cross section.

GB 4

Han Yan "Forehead Fullness", "Jaw Stretching"

On the temporal region, caudal to the natural hairline, 1/4 the distance from ST 8 to GB 7. The temporalis muscle bulges just below this point when the teeth clench.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

Nerves

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[2] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

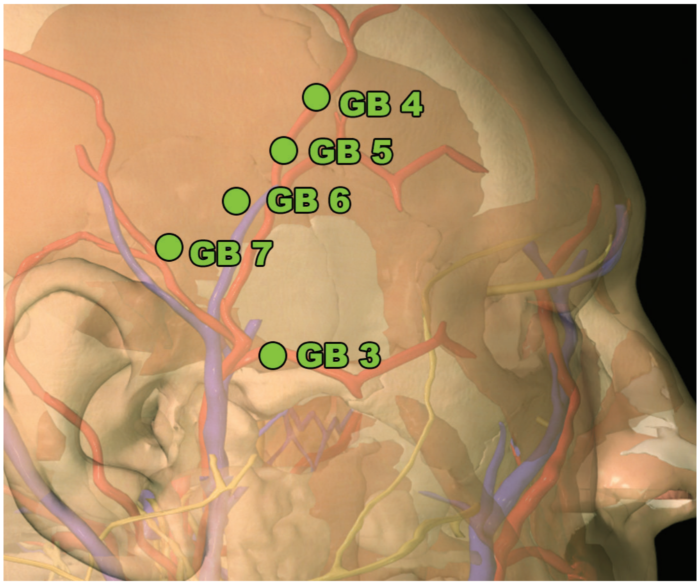


Figure 11-12. GB 4 through GB 7 line up along the superficial temporal vessels, apparent here through the semi-transparent skin layer.

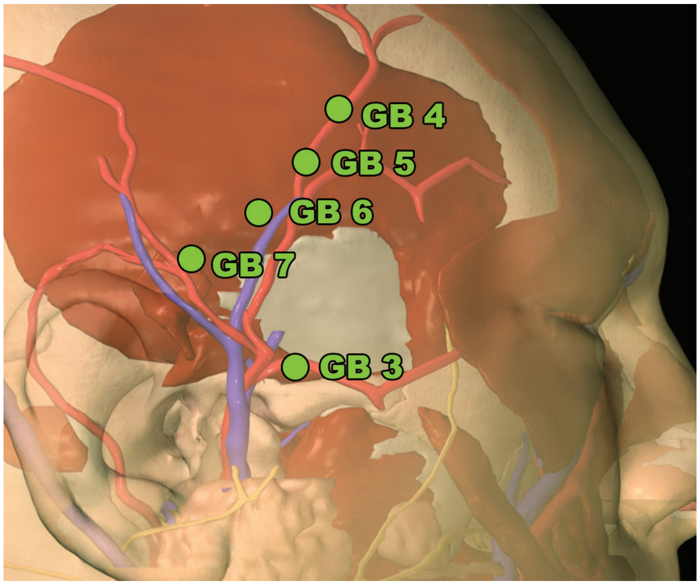


Figure 11-13. Descriptive names for GB 4, "Forehead Fullness" and "Jaw Stretching" allude to the structure and function, respectively, of the temporalis muscle.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[3] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 4 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[4]

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 4, considering the limited responses to conventional methods often seen.[5]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[6]

Indications and Potential Point Combinations

- **Eyestrain and tension around the eyes:** GB 4, tender trigger points in the temporalis and orbicularis oculi muscles.
- **Dry eye:** GB 4, GB 20, TH 23, BL 2, ST 1, Taiyang, GV 23, SP 3, LU 9, LU 10, HT 8.[7]
- **Dizziness:** GB 4, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Toothache:** Rule out odontalgia radiating from the temporalis muscle.

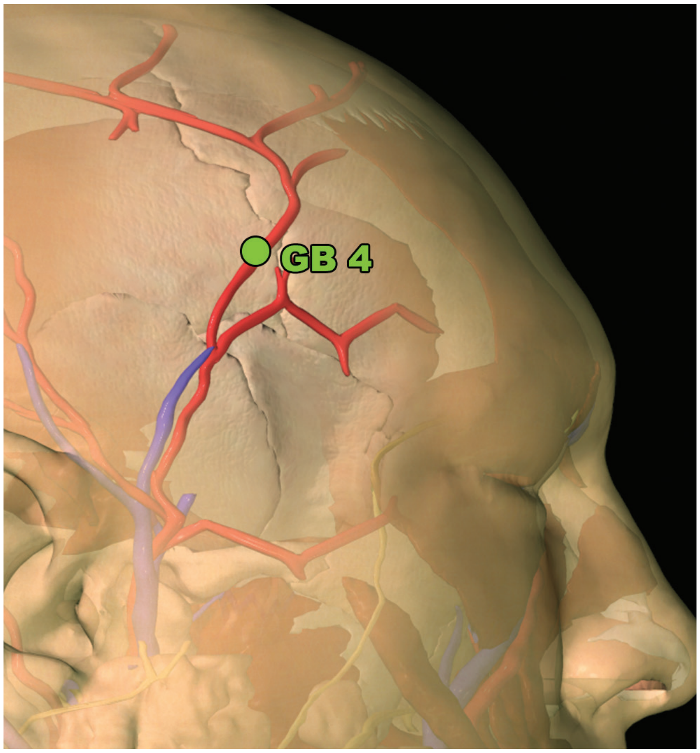


Figure 11-14. As is the case with many other points on the calvarium, GB 4 lands close to or directly over a suture; this point relates to the coronal suture. Most cranial sutures harbor neurovascular elements that respond to neuromodulation. In addition, chronic headache sufferers may exhibit tenderness to palpation over one or more cranial sutures.

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd edition*. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.

2. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.

3. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.

4. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.

5. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.

6. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

7. Kim TH, Kim JI, Shin MS et al. Acupuncture for dry eye: a randomized controlled trial protocol. *Trials.* 2009;10:112.

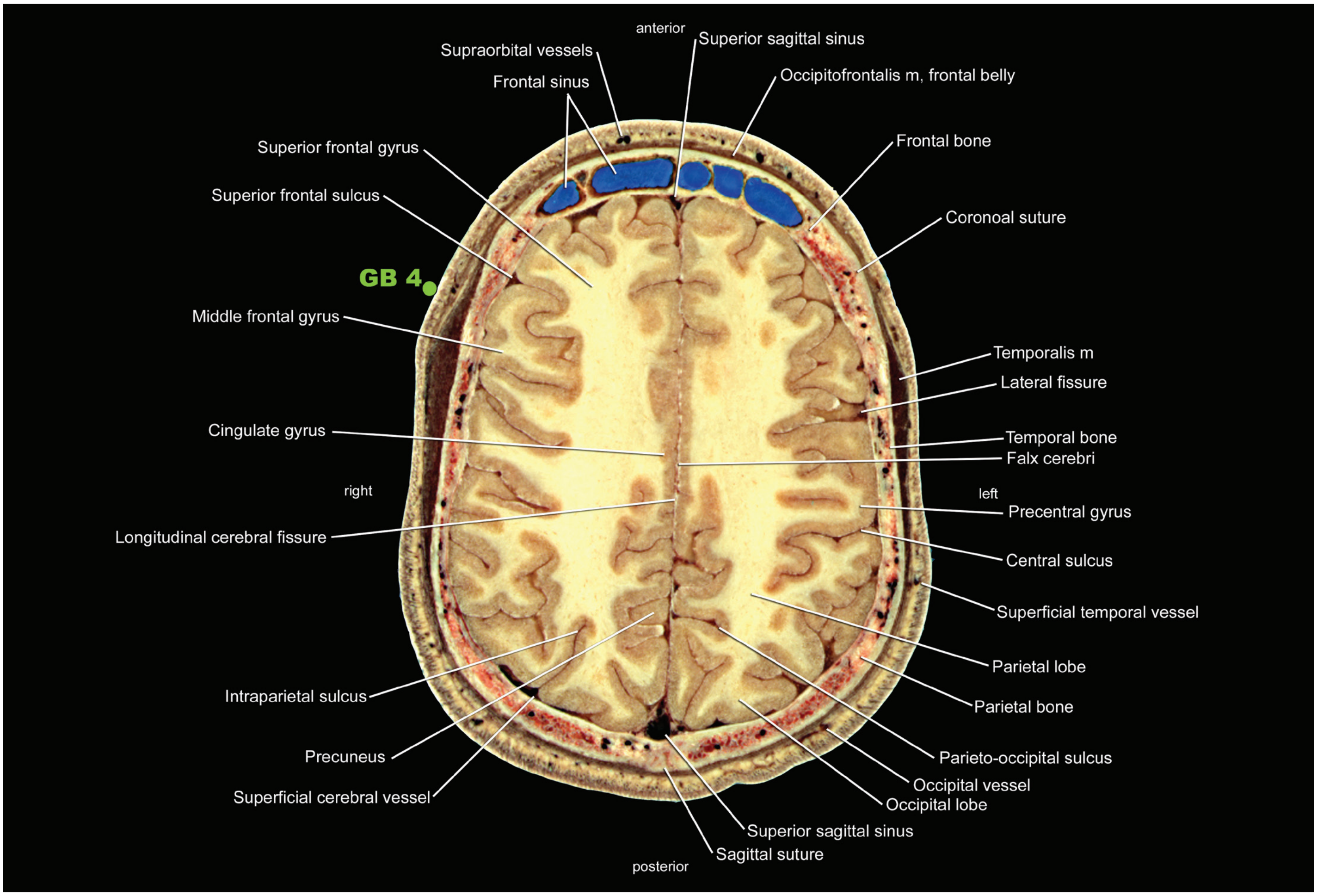

anterior
Supraorbital vessels
Superior sagittal sinus
Frontal sinus
Occipitofrontalis m, frontal belly
Superior frontal gyrus
Frontal bone
Superior frontal sulcus
Coronoal suture
GB 4
Middle frontal gyrus
Temporalis m
Lateral fissure
Cingulate gyrus
Temporal bone
Falx cerebri
right
left
Precentral gyrus
Longitudinal cerebral fissure
Central sulcus
Superficial temporal vessel
Parietal lobe
Intraparietal sulcus
Parietal bone
Precuneus
Parieto-occipital sulcus
Occipital vessel
Superficial cerebral vessel
Occipital lobe
Superior sagittal sinus
Sagittal suture
posterior

Figure 11-15. This cross section illustrates the "Forehead Fullness" as suggested by the descriptive name for GB 4 that the temporalis muscle creates. Note the proximity of the frontal gyri (superior and middle) to GB 4 and consider the implications for transcranial laser therapy at this site.

GB 5

Xuan Lu "Suspended Skull"

On the temporal region, posterior to the natural hairline, at the midpoint of a curved line connecting GB 7 and ST 8.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

Nerves

- **Anterior and posterior deep temporal nerves (CN V$_3$):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Auriculotemporal nerve (CN V$_3$):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[3] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[4] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular

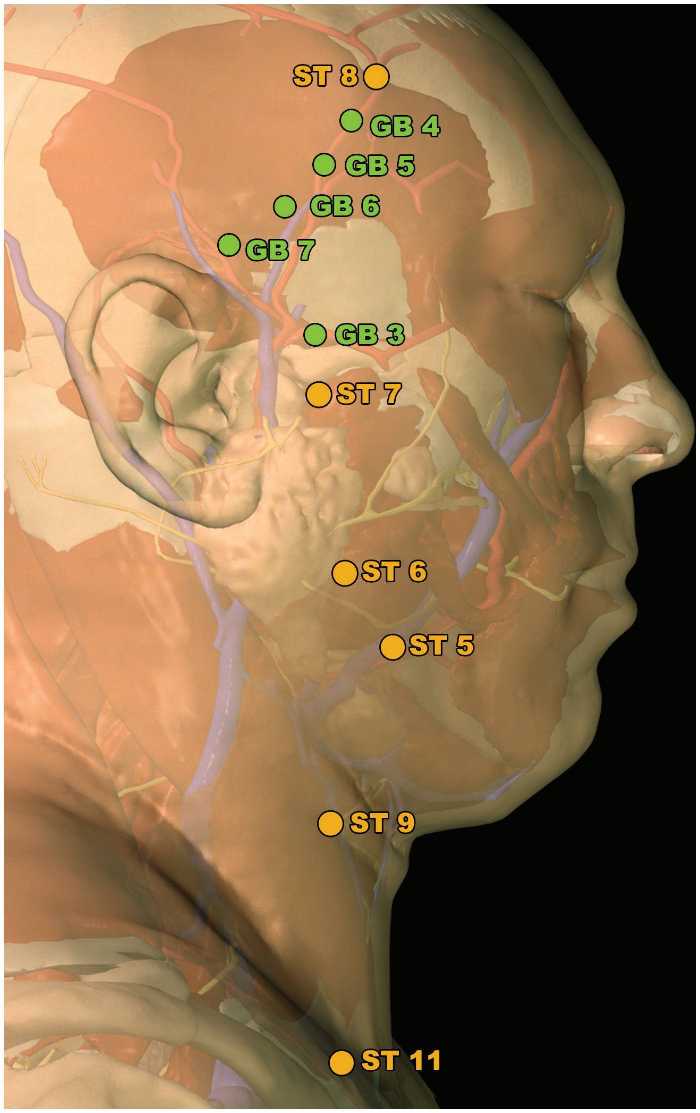


Figure 11-16. The distinction between territories traversed by the ST and GB lines becomes apparent in this image, as do their meeting sites at ST 8/GB 4 and ST 7/GB 3.

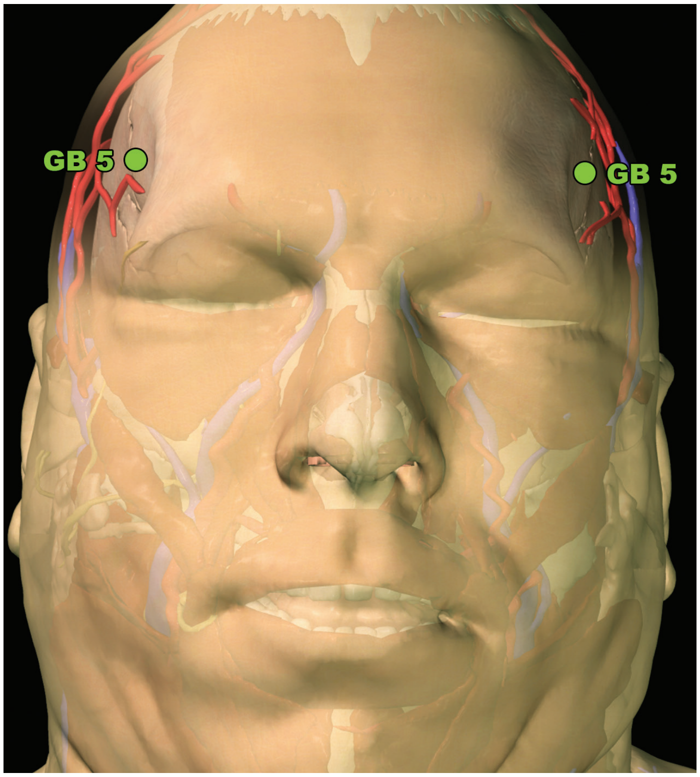


Figure 11-17. Based on the name "Suspended Skull" for GB 5, one can imagine lifting the skull from these points with a set of ice tongs. Alternatively, perhaps when one experiences headache generated by myofascial dysfunction besetting the temporalis muscle at GB 5, one feels as though his or her skull was suspended with a set of ice tongs compressing GB 5.

network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 5 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[5]

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 5, considering the limited responses to conventional methods often seen.[6]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal,

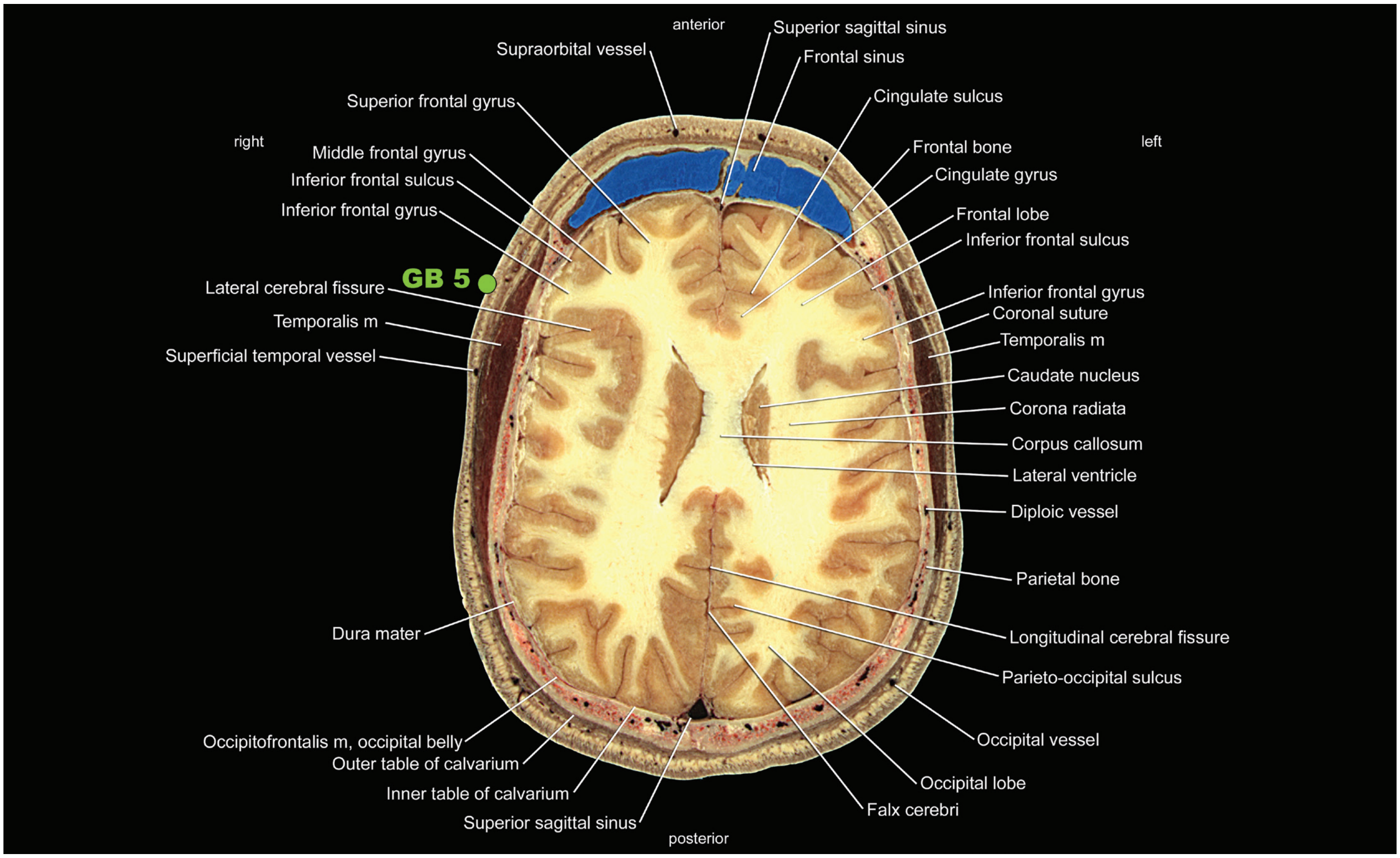

anterior
Supraorbital vessel
Superior sagittal sinus
Frontal sinus
Superior frontal gyrus
Cingulate sulcus
right
left
Middle frontal gyrus
Inferior frontal sulcus
Inferior frontal gyrus
Frontal bone
Cingulate gyrus
Frontal lobe
Inferior frontal sulcus
GB 5
Lateral cerebral fissure
Temporalis m
Superficial temporal vessel
Inferior frontal gyrus
Coronal suture
Temporalis m
Caudate nucleus
Corona radiata
Corpus callosum
Lateral ventricle
Diploic vessel
Parietal bone
Dura mater
Longitudinal cerebral fissure
Parieto-occipital sulcus
Occipitofrontalis m, occipital belly
Outer table of calvarium
Inner table of calvarium
Superior sagittal sinus
Occipital vessel
Occipital lobe
Falx cerebri
posterior

Figure 11-18. As with the other GB points over the temporalis muscles, needling GB 5 can treat troublesome trigger points.

facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supra-orbital, deep temporal, buccal and parotid arteries.[7]

Indications and Potential Point Combinations

- **Eyestrain and tension around the eyes:** GB 5, tender trigger points in the temporalis and orbicularis oculi muscles.
- **Dizziness:** GB 5, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Toothache:** Rule out odontalgia radiating from the temporalis muscle, consider adding GB 5 if tender.
- **Headache at the vertex:** Palpate for trigger points in the intermediate (middle) portion of the temporalis muscle that extend in a fingerlike shape and direction toward the midline. Add GV 20 and local GV, GB, and BL points as necessary.

Evidence-Based Applications

- Needling GB 5 through to GB 8 or GB 8 to Taiyang, supplemented by points GB 20, TH 3, and GB 43, effectively reduced **migraine pain.**[2]
- Acupuncture applied to GB 5, ST 8, GB 20, GV 14, and LU 7 reduced the incidence and associated costs of **migraine without aura.**[8]
- One month of acupressure treatment at trigger points such as GB 5, BL 2, GB 20, GB 20, and TH 21 significantly reduced **chronic headache** for six months.[9]

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Gan Z, Zhang Z, and Huang Y. Treatment of migraine by acupuncturing through Xuanlu or Taiyang to Shuaigu. *Journal of Traditional Chinese Medicine.* 1986;6(1):21-22.
3. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
4. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
5. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
6. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
7. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.
8. Liguori A, Petti F, Bangrazi A, et al. Comparison of pharmacological treatment versus acupuncture treatment for migraine without aura – analysis of socio-medical parameters. *J Tradit Chin Med.* 2000; 20(3):231-240.
9. Hsieh LL, Llou HH, Lee LH, et al. Effect of acupressure and trigger points in treating headache: a randomized controlled trial. *Am J Chin Med.* 2010;38(1):1-14.

GB 6

Xuan Li "Suspended Hair", or "Suspended Tuft"

On the temporal region, caudal to the natural hairline, 3/4 the distance from ST 8 to GB 7; 2 cun caudal to GB 4 on the curved line connecting GB 7 and ST 8. Midway between GB 5 and GB 7.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

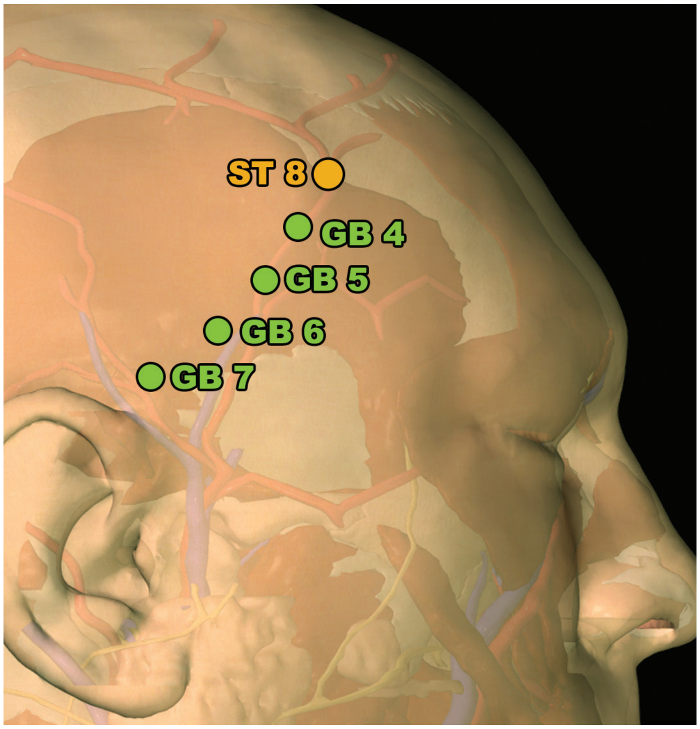


Figure 11-19. The name "Suspended Hair" or "Suspended Tuft" corresponds to the finding that when one locates this point on a patient with a full head of hair, one usually needs to lift a section of hair here. That tuft of hair typically remains elevated at GB 6 instead of falling back into its usual position.

Nerves

- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[2] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[3] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 6 and elsewhere along the neurovascular course.

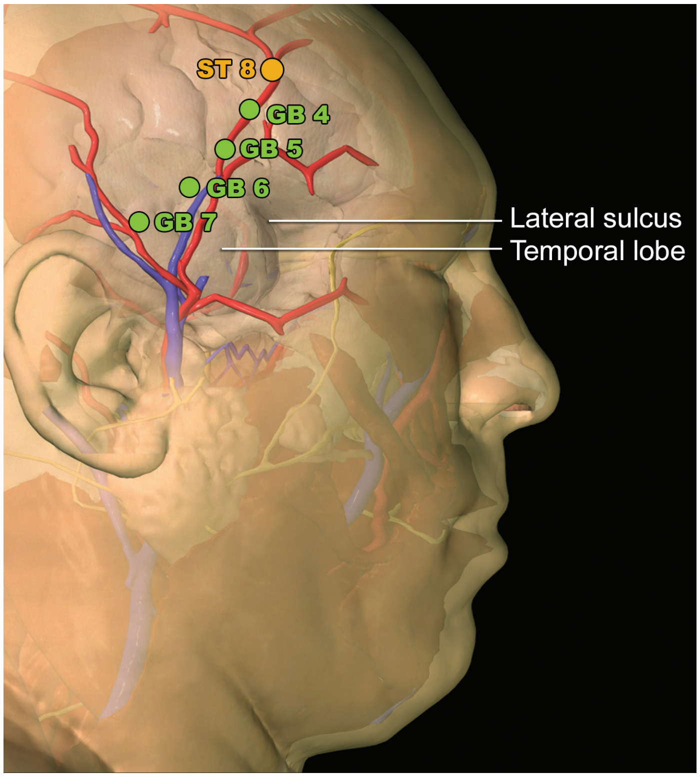


Figure 11-20. GB 6 locates, at least in this individual, the temporal lobe near the lateral sulcus of the brain.

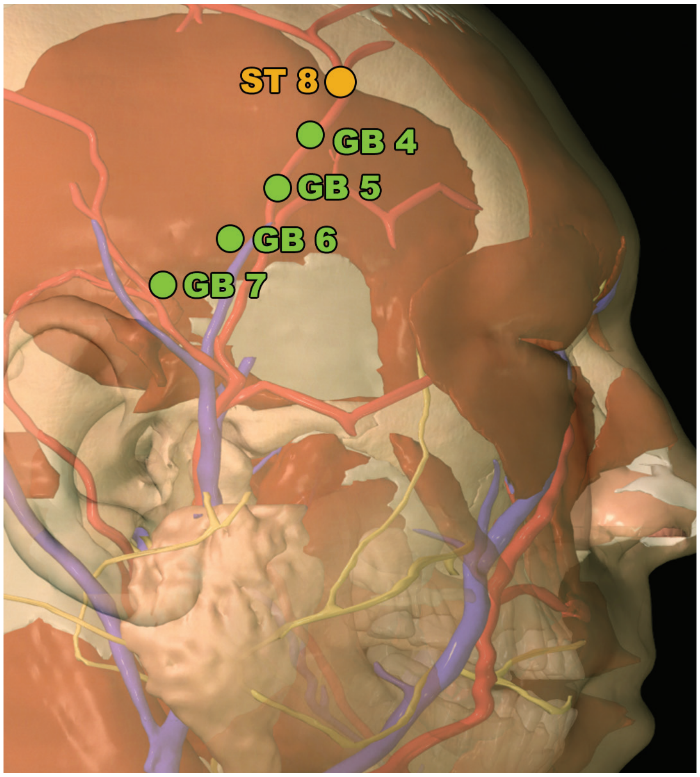


Figure 11-21. The temporalis muscle's ATrP's that refer pain to the teeth, face, and midline typically lie at the muscle-tendon interface, shown here just below GB 6.

Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[4]

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 6, considering the limited responses to conventional methods often seen.[5]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supra-orbital, deep temporal, buccal and parotid arteries.[6]

Indications and Potential Point Combinations

- **Eyestrain and tension around the eyes:** GB 6, TH 23, BL 2, and tender trigger points in the temporalis and orbicularis oculi muscles.
- **Dizziness:** GB 6, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Toothache:** Rule out myofascial source of odontalgia; i.e., radiating pain from the temporalis muscle along its anterior ATrP's.

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body*, 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
3. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
4. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
5. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
6. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

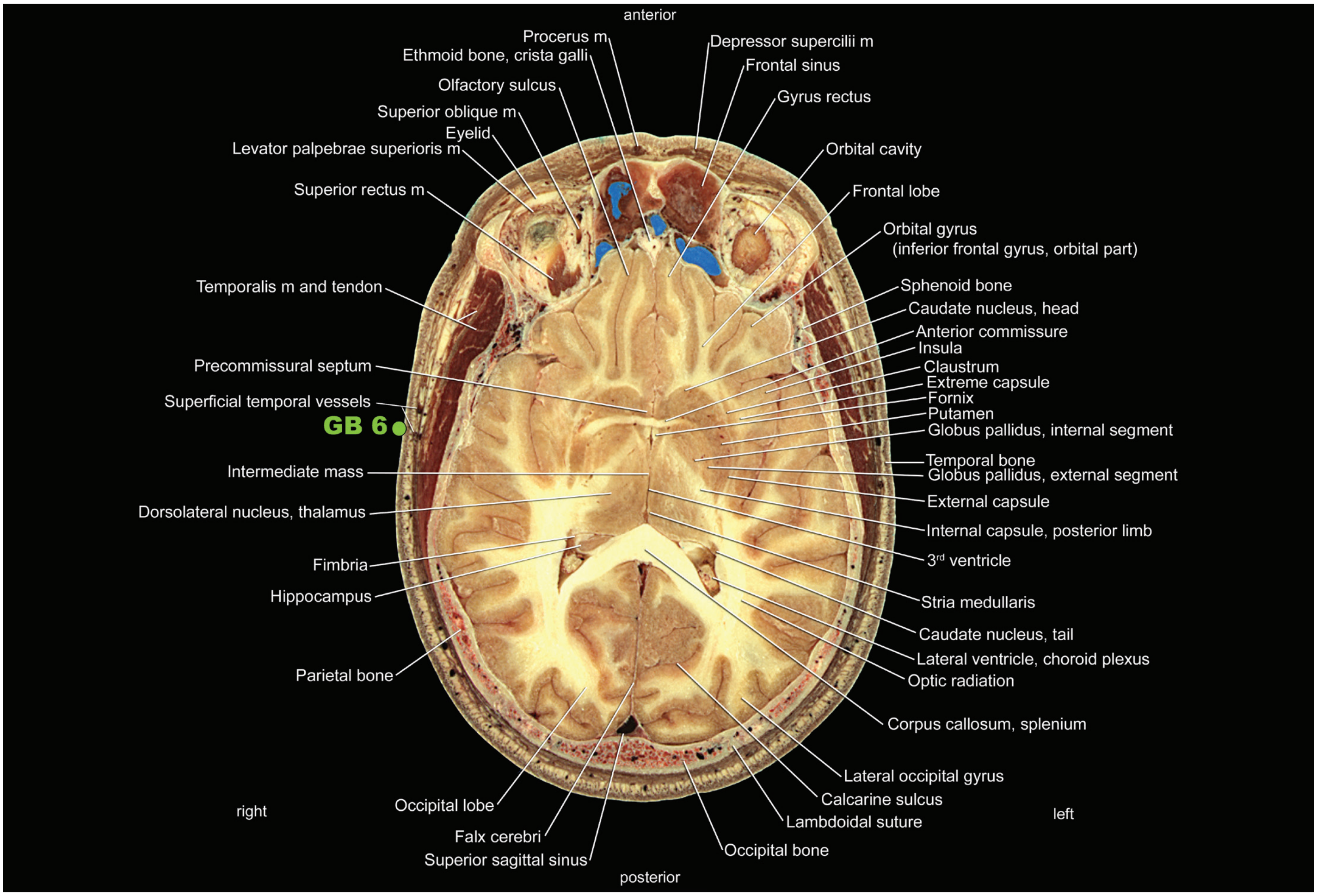

anterior
Procerus m
Ethmoid bone, crista galli
Olfactory sulcus
Superior oblique m
Eyelid
Levator palpebrae superioris m
Superior rectus m
Temporalis m and tendon
Precommissural septum
Superficial temporal vessels
GB 6
Intermediate mass
Dorsolateral nucleus, thalamus
Fimbria
Hippocampus
Parietal bone
right
Occipital lobe
Falx cerebri
Superior sagittal sinus
posterior
Depressor supercilii m
Frontal sinus
Gyrus rectus
Orbital cavity
Frontal lobe
Orbital gyrus
(inferior frontal gyrus, orbital part)
Sphenoid bone
Caudate nucleus, head
Anterior commissure
Insula
Claustrum
Extreme capsule
Fornix
Putamen
Globus pallidus, internal segment
Temporal bone
Globus pallidus, external segment
External capsule
Internal capsule, posterior limb
3rd ventricle
Stria medullaris
Caudate nucleus, tail
Lateral ventricle, choroid plexus
Optic radiation
Corpus callosum, splenium
Lateral occipital gyrus
Calcarine sulcus
Lambdoidal suture
Occipital bone
left

Figure 11-22. The bulk of temporalis muscle evident deep to GB 6 speaks to its indications for trigger point deactivation and headache focus.

GB 7

Qu Bin "Temporal Hairline Curve"

Within the natural hairline, dorsal and rostral to the auricle, level with and approximately one fingerbreadth rostral to TH 20.

Muscles

- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The temporalis muscle, a common source of pain and dysfunction affecting the temporomandibular joint, fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.[1]

Nerves

- **Auriculotemporal nerve (CN V$_3$):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** In this region, supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.
- **Anterior and posterior deep temporal nerves (CN V$_3$):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[3] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[4] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 7 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[5]

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible,

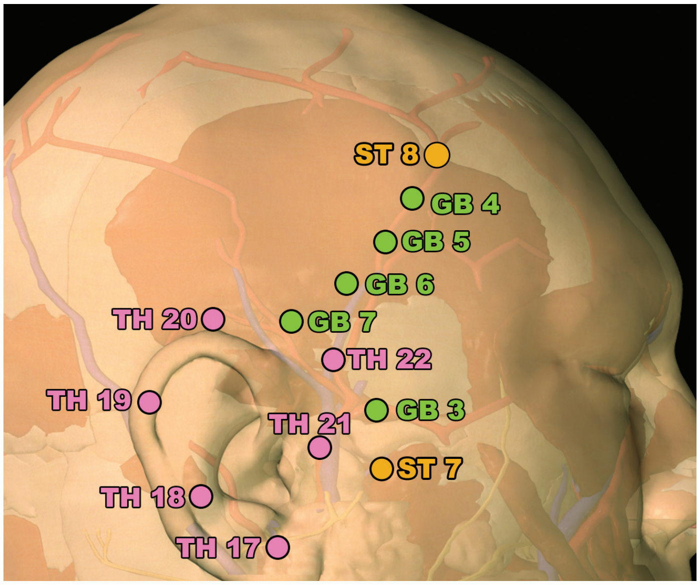


Figure 11-23. The name for GB 7, "Temporal Hairline Curve" speaks to its topographical location along the natural hairline. When the head lacks hair is in this situation, the alternate method of finding the point comes in handy; i.e., find the site level with and approximately one fingerbreadth rostral to TH 20. The vascular correlates of the intersecting GB, TH, and ST lines (i.e., the superficial temporal and posterior auricular vessels) branch off of the external carotid vessels. This vasculature is more readily visible in Figure 11-24.

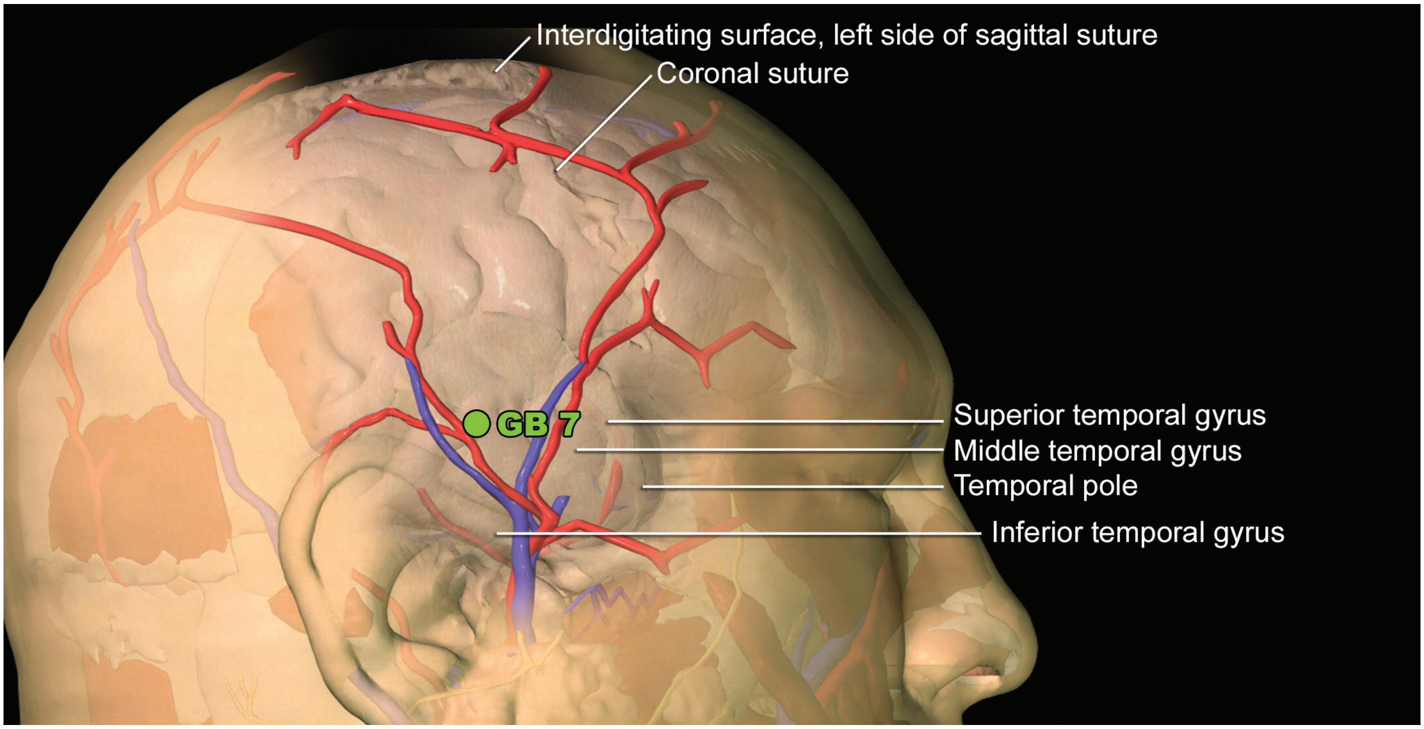

Interdigitating surface, left side of sagittal suture
Coronal suture
GB 7
Superior temporal gyrus
Middle temporal gyrus
Temporal pole
Inferior temporal gyrus

Figure 11-24. Certain scalp acupuncture and laser therapy approaches involve stimulating sites directly over specific brain regions in order to influence functions served by those centers. Viewed from that perspective, GB 7 would be employed to address activities for the temporal lobe, made visible in this lateral perspective through a semi-transparent skull. The temporal lobe of the brain processes auditory information as the home of the primary auditory cortex. It provides other functions as well, including processing of language, vision, memory, and emotions.

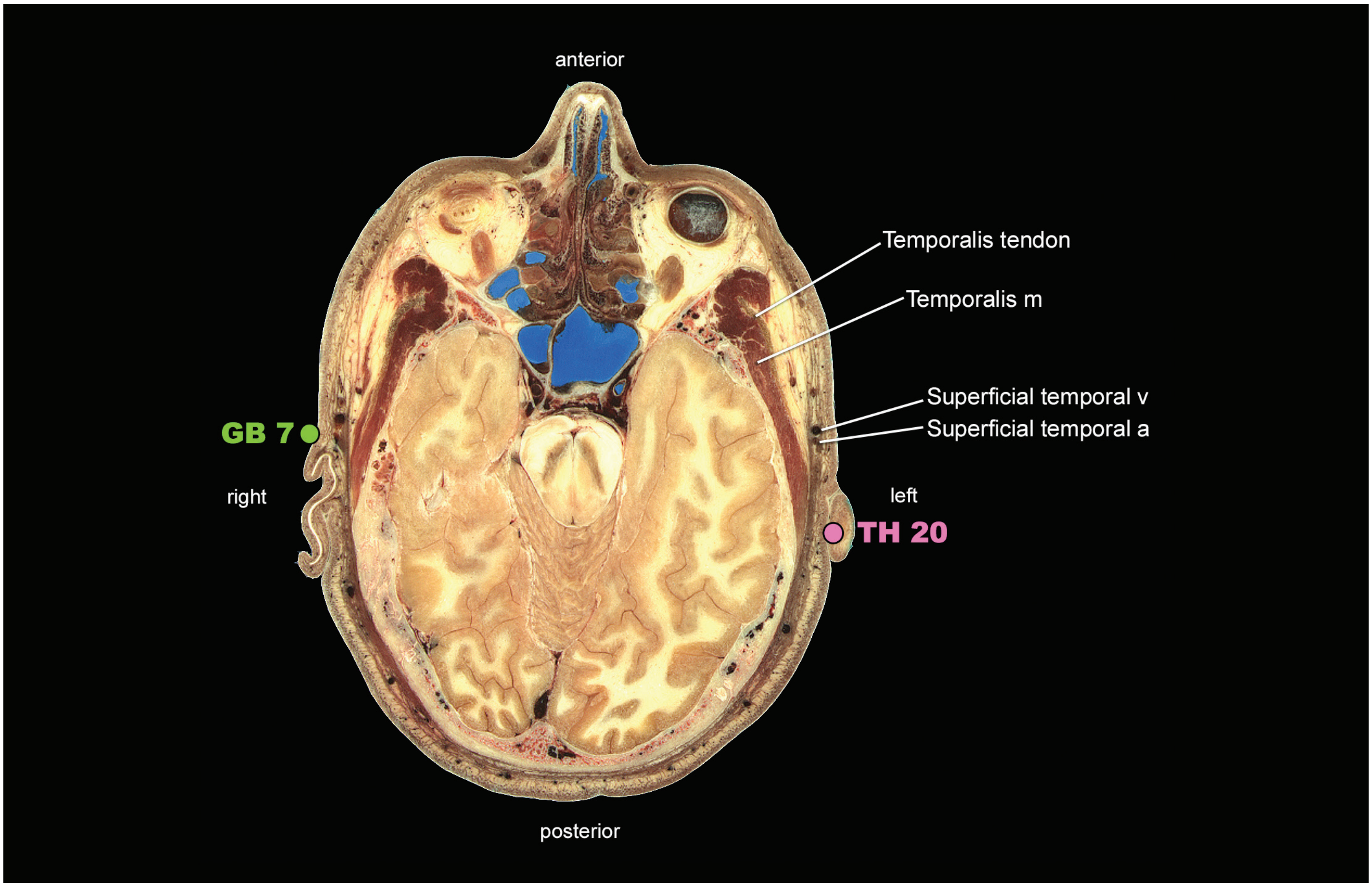

anterior
Temporalis tendon
Temporalis m
Superficial temporal v
Superficial temporal a
GB 7
right
left
TH 20
posterior

Figure 11-25A. GB 7 and TH 20 live at approximately the same level but GB 7 will affect different trigger points in the temporalis muscle than will TH 20. Palpate your own GB 7 and TH 20. Do you have taut bands in both locations? Many patients do as well. This exercise illustrates the imperative of including informed palpation in acupuncture and related techniques as a fundamental first step in diagnosis before deciding upon treatment protocols.

pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait.[2]

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function.

Afferent information reaching the nucleus raphe magnus in the reticular formation makes its way by means of the spinal tract of V. These input can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send afferent input that may sensitize neural pathways related to auriculotemporal nerve input. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or “resting” activity within the reticular formation.

Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input conveyed through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible.

Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.

- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.
- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.
- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, which is one of the dural venous sinuses.
- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 7, considering the limited responses to conventional methods often seen.[6]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[7]

The posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization offers one alternative to pharmacotherapy,[8] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear, from GB 7/TH 20 to TH 17. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Indications and Potential Point Combinations

- **Eyestrain and tension around the eyes:** GB 7, GB 1, TH 23, BL 2, and tender trigger points in the temporalis and orbicularis oculi muscles.
- **Dizziness:** GB 7, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Toothache:** Rule out odontalgia radiating from the temporalis muscle along its anterior ATrP’s. Consider GB 7, GB 6, TH 23, LI 4, LU 7.
- **Headache:** When radiating to the midline from temporalis, palpate for trigger points, consider adding GB 7 if tender to palpation.

Evidence-Based Applications

- Electroacupuncture applied to the right-sided GB 7 and GV 20 in patients recovering from ischemic stroke changed glucose metabolism significantly in the following brain regions: primary motor area, premotor cortex, superior parietal lobule (bilateral) and supplemental motor area on the unaffected hemisphere immediately after electroacupuncture treatment. Longstanding glucose metabolism changes lasted three weeks after daily electroacupuncture stimulation and took place in the bilateral primary motor areas and superior parietal lobules. Glucose metabolism in the insula, putamen, and cerebellum were also altered significantly. These findings implicate electroacu-

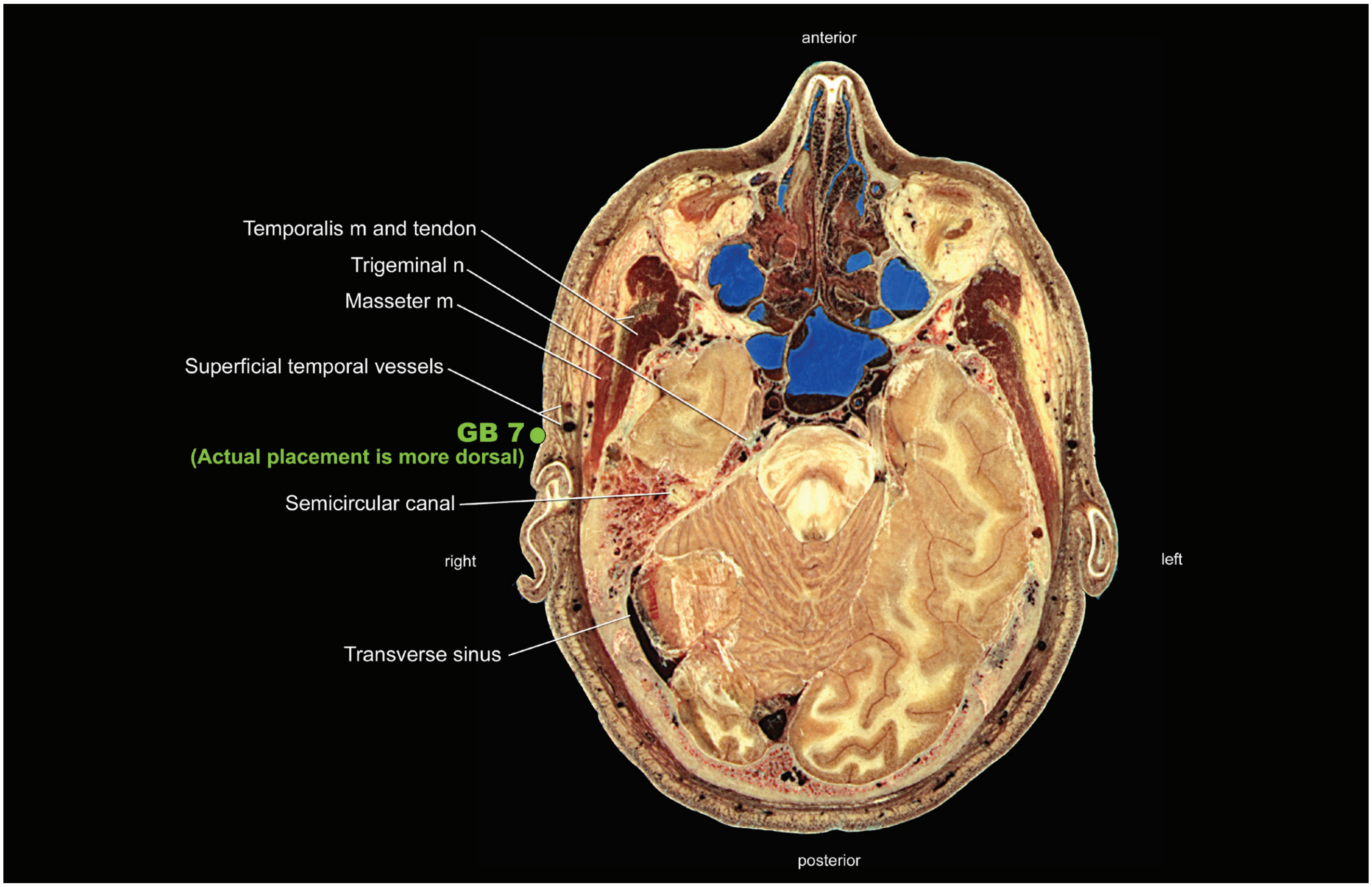


Figure 11-25B. This cross section illustrates the proximity of the semicircular canals to the extracranial site just caudal to GB 7. The semicircular canals process information about balance. The auriculotemporal nerve (near GB 7 as well) provides extracranial afferent input via the trigeminal nerve and the spinal tract of V. Both sources of neural stimulation help maintain equilibrium.

puncture at GB 7 and GV 20 as **influencing cerebral motor plasticity following ischemic stroke.**[9]

- Treatment of **vertigo induced by vertebrobasilar insufficiency** included the following points targeted in a "penetrating needle" fashion (i.e., threading from one location to another): GV 20 toward GV 21, GB 8 to GB 7, BL 9 toward BL 10, stimulated further with electroacupuncture. Activating points in this manner outperformed treatment selected according to TCM metaphors.[10]

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.

2. Stack B and Sims A. The relationship between posture and equilibrium and the auriculotemporal nerve in patients with disturbed gait and balance. *Journal of Craniomandibular Practice.* 2009; 27(4):248-260.

3. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.

4. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.

5. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.

6. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.

7. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

8. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.

9. Fang Z, Ning J, Xiong C, et al. Effects of electroacupuncture at head points on the function of cerebral motor areas in stroke patients: a PET study. *Evidence-Based Complementary and Alternative Medicine.* 2012; doi:10.1155/2012/902413.

10. Qi XJ and Wang S. Penetrating needling on head points for vertigo caused by vertebral-basilar arterial blood-supply insufficiency. *Zhongguo Zhen Jiu.* 2011;31(6):503-507.

GB 8

Shuai Gu “Leading Valley”

On the temporal region, in a small depression 1 cun dorsal to the apex of the auricle and TH 20. Located 1.5 cun inside the hairline where a bulge forms when the teeth clench.

Muscles

- **Superior auricular muscle:** The superior auricular muscle wiggles the ear. It is larger than the rostral (anterior) and caudal (posterior) auricular muscles, but also thin and fan-shaped. The fibers of the superior auricular muscle arise from the galea aponeurotica and converge to create a flat tendon that inserts onto the upper portion of the cranial aspect of the auricle.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The superior auricular muscle, like its larger neighbor, the temporalis muscle, exhibits a fan pattern to its fibers. As such, the distribution of central trigger points in either muscle similarly arrange in a fan-like array rather than a straight line.

A common source of pain and dysfunction affecting the temporomandibular joint,[1] the temporalis muscle fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible.

Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.

Nerves

- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** In this region, supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.
- **Anterior and posterior deep temporal nerves (CN V_3):** Provide motor to the temporalis muscle. They branch off of the anterior division of the mandibular portion of the CN V.
- **Greater occipital nerve (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve.

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[6] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

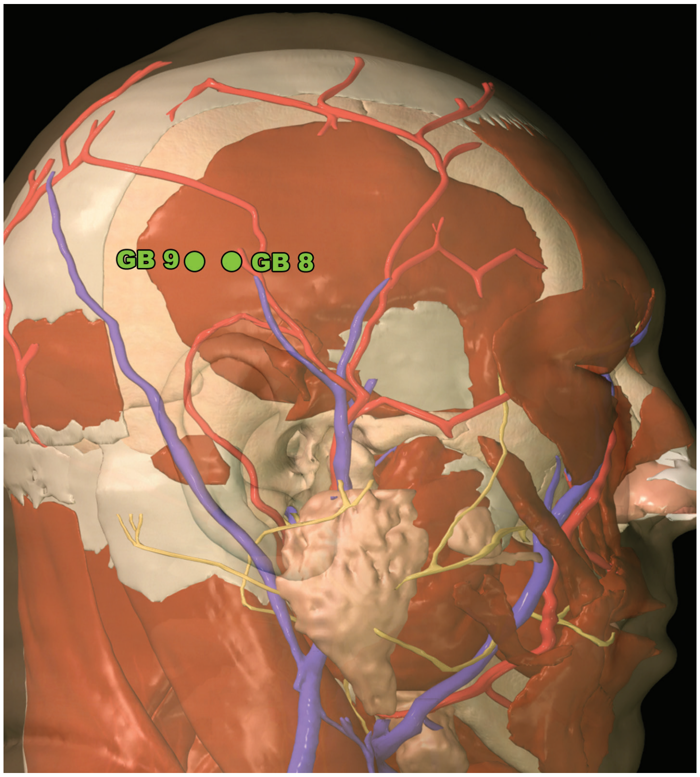


Figure 11-26. GB 8 and GB 9 identify locations where taut bands arise in the Horizontal, caudal part of the temporalis muscle. Find GB 8 where a bulge appears when the teeth tightly clench. Trigger points here refer pain to the parietal region and midline of the head.

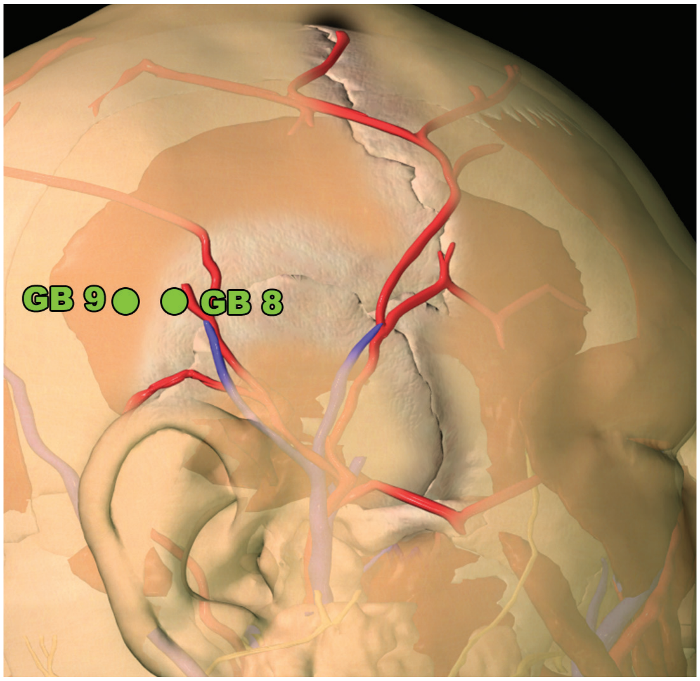


Figure 11-27. Tenderness to palpation at GB 8 may reflect not only myofascial dysfunction in the temporalis muscle but also cranial dysfunction in the temporoparietal suture. The suture appears adjacent to GB 8 in this lateral image. Alternate names for GB 8 such as "Following the Bone" or "Following the Corner" make more sense when seeing the suture and its "corner" near the point.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[7] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 8 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[8]

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible, pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait.[2]

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function.

Afferent information reaching the nucleus raphe magnus in the reticular formation makes its way by means of the spinal tract of V. These input can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send afferent input that may sensitize neural pathways related to auriculotemporal nerve input. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or "resting" activity within the reticular formation.

Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input conveyed through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

The GON ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. The GON becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[9] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

Convergent input between the GON and the trigeminal nerve supplying the rostral epicranium may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[3,4] That is, crosstalk between the GON and the trigeminal nerve along with windup in the trigeminocervical complex in the brainstem and cervical cord can cause both intracranial and extracranial sources of discomfort. Stimulation of the GON through acupuncture and related techniques can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino- cervical convergence at the level of the trigeminal nucleus caudalis.[10]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[11] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[12] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[13,14]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[15] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia,

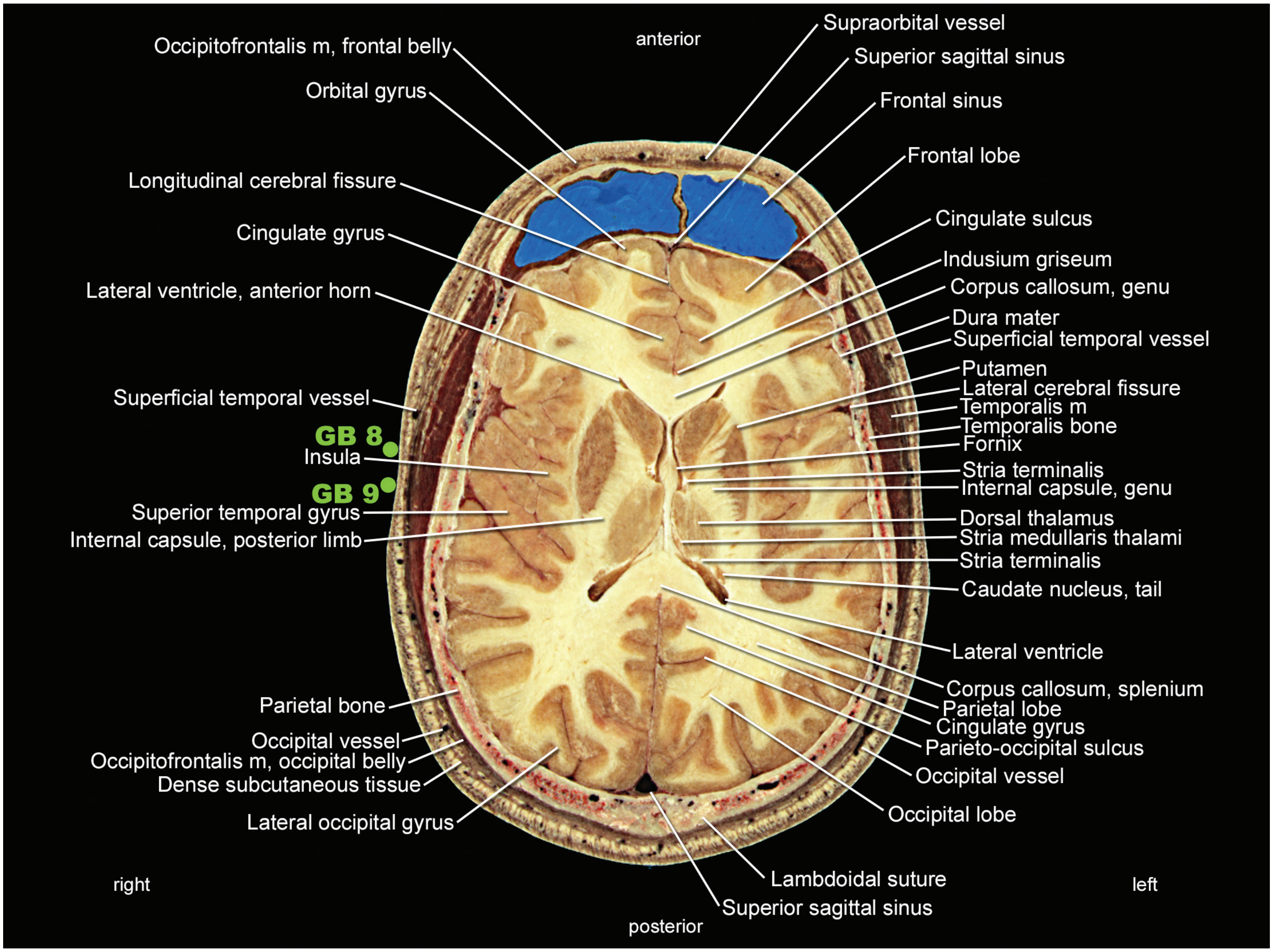

anterior
Occipitofrontalis m, frontal belly
Orbital gyrus
Longitudinal cerebral fissure
Cingulate gyrus
Lateral ventricle, anterior horn
Superficial temporal vessel
GB 8
Insula
GB 9
Superior temporal gyrus
Internal capsule, posterior limb
Parietal bone
Occipital vessel
Occipitofrontalis m, occipital belly
Dense subcutaneous tissue
Lateral occipital gyrus
right
Supraorbital vessel
Superior sagittal sinus
Frontal sinus
Frontal lobe
Cingulate sulcus
Indusium griseum
Corpus callosum, genu
Dura mater
Superficial temporal vessel
Putamen
Lateral cerebral fissure
Temporalis m
Temporalis bone
Fornix
Stria terminalis
Internal capsule, genu
Dorsal thalamus
Stria medullaris thalami
Stria terminalis
Caudate nucleus, tail
Lateral ventricle
Corpus callosum, splenium
Parietal lobe
Cingulate gyrus
Parieto-occipital sulcus
Occipital vessel
Occipital lobe
Lambdoidal suture
Superior sagittal sinus
left
posterior

Figure 11-28. The "valley" referred to by the descriptive name for GB 8, "Valley Lead", could refer to the valley created by the brain deep to this site. The lateral temporal, or Sylvian fissure, will lead to the insula. Targeting the insula with transcranial laser therapy could possibly affect this small area of cortex involved in perpetuating addictive behaviors. The insula has been considered a "critical neural substrate" to smoking addiction.[22]

but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[16] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[17]

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.
- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 8, considering the limited responses to conventional methods often seen.[18]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[19]

The posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization offers one alternative to pharmacotherapy,[20] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear, from GB 8/ TH 20 to TH 17. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Indications and Potential Point Combinations

- **Headache:** When the headache radiates to the midline from the temporalis muscle, palpate for trigger points, consider adding GB 8 or GB 9 if tender to palpation.
- **Dizziness:** GB 8, GB 7, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Persistent nausea and vomiting:** GB 8, PC 6, GV 20, ST 36, SP 6.
- **Smoking cessation:** GB 8, GB 18, HT 7.

Evidence-Based Applications

- Needling GB 5 through to GB 8 or GB 8 to Taiyang, supplemented by points GB 20, TH 3, and GB 43, effectively reduced **migraine** pain.[5]
- A mixture of acupuncture plus oral administration of Chinese herbs effectively treated **migraine**.[21] Points included GB 8, GB 20, GV 20, LR 2, PC 6, and SP 6 as well as loci that exhibited tenderness to palpation.

References

1. Simons DG, Travell JG, and Simons LS. Chapter 9. Temporalis muscle. Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. Upper Half of Body, 2nd edition. Baltimore: Williams & Wilkins, 1999. Pp. 349-364.
2. Stack B and Sims A. The relationship between posture and equilibrium and the auriculotemporal nerve in patients with disturbed gait and balance. Journal of Craniomandibular Practice. 2009; 27(4):248-260.
3. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. Brain. 2002;125:1496-1509.
4. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. Brain. 2003;126:1801-1813.
5. Gan Z, Zhang Z, and Huang Y. Treatment of migraine by acupuncturing through Xuanlu or Taiyang to Shuaigu. Journal of Traditional Chinese Medicine. 1986;6(1):21-22.
6. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
7. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
8. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
9. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
10. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
11. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.
12. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.
13. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.
14. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.
15. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
16. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
17. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.
18. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
19. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.
20. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.
21. He QY, Liang J, Zhang Y, et al. Thirty-two cases of vascular headache treated by acupuncture combined with Chinese herbal decoction. *J Tradit Chin Med.* 2009;29(4):253-257.
22. Naqvi NH, Rudrauf D, Damasio H, et al. Damage to insula disrupts addiction to cigarette smoking. *Science.* 2007; 315(5811):531-534.

GB 9

Tian Chong "Heavenly Rushing", "Celestial Passage", or "Celestial Hub"

On the temporal region, 2 cun within the hairline, posterior and superior to the root of the auricle, about .5 cun posterior to GB 8, in a small depression. Compare the placement of GB 8 and GB 9 in the cross section appearing in Figure 11-28.

Muscles

- **Superior auricular muscle:** The superior auricular muscle wiggles the ear. It is larger than the rostral (anterior) and caudal (posterior) auricular muscles, but also thin and fan-shaped. The fibers of the superior auricular muscle arise from the galea aponeurotica and converge to create a flat tendon that inserts onto the upper portion of the cranial aspect of the auricle.
- **Temporalis muscle:** Closes the jaw by elevating the mandible. Retrudes the mandible after it protrudes.

Clinical Relevance: The superior auricular muscle, like its larger neighbor, the temporalis muscle, exhibits a fan pattern to its fibers. As such, the distribution of central trigger points in either muscle similarly arrange in a fan-like array rather than a straight line.

A common source of pain and dysfunction affecting the temporomandibular joint, the temporalis muscle fills the temporal fossa, overlying the adjoined zygomatic, frontal, parietal, sphenoid, and temporal bones. The temporalis muscle attaches onto the medial and lateral aspects of the coronoid process of the mandible as well as onto the anterior edge of the ramus of the mandible. Its extent almost reaches the last molar tooth. The temporalis muscle fibers fan out in a rostral-caudal direction like spokes of a wheel, collecting onto their mandibular attachment as they would onto a hub. This multi-directional circumstance allows the temporalis to move the mandible in a variety of directions to accommodate the motions required for chewing, speaking, yawning, etc. The rostral/vertical, middle/oblique, and caudal/horizontal bundles of these fibers form three functionally distinct portions with each group referring a different pain pattern when trigger points develop. That is, attachment trigger points (ATrPs) (i.e., those occurring at the musculotendinous junction) in the anterior division leads to a pain trajectory that arches over the supraorbital ridge, up to the forehead, and down to the ipsilateral nasal ala and upper incisor teeth. ATrPs in the middle and caudal sections refer pain upward toward the midline of the cranium in fingerlike projections aligned with the direction of the spokes, or muscle fibers. Normal chewing activates mainly the rostral fibers or a combination or rostral and middle. Jaw clenching, bruxism, chewing gum on one side with a strong lateral component disrupts normal mechanics, leading to overuse and development of myofascial restrictions.

Nerves

- **Auriculotemporal nerve (CN V$_3$):** Provides sensory innervation to the parotid gland. Provides sensation to the skin anterior to the ear and posterior temporal region, the tragus and part of the helix of the auricle, the roof of the exterior auditory meatus, and the upper tympanic membrane.
- **Facial nerve (CN VII), temporal branch:** In this region, supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.
- **Deep temporal nerve branches from the mandibular nerve (CN V$_3$):** Innervate the temporalis muscle.
- **Greater occipital nerve (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[1,2]

Clinical Relevance: Pain from myofascial and temporomandibular (TMJ) sources affects the head and neck; much of this pain results from somatic dysfunction causing neuropathic pain by means of nerve entrapment or compression. Neuromodulation of nerves supplying the TMJ, local musculature, and nearby vessels provides analgesia and alleviates myofascial dysfunction for this craniomandibular disorder.

In addition to musculoskeletal problems, periauricular pain and TMJ discomfort may be caused by neoplasia, such as infiltrating carcinomas of the head and neck.[4] Neural anastomoses and communicating branches connecting the facial and trigeminal nerves create a conduit for perineural tumor spread. This type of tumor growth occurs fairly frequently in patients with either

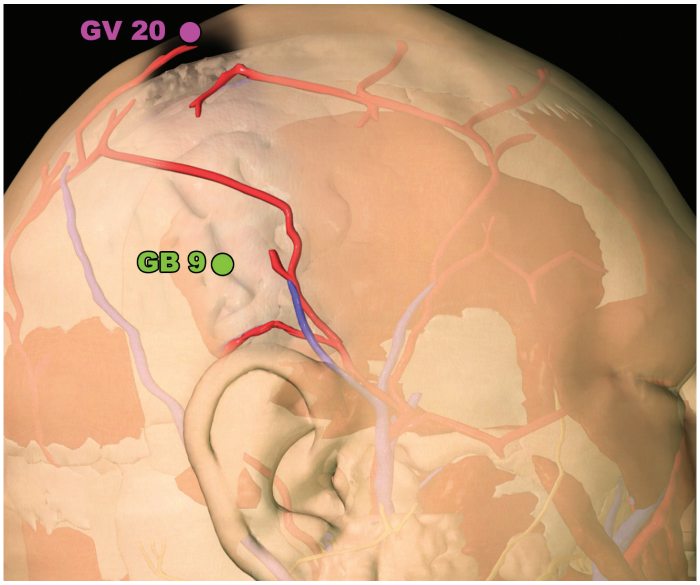


Figure 11-29. The term "Celestial Hub" for GB 9 refers to the relationship between GB 9, the "hub" in this case, and GV 20, a "celestial point" by dint of its relationship to mental-emotional processes. Too, GV 20 occupies the "sky" position on the metaphorical rim of a wheel outlined by the horizon of the calvarium depicted in this image. The direction that vessels take from GB 9 to GV 20 suggests a "rushing up" or "surge" from GB 9 to GB 20. Hence the names, "Heavenly Rushing" and "Celestial Passage". Specifically, as depicted here, the parietal branch of the superficial temporal artery "rushes" blood toward GV 20 along a "celestial passage".

adenoid cystic carcinoma or skin cancer afflicting the head or neck. The auriculotemporal nerve serves as one of several sites through which this spread occurs. Carcinoma of the head and neck thus constitutes a differential diagnosis for pain in the ear and TMJ.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[5] Its hitch-hiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB 9 and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[6]

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible, pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait.

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function.

Afferent information reaching the nucleus raphe magnus in the reticular formation makes its way by means of the spinal tract of V. These input can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send afferent input that may sensitize neural pathways relatedto auriculotemporal nerve input. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or "resting" activity within the reticular formation.

Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input conveyed through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

The GON ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. The GON becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[7] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

Convergent input between the GON and the trigeminal nerve supplying the rostral epicranium may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck. That is, crosstalk between the GON and the trigeminal nerve along with windup in the trigeminocervical complex in the brainstem and cervical cord can cause both intracranial and extracranial sources of discomfort.

Stimulation of the GON through acupuncture and related techniques can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino- cervical convergence at the level of the trigeminal nucleus caudalis.[8]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[9] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[10] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[11,12]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[13] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[14] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[15]

Functional brain imaging reveals how neuromodulation affects cerebral activation levels, whether the stimulation arrives by cranial, spinal, or peripheral neural avenues. Functional magnetic resonance imaging (fMRI) research evaluating the effects of acupuncture on the brain has compared stimulation of scalp and body loci. Findings expose unique signal activations between the two groups, most likely resulting from the different afferent endings stimulated by each approach.[16] The scalp acupuncture group (needled at left-side only TH 20, GB 18, GB 9, and Sishencong) demonstrated more activity in the contralateral somatosensory association cortex, the postcentral gyrus, and the parietal lobe as compared to the limb acupuncture group, who received treatment at right-side only LI 1, LI 10, LR 3, and

ST 36. Perhaps unsurprisingly, the latter points produced activation in the right occipital lobe, lingual gyrus, visual association cortex, right parahippocampal gyrus, limbic lobe, hippocampus, left anterior lobe, culmen, and cerebellum.

Vessels

- **Posterior auricular artery:** This small branch of the external carotid artery ascends between the external acoustic meatus and the mastoid process. Its distribution includes the nearby muscles, parotid gland, facial nerve, auricle, scalp, and structures in the temporal bone.
- **Posterior auricular vein:** The posterior auricular vein not only drains the scalp posterior to the auricle, but it also often receives a mastoid emissary vein from the sigmoid sinus, which is one of the dural venous sinuses.
- **Superficial temporal artery:** Arises from the external carotid artery and ascends anterior to the ear, to the temporal region; ends in the scalp. Provides blood circulation to the facial muscles and the skin of the frontal and temporal regions.
- **Superficial temporal vein:** This vein arises from the widespread plexus of veins on the scalp's lateral aspect and along the zygomatic arch. The superficial temporal vein drains blood from the side of the scalp, the superficial portions of the temporal muscle, and the external ear.
- **Deep temporal arteries and veins:** Supply and drain the temporalis muscle.

Clinical Relevance: The posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization offers one alternative to pharmacotherapy,[17] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Indications and Potential Point Combinations

- **Headache:** When the headache radiates to the midline from the temporalis muscle, palpate for trigger points, consider adding GB 8 or GB 9 if tender to palpation.
- **Dizziness:** GB 9, GB 7, SI 19, GB 20, GV 24.5 (Yintang), GV 20.
- **Persistent nausea and vomiting:** GB 9, PC 6, GV 20, ST 36, SP 6.
- **Ear wiggling disorder affecting the auricularis superior muscle:**[3] GB 9, GB 8, TH 17.

References

1. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain.* 2002;125:1496-1509.
2. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain.* 2003;126:1801-1813.
3. Srirompotong S, Saeseow P, Kharmwan S, et al. Ear wiggling ticcs: treatment with botulinum toxin injection. *Eur Arch Otorhinolaryngol.* 2007;264:385-387.
4. Schmalfuss IM, Tart RP, Mukherji S, et al. Perineural tumor spread along the auriculotemporal nerve. *AJNR Am J Neuroradiol.* 2002;23:303-311.
5. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
6. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
7. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
8. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
9. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.
10. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.
11. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.
12. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.
13. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
14. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
15. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.
16. Park SU, Shin AS, Jahng GH, et al. Effects of scalp acupuncture versus upper and lower limb acupuncture on signal activation of blood oxygen level dependent (BOLD) fMRI of the brain and somatosensory cortex. *J Altern Complement Med.* 2009;15(11):1193-2000.
17. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.

GB 10

Fu Bai "Floating White"

On the temporal region, posterior to the auricle and superior to the mastoid process, at the junction of the upper and middle thirds of a curved line running parallel to the rim of the ear and within the hairline that connects GB 9 and GB 12. Note its relationship to GB 9 and GB 12 as demarcated in Figure 11-30A.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as that near GB 10, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipitalis (e.g., BL 9) muscles. Figure 11-30A depicts the relationship of GB 10 to the galea aponeurotica and the occipital belly of the epicranius ("occipitialis" m). Lateral pulls from the temporalis fascia accentuate tension in the epicranial aponeurosis and predisposes patients to headache syndromes.

Clinical Relevance: GB 10 can become tender to palpation with occipitofrontalis tension (e.g., in cases of tension headache) that results in traction on the epicranial aponeurosis. GB 10 also becomes tender in some patients suffering from migraine and chronic neck pain. In addition, many muscles refer pain to the occipital region when they harbor trigger points. These muscles include the trapezius, sternocleidomastoid, semispinalis, splenius, suboccipital group, occipitalis, digastric and temporalis.

Nerves

- **Posterior auricular nerve (from the facial nerve, CN VII):** Supplies the auricularis posterior muscle and the occipital belly of the occipitofrontalis muscle.
- **Great auricular nerve (ventral rami of C2, C3):** This branch of the cervical plexus emerges from the posterior triangle of the neck. It courses parallel to the external jugular vein, then branches to provide sensation to the skin over the parotid gland, mastoid process, and pinna. Specifically, the great auricular nerve supplies the lobule and antitragus. It sometimes acts alone to supply sensation to the tragus; other times it shares this function with the auriculotemporal nerve.[4] The great auricular nerve also usually innervates the tail of the helix and the scapha. It also supplies sensation to the skin overlying the angle of the mandible. Communicates with the transverse cervical nerve, the cervical branch of the facial nerve, and the marginal mandibular nerve.[5] The great auricular nerve may issue a mastoid branch to that communicates with the lesser occipital nerve.
- **Lesser occipital nerve (ventral rami of C2, C3):** Supplies the skin over its course that runs from the posterior border of the SCM to the occiput; communicates with the greater occipital nerve. Lesser occipital nerve pain typically appears after physical exertion.[6]
- **Greater occipital nerve, or Arnold's nerve (dorsal rami of C2, (C3)):** This medial branch of the dorsal ramus of predominantly the C2 spinal nerve constitutes the greater occipital nerve; fibers from C3 may join in. It provides sensation to the skin from the occiput to the vertex and crosstalks with the lesser and third (least) occipital nerves.[1] The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle

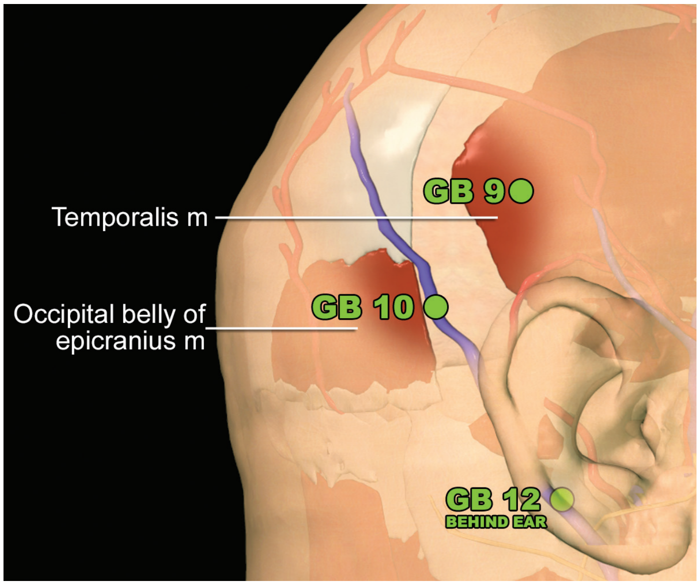


Figure 11-30A. A trigger point in the occipital belly of the epicranius muscle, otherwise known as the occipitalis muscle, refers pain to the ipsilateral parietal region and eye. The term "Floating White" may correspond to the epicranial aponeurosis. Or, this descriptive title for GB 10 may speak to the absence of muscle at this site altogether. This image illustrates the "in-between" location of GB 10, "floating" between myofascial elements atop the whiteness of the calvarium.

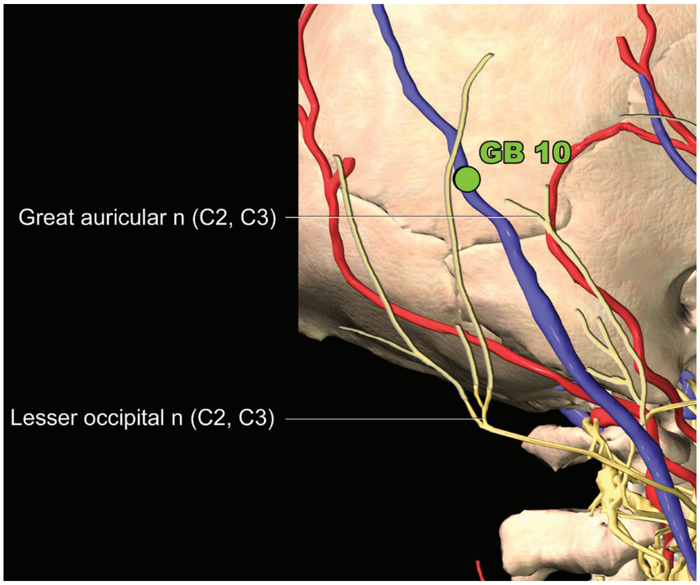


Figure 11-30B. The great auricular nerve and the lesser occipital nerve supply the integument in the vicinity of GB 10. The lesser occipital nerve communicates with the greater occipital nerve, and neuropathy of either can lead to headache. Peripheral stimulation of the occipital nerves has become more widely accepted for intractable chronic cluster headache.[21] While some practitioners implant electrodes in the suboccipital region to treat chronic headache, acupuncture and related techniques offer a much less invasive alternative.

cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[2,3]

The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[7] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

Clinical Relevance: One of the risks of having a facelift performed involves nerve damage; injury to the great auricular nerve happens in about 7% of patients.[8] This nerve courses over the mid-body of the SCM where it bifurcates into anterior and posterior (or rostral and caudal) branches and its terminal arborization. Rhytidectomy surgery involving revision of cervical folds may damage the great auricular nerve and cause loss of sensation caudal to the ear. Nerve stimulation in this zone may facilitate return of sensation, depending on the type of nerve damage induced.

Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[9]

This region also receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of BL 9 in point protocols addressing intracranial and extracranial sources of discomfort.

Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino-cervical convergence at the level of the trigeminal nucleus caudalis.[1,10]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[11] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[12] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[13,14]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[15] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[16] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[17]

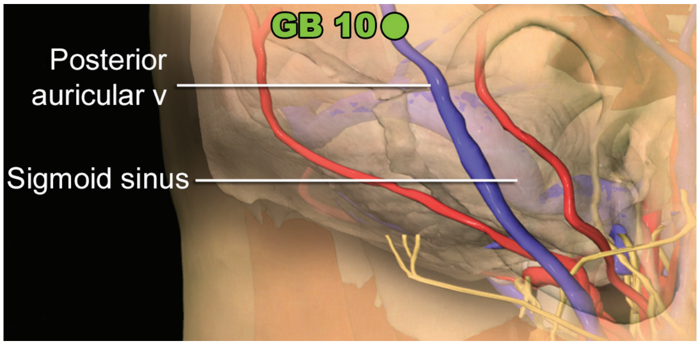


Figure 11-31. The posterior auricular vein beneath GB 10 connects to the sigmoid sinus, a dural venous sinus, via a mastoid emissary vein (not shown).

Vessels

- **Posterior auricular artery:** Begins at the external carotid artery and courses posteriorly, deep to the parotid gland, and migrates along the styloid process between the ear and the mastoid process. Nourishes the scalp posterior to the auricle, as well as the auricle itself.
- **Posterior auricular vein:** Drains the scalp posterior to the auricle. The posterior auricular vein often receives blood from the sigmoid sinus (a dural venous sinus) via the mastoid emissary vein.
- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Usually drains into the suboccipital venous plexus or the internal jugular vein.

Clinical Relevance: True to its name as "spasm vessel" or "tugging vessel", the posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization represents one alternative to pharmacotherapy,[18] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact

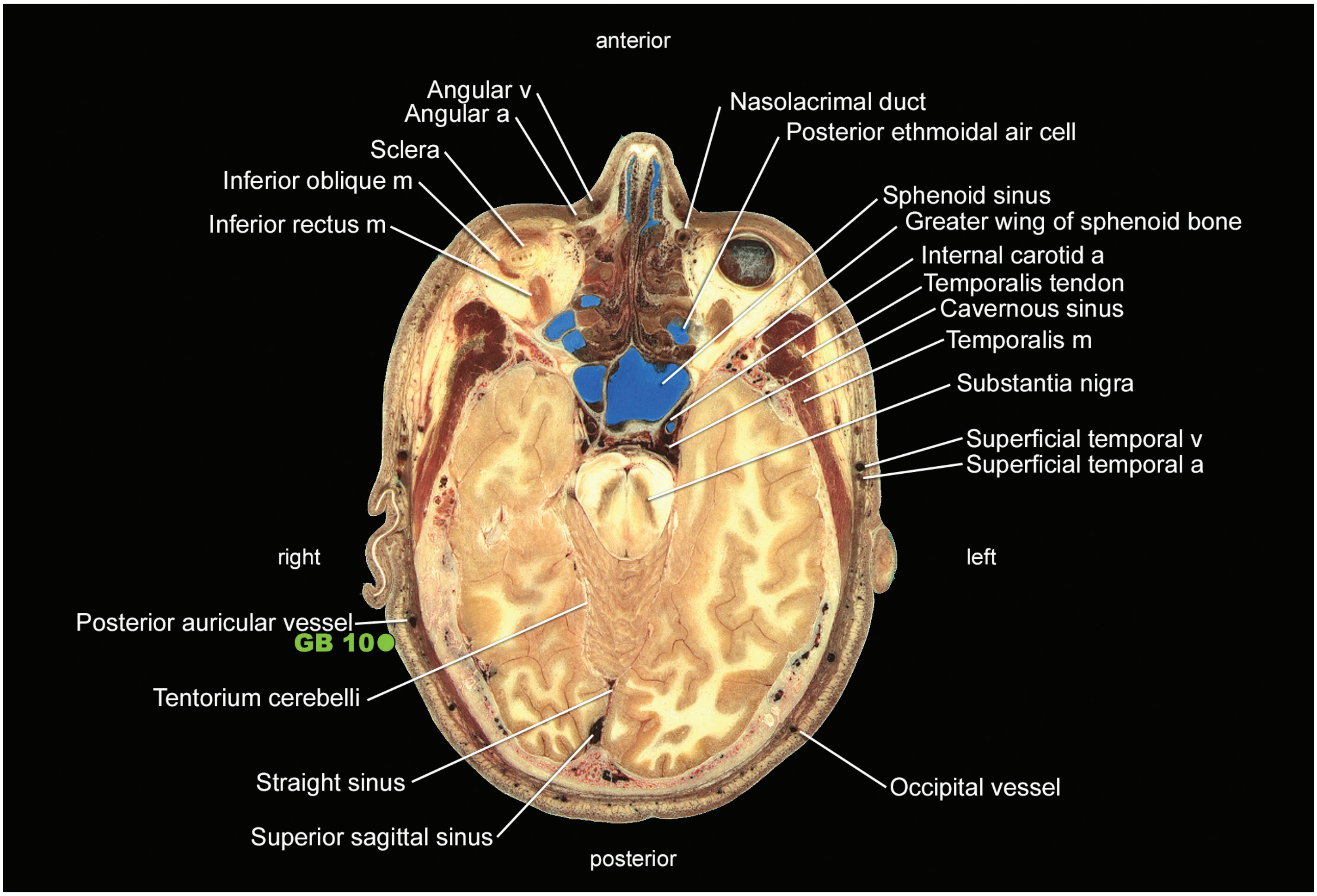

anterior
Angular v
Angular a
Sclera
Inferior oblique m
Inferior rectus m
Nasolacrimal duct
Posterior ethmoidal air cell
Sphenoid sinus
Greater wing of sphenoid bone
Internal carotid a
Temporalis tendon
Cavernous sinus
Temporalis m
Substantia nigra
Superficial temporal v
Superficial temporal a
right
left
Posterior auricular vessel
GB 10
Tentorium cerebelli
Straight sinus
Superior sagittal sinus
Occipital vessel
posterior

Figure 11-32. Typical indications for GB 10 include headache, movement disorders, and visual disturbances. A local source of extracranial head pain involves myofascial trigger points in the occipitalis muscle. Intracranial sources of pain include dural irritation. Applications for movement disorders and visual problems correspond to the nearby cerebellar and occipital portions of the brain. These intracerebral sites offer access through transcranial laser therapy or reflexive neuromodulation by means of acupuncture.

reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[19] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[20] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Headache from local myofascial dysfunction:** GB 10, GV 20, GV 19, BL 10, tender myofascial trigger points.
- **Cluster headache:** GB 10, BL 10, GB 20, LI 4, Yintang, GV 20.
- **Epilepsy:** GB 10, GV 20, BL 10, BL 60, HT 3, ST 36, Yingtang.
- **Great auricular neuritis (non-infectious):** GB 10, GB 12, TH 18, TH 20.
- **Tinnitus:** Palpate for somatic dysfunction and trigger points in the temporalis, occipitalis, and suboccipital muscles. Ask the patient if pressure at any of these sites, including GB 10, reduces the intensity of the tinnitus. If so, consider a structural etiology and deactivate trigger points accordingly. Employ soft tissue therapy and myofascial release to improve fascial and structural mobility in the region, reducing pressure on the "sound system" of the ear, including the temporal bone in which it is housed.
- **Greater occipital neuralgia (Arnold's neuralgia), with pain extending from suboccipital locations to the vertex (GV 20):** GB 10, GB 19, GB 20, GB 21, BL 10, BL 9, GV 20.

References

1. Tubbs RS, Salter EG, Wellons III JC, et al. Landmarks for the identification of the cutaneous nerves of the occiput and nuchal regions. *Clinical Anatomy.* 2007;20:235-238.
2. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain.* 2002;125:1496-1509.
3. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. Brain. 2003;126:1801-1813.
4. Peuker ET and Filler TJ. The nerve supply of the human auricle. *Clinical Anatomy.* 2002; 15(1):35-37.
5. Brennan PA, Gholmy MA, Ounnas H, et al. Communication of the anterior branch of the great auricular nerve with the marginal mandibular nerve: A prospective study of 25 neck dissections. *Br J Oral Maxillofac Surg.* 2010;48(6):431-433.
6. Tubbs RS, Salter EG, Wellons III JC, et al. Landmarks for the identification of the cutaneous nerves of the occiput and nuchal regions. *Clinical Anatomy.* 2007;20:235-238.
7. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
8. Lefkowitz T, Hazani R, Chowdhry S, et al. Anatomical landmarks to avoid injury to the great auricular nerve during rhytidectomy. *Aesthet Surg J.* 2013;33(1):19-23.
9. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine.* 1998;23:1435-1441.

10. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.

11. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.

12. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.

13. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.

14. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.

15. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.

16. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.

17. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.

18. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.

19. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.

20. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.

21. Burns B, Watkins L, and Goadsby PJ. Treatment of intractable chronic cluster headache by occipital nerve stimulation in 14 patients. *Neurology.* 2009;72:341-345.

GB 11

Tou Qiao Yin "Yin Portals of the Head"

On the temporal region, posterior to the auricle and to the superior ridge of the mastoid process, at the junction of the middle and lower thirds of a curved line running parallel to the rim of the ear and within the hairline that connects GB 9 and GB 12. Feel for the depression in which this point sits. Figure 11-34 examines the source of this depression at GB 11 along with the relationship between GB 11 and its neighboring points along the GB channel.

Muscles

- **Auricularis posterior muscle:** Retracts the auricle.
- **Splenius capitis muscle:** Working bilaterally, the splenius capitis muscles extend the head. Working unilaterally, the splenius capitis bends the head in a lateral direction.
- **Sternocleidomastoid (SCM) muscle:** Acting unilaterally, tilts the head laterally. Flexes the neck and rotates it so that the face turns superiorly to the opposite side. When acting bilaterally, the chin thrusts forward.

Clinical Relevance: Myofascial trigger points in any of the muscles in this region can lead to head and neck pain. In addition, pain at the back of the head can arise from trigger points in the multifidi, levator scapulae, splenius cervicis, and infraspinatus muscles. Restriction in the soft tissues in the neck elevates pressure on large, vital neural, vascular, and glandular components, raising the potential for pain and suboptimal endocrine regulation.

GB 11 abuts the posterior, or caudal auricular muscle. As such, neuromodulation at this site may benefit myofascial pathology not only in this muscle but fibers from the attachment of the SCM muscle as well, shown in Figure 11-33. Motor fibers from the accessory nerve (CN XII) exit the skull via the jugular foramen in close association with the vagus nerve, helping to explain the autonomic concomitants associated with SCM dysfunction.

Trigger points in this area radiate pain to the ear, the jaw, the chin, the vertex, the forehead, and the supraorbital ridge (eyebrow).

Nerves

- **Posterior auricular nerve (from the facial nerve, CN VII):** Supplies the auricularis posterior muscle and the occipital belly of the occipitofrontalis muscle.
- **Greater occipital nerve (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[1,2]

The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[3] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

- **Lesser occipital nerve (C2, C3):** Supplies the skin behind the ear, the superior ear, the mastoid area, and possibly a small portion of the skin of the neck. May receive communicating branches from the greater occipital nerve. The lesser and greater occipital nerves pierce the trapezius at the base of the skull and are therefore subject to compression by cervical muscle tension, producing an occipital neuralgia. When this occurs, it may produce further cervical tension, perpetuating occipital head pain.
- **Greater auricular nerve (C2, C3):** Provides sensory innervation for the skin over the mastoid process, parotid gland, and pinna. Its anterior branch communicates with the facial nerve (CN VII) inside the substance of the parotid gland. The posterior branch communicates with the lesser occipital nerve, the auricular branch of the vagus, and the posterior auricular branch of the facial nerve.
- **Dorsal rami of upper cervical nerves:** Innervate the semispinalis capitis and splenius capitis muscles.
- **Spinal accessory nerve (CN XI):** Provides motor to the trapezius muscle.

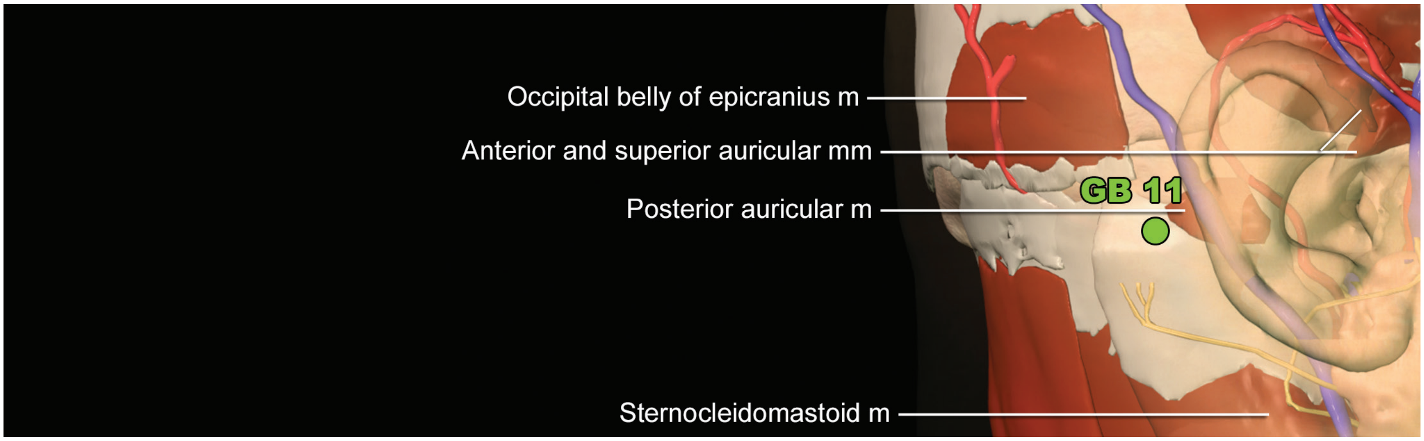

Occipital belly of epicranius m
Anterior and superior auricular mm
Posterior auricular m
GB 11
Sternocleidomastoid m

Figure 11-33. GB 11 lands at the intersection of the occipital belly of the epicranius, the posterior auricular and SCM muscles.

- **Spinal nerves C2, C3, and C4**: Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.

Clinical Relevance: One of the risks of having a facelift performed involves nerve damage; injury to the great auricular nerve happens in about 7% of patients.[4] This nerve courses over the mid-body of the SCM where it bifurcates into anterior and posterior (or rostral and caudal) branches and its terminal arborization. Rhytidectomy surgery involving revision of cervical folds may damage the great auricular nerve and cause loss of sensation caudal to the ear. Nerve stimulation in this zone may facilitate return of sensation, depending on the type of nerve damage induced.

Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[5]

This region also receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of GB 11 in point protocols addressing intracranial and extracranial sources of discomfort.

Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino-cervical convergence at the level of the trigeminal nucleus caudalis.[1,6]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[7] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[8] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[9,10]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[11] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[12] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[13]

Vessels

- **Posterior auricular artery:** Begins at the external carotid artery and courses posteriorly, deep to the parotid gland, and migrates along the styloid process between the ear and the mastoid process. Nourishes the scalp posterior to the auricle, as well as the auricle itself.

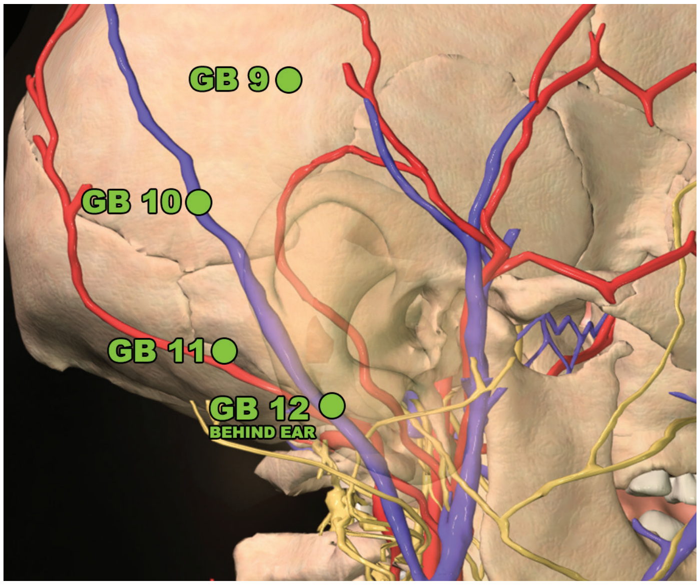


Figure 11-34. The "Yin Portals of the Head" associated with GB 11 include the acoustic auditory meatus, the nearby foramen magnum, and the jugular foramen.

- **Posterior auricular vein:** Drains the scalp posterior to the auricle. The posterior auricular vein often receives blood from the sigmoid sinus (a dural venous sinus) via the mastoid emissary vein.
- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Usually drains into the suboccipital venous plexus or the internal jugular vein.

Clinical Relevance: True to its name as "spasm vessel" or "tugging vessel", the posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization represents one alternative to pharmacotherapy,[14] it seems unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

The occipital artery is often a main feeding artery in cases

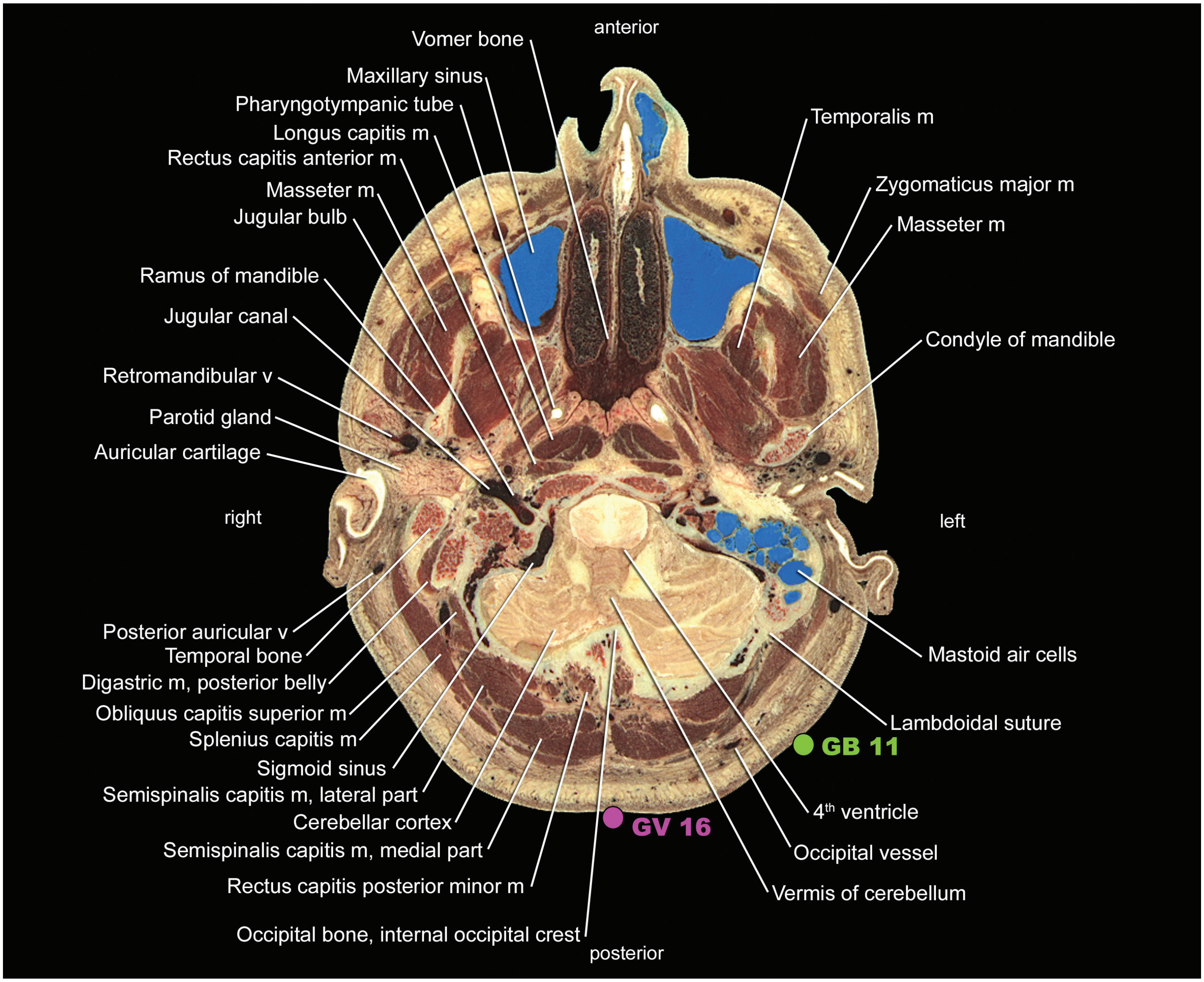

anterior
Vomer bone
Maxillary sinus
Pharyngotympanic tube
Longus capitis m
Rectus capitis anterior m
Masseter m
Jugular bulb
Ramus of mandible
Jugular canal
Retromandibular v
Parotid gland
Auricular cartilage
right
Posterior auricular v
Temporal bone
Digastric m, posterior belly
Obliquus capitis superior m
Splenius capitis m
Sigmoid sinus
Semispinalis capitis m, lateral part
Cerebellar cortex
Semispinalis capitis m, medial part
Rectus capitis posterior minor m
Occipital bone, internal occipital crest
posterior
Temporalis m
Zygomaticus major m
Masseter m
Condyle of mandible
left
Mastoid air cells
Lambdoidal suture
GB 11
4th ventricle
GV 16
Occipital vessel
Vermis of cerebellum

Figure 11-35. Stimulation of GB 11 activates cervico-trigeminal reflexes. These affect not only headache and migraine but also sinusitis and rhinitis. (The blue areas reflect air, such as that in contained within the maxillary sinus and mastoid air cells.) Muscles underlying GB 11 commonly contribute to cervicogenic headache.

of intracranial dural arteriovenous fistulae.[15] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[16] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Headache (occipital or nuchal region):** Palpate for local trigger points, consider GB 11 if tender. Add BL 9, BL 10, GB 19, GB 21, GV 20.
- **Migraine:** GB 11, GB 20, GB 21, BL 10, GV 20, LR 3, LI 4.
- **Neck pain:** GB 11 if tender, add other trigger points, BL 10, GV 14, GB 21.
- **Ear pain:** Consider source of pain; needle trigger points referring to the ear such as GB 11 in the attachment zone of the SCM. Add input to the auriculotemporal nerve: TH 21, SI 19, GB 2, etc.
- **Sinusitis:** GB 11, BL 10, add points specific for sinus affected: BL 2, GB 14 for frontal sinus pain; LI 20, ST 3 for maxillary sinus pain.
- **Tinnitus:** Palpate for somatic dysfunction and trigger points in the temporalis, occipitalis, and suboccipital muscles. Ask the patient if pressure at any of these sites, including GB 11, reduces the intensity of the tinnitus. If so, consider a structural etiology and deactivate trigger points accordingly. Employ soft tissue therapy and myofascial release to improve fascial and structural mobility in the region, reducing pressure on the "sound system" of the ear, including the temporal bone in which it is housed.

References

1. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain.* 2002;125:1496-1509.
2. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain.* 2003;126:1801-1813.
3. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.

4. Lefkowitz T, Hazani R, Chowdhry S, et al. Anatomical landmarks to avoid injury to the great auricular nerve during rhytidectomy. *Aesthet Surg J.* 2013;33(1):19-23.

5. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine.* 1998;23:1435-1441.

6. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.

7. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.

8. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.

9. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.

10. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.

11. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.

12. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.

13. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.

14. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.

15. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.

16. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.

GB 12

Wan Gu "Mastoid Process"

In a depression posterior and inferior to the mastoid process, level with the inferior ridge of the auricle. Locate by sliding a fingertip caudad from the mastoid process, into a depression.

Muscles

- **Sternocleidomastoid muscle (SCM):** Acting unilaterally, the SCM flexes the head laterally and rotates both the head and neck to cause the ear to approach the ipsilateral shoulder. Bilateral activation of the SCM causes neck flexion.
- **Splenius capitis muscle:** Extends the head and neck when both activate; working individually, the splenius rotates the head and neck toward the ipsilateral side. The splenius capitis attaches to the mastoid process at its cranial extent near GB 12.

Clinical Relevance: Myofascial dysfunction in the SCM causes pain to refer to the head and sometimes specifically the face, causing atypical facial neuralgia, tension headache, and cervicocephalalgia.

Enthesopathy of the SCM attachment at the mastoid develop secondary to central trigger points in the muscle belly. Trigger points in the sternal division of the SCM refer to the occipitotemporal and supraorbital regions, the hyoid and chin regions, cheek, TMJ, and vertex. Trigger points in the clavicular division issue referred pain patterns to the concha, posterior auricular section, and the forehead. Both divisions attach onto the mastoid process. Concomitant symptoms resulting from clavicular trigger points include disequilibrium problems such as postural dizziness or, less often, vertigo. Autonomic problems include excessive lacrimation, conjunctival hyperemia, and visual disturbances.

Trigger points in the splenius capitis (closer to BL 10) typically send pain to the vertex.

Nerves

- **Posterior auricular nerve (from the facial nerve, CN VII):** Supplies the auricularis posterior muscle and the occipital belly of the occipitofrontalis muscle.
- **Spinal accessory nerve (CN XI, motor) and branches of C2 and C3 (pain and proprioception):** Innervate the sternocleidomastoid muscle.
- **Greater occipital nerve (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[1,2] Convergence between the cervical and trigeminal excitatory nociceptive systems argues for neuromodulatory acupuncture within the greater occipital nerve distribution for pain problems in the face, e.g., dental and sinus pain to engage inhibitory control over these neural pathways.[3]
- **Lesser occipital nerve (C2, C3):** Supplies the skin behind the ear, the superior ear, the mastoid area, and possibly a small portion of the skin of the neck. May receive communicating branches from the greater occipital nerve. The lesser and

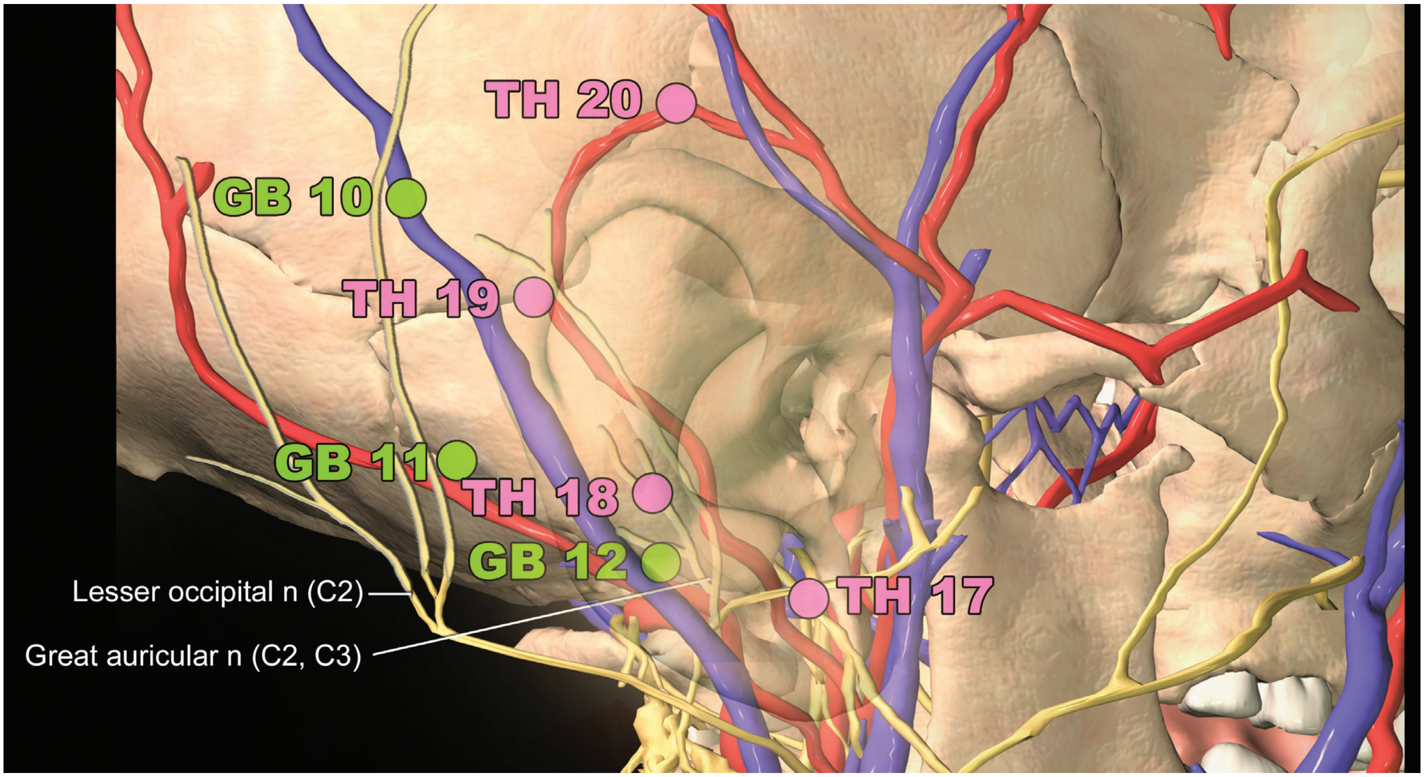


Figure 11-36. GB 12, located on the mastoid process (explaining its name), relates to both the great auricular nerve and the lesser occipital nerve, shown here. These nerves crosstalk with the vagus and facial nerves, providing for multifaceted neuromodulation. Comparative periauricular GB and TH point locations appear here as well. Not shown are the retroauricular lymph nodes that exist at this site.[22]

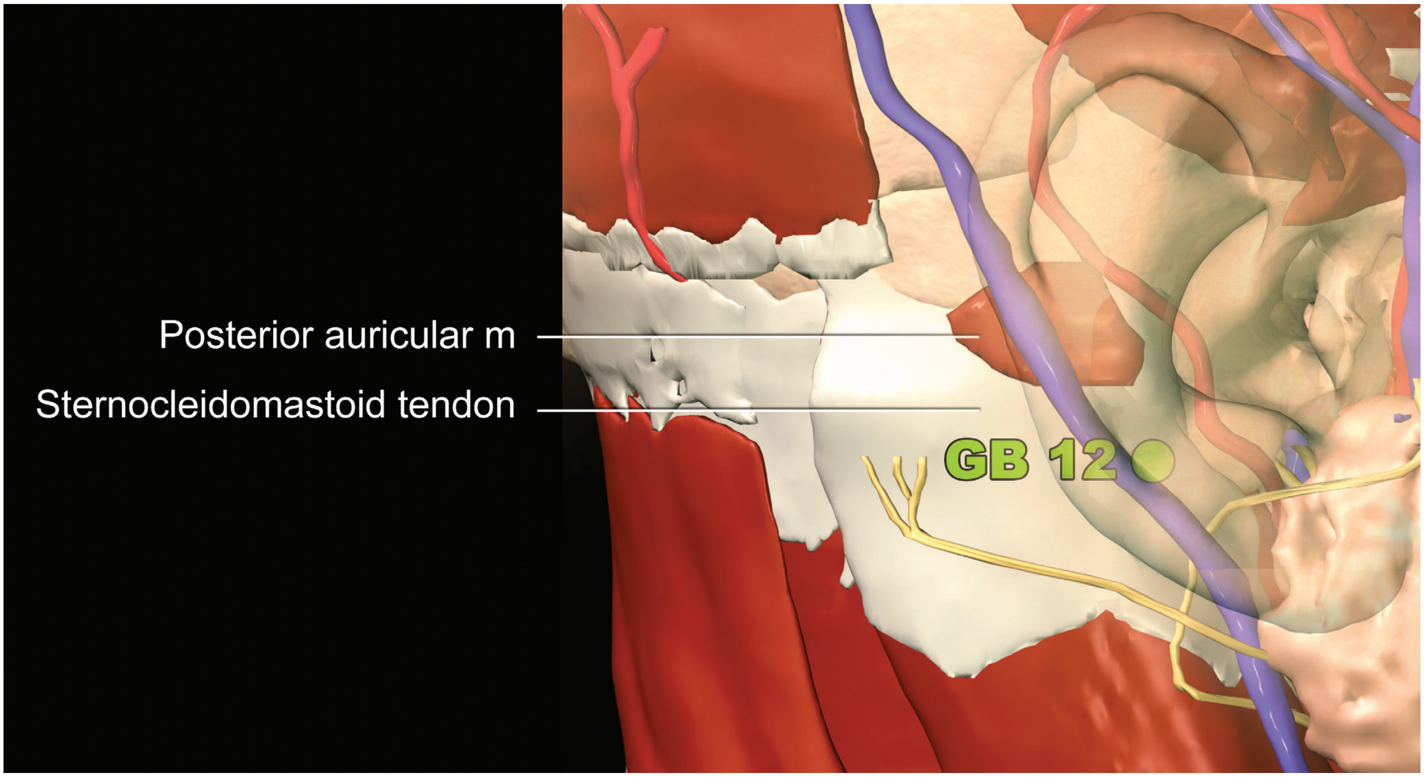


Figure 11-37. Trigger points in either the clavicular or sternal division of the SCM can produce attachment trigger points at GB 12.

greater occipital nerves pierce the trapezius at the base of the skull and are therefore subject to compression by cervical muscle tension, producing an occipital neuralgia. When this occurs, it may produce further cervical tension, perpetuating occipital head pain.

- **Greater auricular nerve (C2, C3):** Provides sensory innervation for the skin over the mastoid process, parotid gland, and pinna. Its anterior branch communicates with the facial nerve (CN VII) inside the substance of the parotid gland. The posterior branch communicates with the lesser occipital nerve, the auricular branch of the vagus, and the posterior auricular branch of the facial nerve.

Clinical Relevance: One of the risks of having a facelift performed involves nerve damage; injury to the great auricular nerve happens in about 7% of patients.[5] This nerve courses over the mid-body of the SCM where it bifurcates into anterior and posterior (or rostral and caudal) branches and its terminal arborization. Rhytidectomy surgery involving revision of cervical folds may damage the great auricular nerve and cause loss of sensation caudal to the ear. Nerve stimulation in this zone may facilitate return of sensation, depending on the type of nerve damage induced.

Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[6]

This region also receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of GB 12 in point protocols addressing intracranial and extracranial sources of discomfort.

Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino-cervical convergence at the level of the trigeminal nucleus caudalis.[1,7]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[8] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[9] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[10,11]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[12] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[13] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[14]

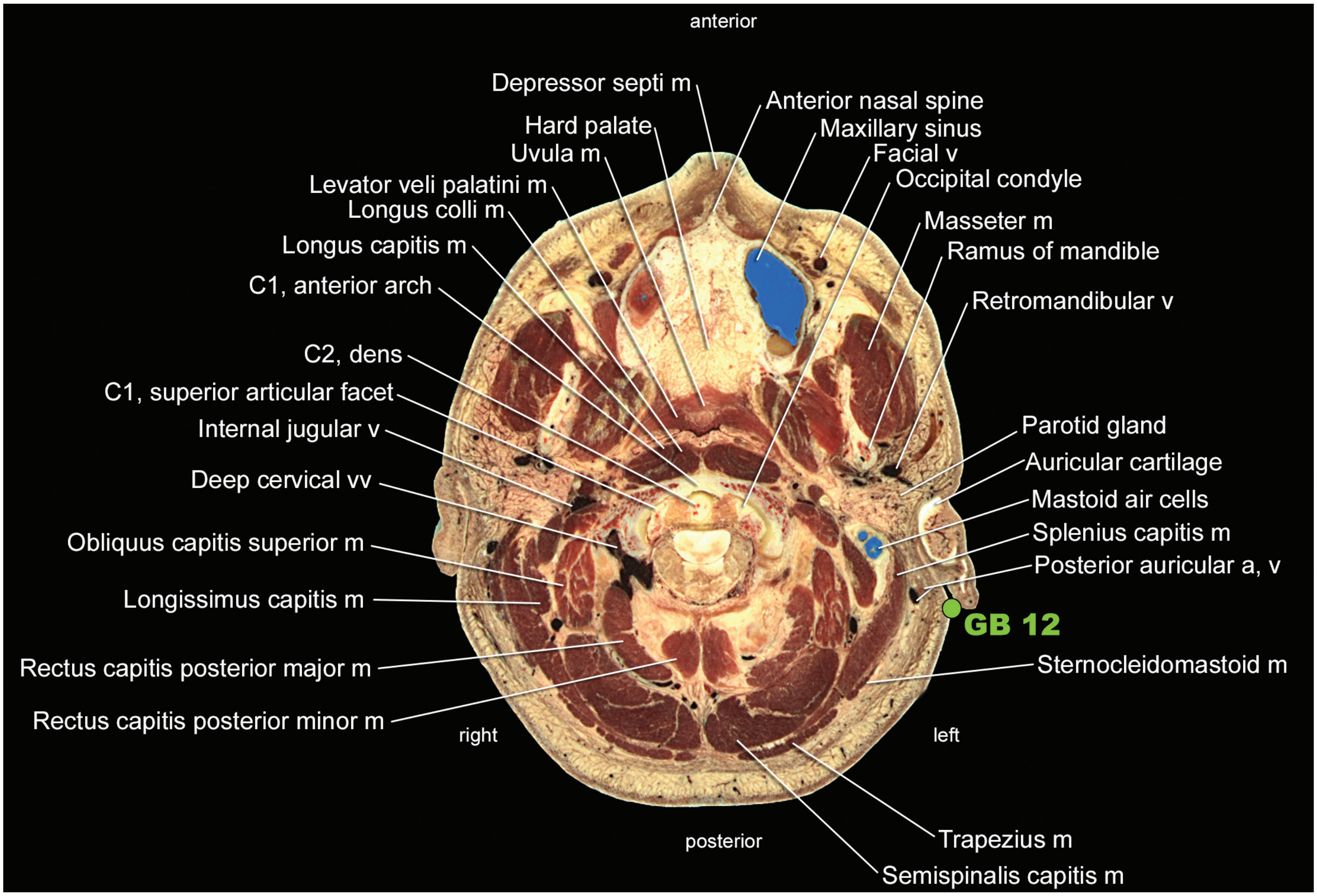

anterior
Depressor septi m
Hard palate
Uvula m
Levator veli palatini m
Longus colli m
Longus capitis m
C1, anterior arch
C2, dens
C1, superior articular facet
Internal jugular v
Deep cervical vv
Obliquus capitis superior m
Longissimus capitis m
Rectus capitis posterior major m
Rectus capitis posterior minor m
right
Anterior nasal spine
Maxillary sinus
Facial v
Occipital condyle
Masseter m
Ramus of mandible
Retromandibular v
Parotid gland
Auricular cartilage
Mastoid air cells
Splenius capitis m
Posterior auricular a, v
GB 12
Sternocleidomastoid m
left
posterior
Trapezius m
Semispinalis capitis m

Figure 11-38. Trigger points in the SCM and splenius capitis muscles, both shown here, can radiate headache pain to the face and vertex.

Vessels

- **Posterior auricular artery:** Begins at the external carotid artery and courses posteriorly, deep to the parotid gland, and migrates along the styloid process between the ear and the mastoid process. Nourishes the scalp posterior to the auricle, as well as the auricle itself.
- **Posterior auricular vein:** Drains the scalp posterior to the auricle. The posterior auricular vein often receives blood from the sigmoid sinus (a dural venous sinus) via the mastoid emissary vein.
- **Occipital artery (a branch of the external carotid artery):** Supplies the scalp at the back of the head.
- **Occipital vein:** Usually drains into the suboccipital venous plexus or the internal jugular vein.

Clinical Relevance: True to its name as "spasm vessel" or "tugging vessel", the posterior auricular artery can cause a vascular headache, or migraine. While surgical cauterization represents one alternative to pharmacotherapy,[15] it is almost unthinkable to transect or otherwise injure a nerve when one could try neuromodulation through noninvasive means first. Furthermore, limiting blood supply to the scalp by surgically annihilating the posterior auricular artery would likely predispose the already disturbed myofascial covering to the skull to even more myofascial trigger pathology.

The posterior, or caudal, auricular artery can also be affected by vasculitides, including giant cell arteritis. When involving the posterior auricular artery, vasculitis causes pain in the auditory canal, pinna, or parotid gland.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[16] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[17] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Pain in mastoid region:** GB 12, GB 19.
- **Red ear syndrome (consists of red ears and burning pain triggered by tactile stimulation) involving great auricular neuropathy:**[4] Neuromodulate the great auricular nerve with GB 12,

GB 11, GB 20, TH 18, TH 19, and BL 10.

- **Tinnitus:** GB 12, SI 19, palpate for tender temporalis, trapezius, cervical paraspinal, and SCM trigger points.
- **Dysequilibirum:** GB 12, trigger points in the clavicular division of the SCM.
- **Headache:** Palpate for trigger points in the splenius capitis and SCM. Add GB 12 to address attachment trigger points at GB 12.

Evidence-Based Applications

- Nerve growth factor (NGF) injection at GB 12 and TH 17 demonstrated value for patients with **nerve deafness and tinnitus.**[18]
- Acupuncture at GB 12, BL 10, and GB 20 along with leech and centipede capsules improved blood coagulation parameters in patients with **transient cerebral ischemic attacks.**[19]
- Needling at GB 12, GB 20, and BL 10 improve blood flow through the vertebrobasilar artery. Adding GV 23 and Yintang improve emotional states and reduce tension in patients with **facial spasm, trigeminal neuralgia, and "stubborn facial paralysis".**[20]
- Acupuncture at GB 12, GB 20, TH 17, CV 23, Jinjin and YuYe alleviated **dysphagia** in patients recovering from stroke better than did routine rehabilitation alone.[21]

References

1. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain.* 2002;125:1496-1509.
2. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain.* 2003;126:1801-1813.
3. Piovesan EJ, Di Stani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attacks. Evidence for inhibitory trigemino-cervical convergence mechanisms. *Arq Neuropsiquiatr.* 2007;65(3-A):599-604.
4. Selekler M, Kutlu A, Ucar S, et al. Clinical Correspondence: Immediate response to greater auricular nerve blockade in red ear syndrome. *Cephalalgia.* 2008;29:478-479.
5. Lefkowitz T, Hazani R, Chowdhry S, et al. Anatomical landmarks to avoid injury to the great auricular nerve during rhytidectomy. *Aesthet Surg J.* 2013;33(1):19-23.
6. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine.* 1998;23:1435-1441.
7. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
8. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.
9. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.
10. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.
11. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.
12. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
13. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
14. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.
15. Shevel E. Surgical treatment of vascular headaches. *The Specialist Forum.* August 2007: 73-76.
16. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.
17. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.
18. Zhou F, Wu P, Wang L, et al. The NGF point-injection for treatment of the sound-perceiving nerve deafness and tinnitus in 68 cases. *J Tradit Chin Med.* 2009;29(1):39-42.
19. Feng L, Zhang J, Wei C, et al. Clinical observation on 30 cases of transient cerebral ischemia attack treated with acupuncture and medication. *J Tradit Chin Med.* 2007;27(2):100-102.
20. Liu Z and Fang G. Mind-refreshing acupuncture therapy for facial spasm, trigeminal neuralgia and stubborn facial paralysis. *J Tradit Chin Med.* 2004;24(3):191-192.
21. Xie Y, Liu H, and Zhou W. Effect of acupuncture on dysphagia of convalescent stroke patients. *Zhongguo Zhong Xi Yi Jie He Za Zhi.* 2011;31(6):736-740.
22. Pan W-R, Le Roux, CM, and Briggs CA. Variations in the lymphatic drainage pattern of the head and neck: further anatomic studies and clinical implications. *Plast Reconstr Surg.* 2011;127:611-620.

GB 13

Ben Shen "Root of the Spirit"

On the frontal region, 0.5 cun within the anterior hairline, on a sagittal line ascending directly upward from the lateral canthus of the eye. Located 2/3 the distance from GV 24 to ST 8.

Muscles

- **Frontal belly of the occipitofrontalis muscle:** Elevates the eyebrows and causes transverse wrinkles to appear in the forehead during frowning.

Clinical Relevance: The trigger point for the frontalis muscles sits at GB 14. It refers fingerlike projections of pain toward the hairline from the midline to the superior temporal region. The pain extends to GB 13 and GB 15 (i.e., frontalis muscle attachment trigger points) where the muscle meets the hairline at the galea aponeurotica. Tension in the frontalis muscle can entrap the supraorbital nerve, leading to a unilateral frontal headache. Frontalis trigger points worsen with anxiety and consternation, emotional states that cause tension in the forehead.

The occipitofrontalis muscle comprises two physiologically and anatomically distinct muscles.[1] The rostral limit of the galea aponeurotica in the vicinity of GB 13 and GB 15 creates a unique layering system that risks nerve entrapment. Here, the superficial fascia over the occipital belly attaches to temporoparietal fascia and the superior, or upper, border of the frontalis muscle. This superficial musculoaponeurotic complex lifts the eyebrow and pulls the scalp rostrad. In contrast, the occipital belly of the occipitofrontalis muscle joins with the galea aponeurotica and inserts on the deeper aspect, or underside, of the frontalis muscle, forming the deep musculoaponeurotic system. The occipital muscle attachment gives this layer the capacity to pull the scalp, including the superficial musculoaponeurotic system, caudad. Clinically, this layering system poses opportunities for nerve entrapment as branches travel between layers. Compression or traction of the cranial and upper cervical spinal nerves that supply the scalp, muscle, fascia, and aponeurotica leads to headache and, potentially, visual disturbances. After giving off branches that supply the upper eyelid and mucosal lining of the frontal sinus, the supraorbital nerve pierces the frontalis muscle at variable levels from the orbital rim to the mid-forehead. It also courses through the galea aponeurotica to supply sensation to the skin, subcutaneous tissue, and periosteum of the scalp as far as the vertex of the skull.[2] Palpate the rostral cranium and forehead to determine the loci of tender sites and trigger points. Treat accordingly.

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp, as well as the frontal sinus and upper eyelid (palpebral conjunctiva). The supraorbital nerve is the largest of five branches of the ophthalmic division of the trigeminal nerve to reach the skin of the face. Innervates the mucous membrane of the frontal sinus and upper eyelid (palpebral conjunctiva); supplies skin of forehead to the hairline. The supraorbital nerve divides into deep and superficial branches. The deep branch courses between the galea aponeurotica and the periosteum.

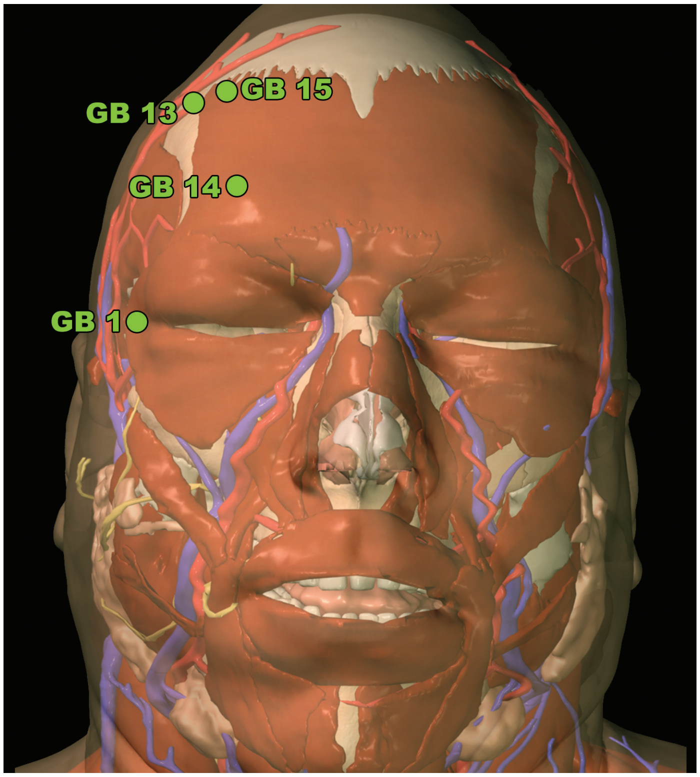


Figure 11-39. GB 13, "Root Spirit" accompanies the region shared by GB 14 and GB 15 over the frontalis portion of the epicranius, or occipitofrontalis muscle. Trigger points in the epicranius have become recognized as the generators of tension headaches that produce pain in the occiput and the forehead.

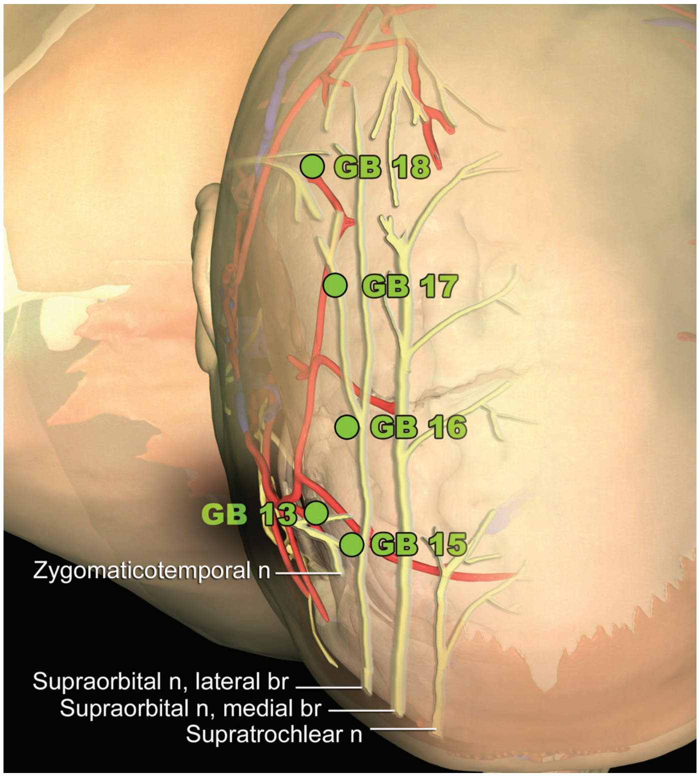


Figure 11-40. This image of the vertex (nose pointing toward the bottom of the page) investigates the neural relationships between the GB points and nerves coursing over the cranium. As shown here, GB 13 associates with the zygomaticotemporal nerve and extensions from the lateral branch of the supraorbital nerve.

The superficial branch passes through the rostral frontalis muscle and courses caudally over the muscle to supply the scalp. Branches of both the superficial and deep components of the supraorbital nerve head toward the vertex and GV 20, helping explain that point's name of "Bai Hui" or Hundred Convergences.

The lateral branch of the supraorbital nerve supplies sensation in the vicinity of GB 13 and GB 15.

- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle. Also innervates the corrugator supercilii muscle.
- **Zygomaticotemporal nerve (CN V_2):** A sensory branch of the trigeminal nerve that courses along the lateral wall of the orbit in a groove housed in the zygomatic bone. The zygomaticotemporal nerve receives a communicating branch from the lacrimal nerve, then travels through the zygomaticotemporal foramen in the zygomatic bone. After it enters the temporal fossa, it ascend between the bone and the temporalis muscle. The nerve exits the fascia approximately one inch dorsal to the zygomatic arch. It supplies the skin of the lateral forehead with sensation. The zygomaticotemporal nerve crosstalks with the facial nerve as well as the auriculotemporal nerve (CN V_3).

Clinical Relevance: Entrapment or compression of the zygomaticotemporal branch of the trigeminal nerve can lead to frontal migraine headaches.3 Entrapment can occur due to pressure from the temporalis muscle because part of the nerve's journey takes it through the temporalis muscle or at least beneath its fascia. Treating trigger points with botulinum toxin type A injection may cause diplopia if it affects the lateral rectus muscle. Visual disturbances can last several months or more. Thus, safer means of deactivating trigger points in the zygomaticotemporal region would substitute acupuncture, laser therapy, and soft tissue manual treatment for pharmaceuticals and harsher methods.

Vessels

- **Supraorbital artery:** A terminal branch of the ophthalmic artery, which is a branch of the internal carotid artery, the supraorbital artery supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Begins by anastomosing with a tributary of the superficial temporal vein, joins the supratrochlear and superior ophthalmic veins, and ends as the angular vein, at the root of the nose. It drains the forehead and anterior part of the scalp.
- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches

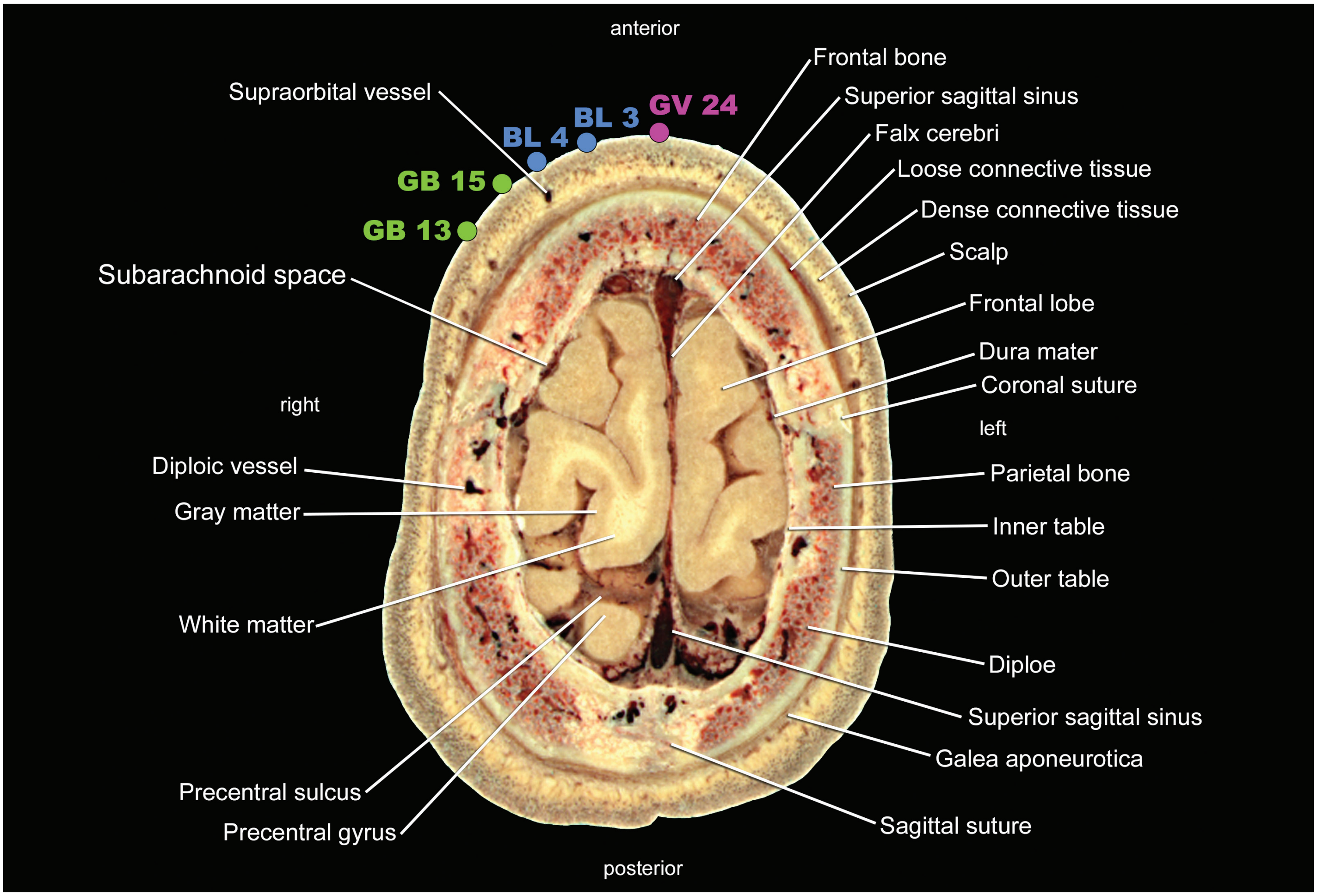

anterior
Supraorbital vessel
BL 4
BL 3
GV 24
GB 15
GB 13
Frontal bone
Superior sagittal sinus
Falx cerebri
Loose connective tissue
Dense connective tissue
Scalp
Subarachnoid space
Frontal lobe
Dura mater
Coronal suture
right
left
Diploic vessel
Gray matter
Parietal bone
Inner table
Outer table
White matter
Diploe
Superior sagittal sinus
Galea aponeurotica
Precentral sulcus
Precentral gyrus
Sagittal suture
posterior

Figure 11-41. Anxiety produces tension in the frontalis muscle which then can cause a tension headache. GB 13's job of "rooting the spirit" as indicated by its descriptive title connotes its impact on frontal lobe activities associated with cognitive, emotional, and social functions. The frontal lobe also associates with goal-directed behavior, possibly implicated in tension headache when one confronts obstacles to achieving goals or excessive focus thereupon.

include the transverse facial, middle temporal, and anterior auricular arteries.

- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis structures. Figure 11-39 reveals the proximity of the superficial temporal artery and GB 13. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 13, considering the limited responses to conventional methods often seen.[4]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[5]

Indications and Potential Point Combinations

- **Frontal headache:** GB 13, GB 14, related trigger points. Add BL 2 for supraorbital nerve entrapment.
- **Frontal sinusitis:** GB 13, GB 14, BL 2, Yintang.

Evidence-Based Application

- Rapid needling with filiform needles at GB 13, GV 14, and LI 11 reduced fever, respiratory rate, heart rate, blood pressure, and peripheral leukocyte and lymphocyte counts in patients with **acute upper respiratory infections.**[6]

References

1. Kushima H, Matsuo K, Yuzuriha S, et al. The occipitofrontalis muscle is composed of two physiologically and anatomically different muscles separately affecting the positions of the eyebrow and hairline. *British Journal of Plastic Surgery*. 2005;58:681-687.
2. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery*. 1995;96(3):564-569.
3. Janis JE, Hatef DA, Thakar H, et al. The zygomaticotemporal branch of the trigeminal nerve: Part II. Anatomical variations. *Plast Reconstr Surg*. 2010;126:435-442.
4. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich*. 1999; 93(9):645-649.
5. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn*. 2011;88(3):111-119.
6. Tan D. Treatment of fever due to exopathic wind-cold by rapid acupuncture. *J Tradit Chin Med*. 1992;12(4):267-271.

GB 14

Yang Bai "Whiteness of Yang" or "Clearing Yang"

On the frontal region, in line with the pupil when the eyes are looking straight ahead, 1 cun dorsal to the middle of the eyebrow. Located approximately at the junction of the lower and middle thirds of the distance between the eyebrow and the rostral hairline, with the distance between the glabella and the midline rostral hairline equating to 3 cun.

Muscles

- **Frontal belly of the occipitofrontalis muscle:** Elevates the eyebrows and causes transverse wrinkles to appear in the forehead during frowning.

Clinical Relevance: The trigger point for the frontalis muscles sits at GB 14. It refers fingerlike projections of pain toward the hairline from the midline to the superior temporal region. The pain extends to GB 13 and GB 15 (i.e., frontalis muscle attachment trigger points) where the muscle meets the hairline at the galea aponeurotica. Tension in the frontalis muscle can entrap the supraorbital nerve, leading to a unilateral frontal headache. Frontalis trigger points worsen with anxiety and consternation, emotional states that cause tension in the forehead. Longstanding trigger points in the clavicular division of the SCM may promote or perpetuate frontal headaches that fail to clear with deactivation of frontalis trigger points alone.

The occipitofrontalis muscle comprises two physiologically and anatomically distinct muscles.[5] The rostral limit of the galea aponeurotica in the vicinity of GB 13 and GB 15 creates a unique layering system that risks nerve entrapment. Here, the superficial fascia over the occipital belly attaches to temporoparietal fascia and the superior, or upper, border of the frontalis muscle. This superficial musculoaponeurotic complex lifts the eyebrow and pulls the scalp rostrad. In contrast, the occipital belly of the occipitofrontalis muscle joins with the galea aponeurotica and inserts on the deeper aspect, or underside, of the frontalis muscle, forming the deep musculoaponeurotic system. The occipital muscle attachment gives this layer the capacity to pull the scalp, including the superficial musculoaponeurotic system, caudad. Clinically, this layering system poses opportunities for nerve entrapment as branches travel between layers. Compression or traction of the cranial and upper cervical spinal nerves that supply the scalp, muscle, fascia, and aponeurotica leads to headache and, potentially, visual disturbances. After giving off branches that supply the upper eyelid and mucosal lining of the frontal sinus, the supraorbital nerve pierces the frontalis muscle at variable levels from the orbital rim to the mid-forehead. It also courses through the galea aponeurotica to supply sensation to the skin, subcutaneous tissue, and periosteum of the scalp as far as the vertex of the skull.[6] Palpate the rostral cranium and forehead to determine the loci of tender sites and trigger points. Treat accordingly.

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp, as well as the frontal sinus and upper eyelid (palpebral conjunctiva). The supraorbital nerve is the largest of five branches of the ophthalmic division of the trigeminal nerve to reach the skin of the face. Innervates the mucous membrane of the frontal sinus and upper eyelid (palpebral conjunctiva); supplies skin of forehead to the hairline. The supraorbital nerve divides into deep and superficial branches. The deep branch courses between the galea aponeurotica and the periosteum. The superficial branch passes through the rostral frontalis muscle and courses caudally over the muscle to supply the scalp. Branches of both the superficial and deep components of the supraorbital nerve head toward the vertex and GV 20, helping explain that point's name of "Bai Hui" or Hundred Convergences.

The lateral branch of the supraorbital nerve supplies sensation in the vicinity of GB 14.

- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis

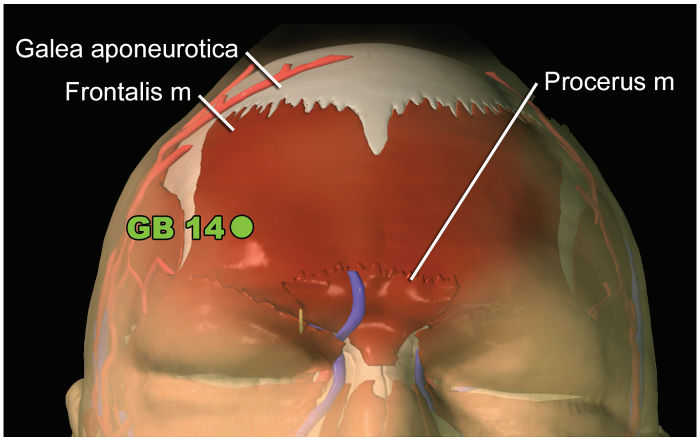


Figure 11-42. GB 14 sits over the region in the frontalis muscle where trigger points develop. While the frontalis and occipitalis portions of the epicranius muscle function as synergists, the frontalis muscle and the procerus operate as antagonists.

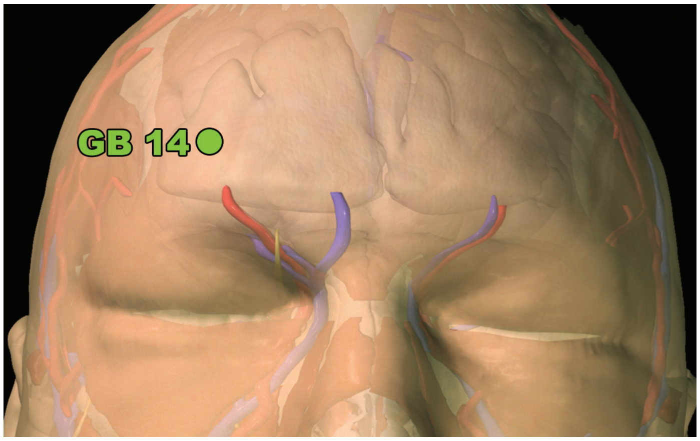


Figure 11-43. "Whiteness of Yang" and "Clearing Yang" as descriptive names for GB 14 refer to the reduction in ocular hyperemia that follows treatment. Clearing the head ("yang") could also result from its assistance in draining the frontal sinuses, shown in relation to GB 14 in this image.

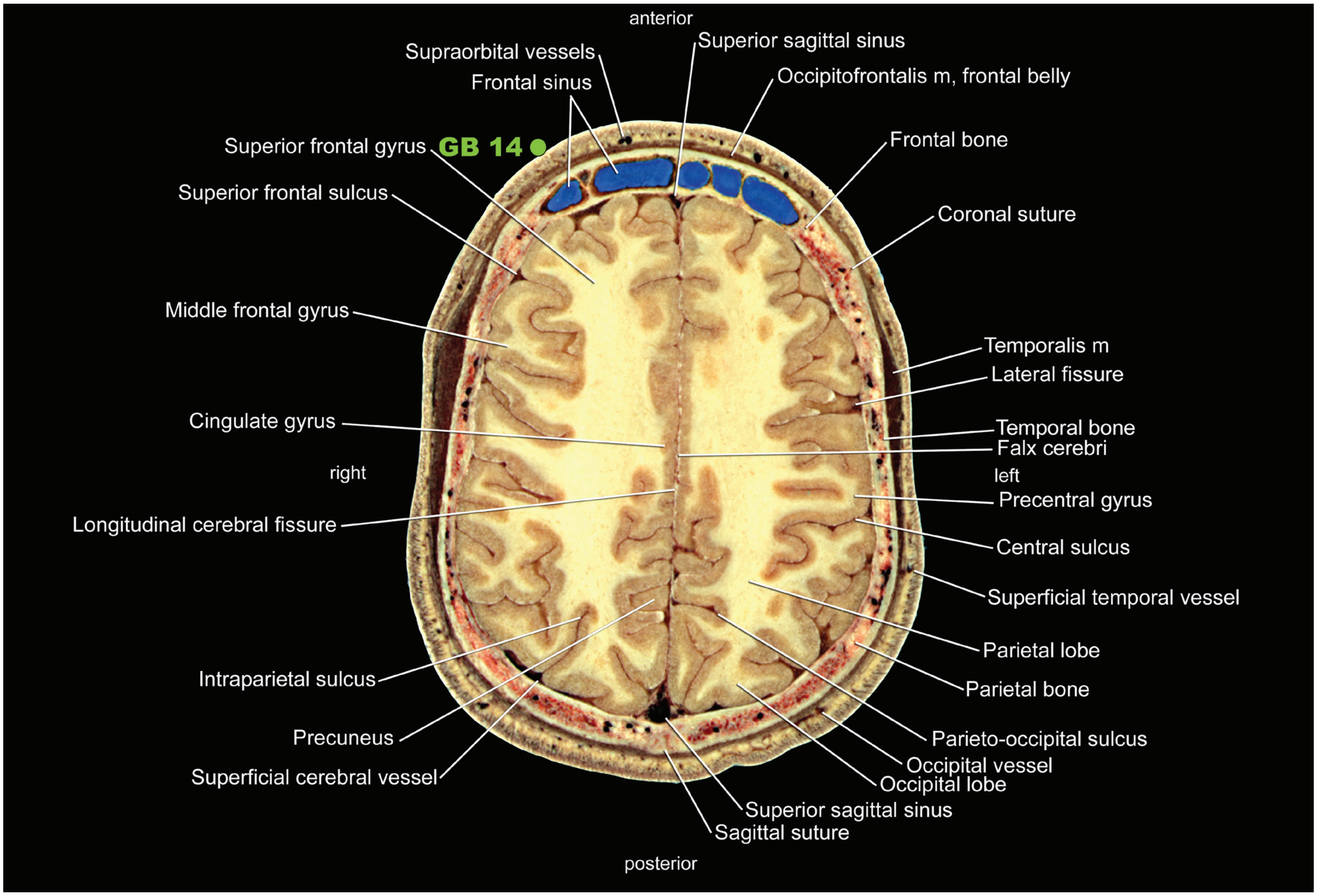

anterior
Supraorbital vessels
Frontal sinus
Superior sagittal sinus
Occipitofrontalis m, frontal belly
Superior frontal gyrus
GB 14
Frontal bone
Superior frontal sulcus
Coronal suture
Middle frontal gyrus
Temporalis m
Lateral fissure
Cingulate gyrus
Temporal bone
Falx cerebri
right
left
Precentral gyrus
Longitudinal cerebral fissure
Central sulcus
Superficial temporal vessel
Parietal lobe
Intraparietal sulcus
Parietal bone
Parieto-occipital sulcus
Precuneus
Occipital vessel
Superficial cerebral vessel
Occipital lobe
Superior sagittal sinus
Sagittal suture
posterior

Figure 11-44. This cross section further emphasizes the relationship between GB 14 and the frontal sinus. The supraorbital nerve supplies the mucous membrane lining the frontal sinus as well as the skin on the forehead.

oculi muscle. Also innervates the corrugator supercilii muscle.

Clinical Relevance: Pain in the eye or head associated with the supraorbital nerve or, more broadly, the ophthalmic division of the trigeminal nerve, often responds to neuromodulation at this and other relevant sites. This includes not only pain in the head but also the sinuses.

Neural crosstalk between trigeminal, facial, and parasympathetic branches at and near GB 14 helps explain the point's frequent appearance in protocols for dry eye and facial nerve injury.

Vessels

- **Supraorbital artery:** A terminal branch of the ophthalmic artery, which is a branch of the internal carotid artery, the supraorbital artery supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Begins by anastomosing with a tributary of the superficial temporal vein, joins the supratrochlear and superior ophthalmic veins, and ends as the angular vein, at the root of the nose. It drains the forehead and anterior part of the scalp.

Clinical Relevance: The supraorbital vessels anastomose with their superficial temporal neighbors. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 14, considering the limited responses to conventional methods often seen.[7]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and parotid arteries.[8]

Indications and Potential Point Combinations

- **Frontal headache:** GB 14, attachment trigger points of the frontalis muscle (such as GB 13 and GB 15), Yintang, BL 10, GB 20.
- **Frontal sinusitis:** GB 14, Yintang, BL 2.
- **Eye problems:** pain, discharge, night blindness, epiphora, blepharospasm: GB 14, BL 2, GB 1, Yintang, TH 23.
- **Migraine (frontal):** TH 23, GB 14, BL 2, LI 4, LR 3, GV 20, and pertinent trigger points.

Evidence-Based Applications

- A randomized, placebo-controlled trial suggested that treatment with laser acupuncture at LU 7, LI 4, GB 14, and GB 20 benefits **chronic tension headache.**[1]

- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in **prophylaxis of migraine** compared to flunarizine.[2]
- Case series reported electroacupuncture at GB 14, GB 20, SI 18, ST 7, and LI 4 was effective treatment for **peripheral facial paralysis.**[3]
- Needling at GB 14, BL 2, ST 3, Shangneidicang, Xiangneidicang, LI 20, SI 18, and ST 36, along with direct moxibustion at GB 14 and ST 4 (2cm-3cm above the skin for 5 minutes) rapidly improved signs of **Bell's palsy** in a 27-week pregnant patient.[9]
- Evidence based points for **peripheral facial nerve paralysis** include: GB 14, GB 20, ST 2, ST 4, ST 6, ST 7, CV 24, LI 20, SI 18, TH 17, GV 26, Yuyao, and LI 4. Treatments should take place daily for intervals of 10 visits with 2-5 days off between intervals, for 20-40 total treatments.[10]
- Thermography of the face in patients with **peripheral facial nerve paralysis** may aid in indicating ideal points to treat based on temperature at the points. Most frequent points selected based on temperature included, in decreasing order, ST 4, LI 20, Taiyang, GB 14, and SI 18.[11]
- Acupuncture at ST 2, ST 8, ST 36, GB 1, GB 14, BL 2, and LI 4 provided subjective beneficial effects in patients with keratoconjunctivitis sicca **(KCS or dry eye).**[4]
- Treatment with acupuncture at TH 23, GB 14, BL 2, Taiyang, ST 1, GB 20, LI 4, LI 11, and GV 23 improved patients' ocular surface disease index (OSDI), lessened pain, and increased tear film break up time significantly after eight weeks of treatment for patients with **dry eye.**[12]
- Acupuncture at GB 14, GB 20, BL 2, TH 23, Ex 1, ST 1, and GV 23 along with SP 3, LU 9, LU 10, and HT 8 produced improvements in signs and symptoms of **dry eye** both with and without de qi manipulation and with both superficial and deep needling.[13]

References

1. Ebneshahidi NS, Heshmatipour M, Moghaddami A, Eghtesadi-Araghi P. The effects of laser acupuncture on chronic tension headache – a randomised controlled trial. *Acupuncture in Medicine.* 2005;23(1):13-18.
2. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache*. 2002;42:855-861.
3. Zhang X. Electric needle therapy for peripheral facial paralysis. *Journal of Traditional Chinese Medicine*. 1997;17(1):47-49.
4. Grönlund MA, Stenevi U, and Lundeberg T. Acupuncture treatment in patients with keratoconjunctivitis sicca: a pilot study. *Acta Ophthalmol Scand.* 2004;82:283-290.
5. Kushima H, Matsuo K, Yuzuriha S, et al. The occipitofrontalis muscle is composed of two physiologically and anatomically different muscles separately affecting the positions of the eyebrow and hairline. *British Journal of Plastic Surgery*. 2005;58:681-687.
6. Knize DM. A study of the supraorbital nerve. *Plastic and Reconstructive Surgery.* 1995;96(3):564-569.
7. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
8. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.
9. Lei H, Wang W, and Huang G. Acupuncture benefits a pregnant patient who has Bell's palsy: a case study. *J Alt Complement Med.* 2010;16(9):1011-1014.
10. Zheng H, Li Y, and Chen M. Evidence based acupuncture practice recommendations for peripheral facial paralysis. *Am J Chin Med.* 2009;37(1):35-43.
11. Zhang D. A method of selecting acupoints for acupuncture treatment of peripheral facial paralysis by thermography. *Am J Chin Med.* 2007; 35(6):967-975.
12. Kim T-H, Kang JW, Kim KH, et al. Acupuncture for the treatment of dry eye: a multicenter randomised controlled trial with active comparison intervention (artificial teardrops). PLoS ONE. 2012; 7(5): e36638. doi:10.1371/journal.pone.0036638
13. Shin MS, Kim JI, Lee MS, et al. Acupuncture for treating dry eye: a randomized placebo-controlled trial. *Acta Ophthalmol.* 2010;88(8):e328-e333.

GB 15

Tou Lin Qi "Head Overlooking Tears", "Tears Control"

On the frontal region, directly in line with the pupil and GB 14, 0.5 cun within the rostral hairline. Approximately 3 cun lateral to the midline and midway between GV 24 and ST 8. If the rostral hairline is not evident, find its likely location by finding one-fifth the distance from the glabella (or Yintang, GV 24.5) and the caudal hairline. Because the distance between the glabella and the caudal hairline equals 15 cun, one-fifth the distance equals 3 cun, which is where the rostral hairline should fall. If the location of the caudal hairline is indistinct, it can be assumed to be located 1 cun caudal to GV16, immediately below the external occipital protuberance.

Figure 11-41 reveals the comparative locations of GB 13, GB 15, BL 4, BL 3, and GV 24, which line up from the temporal region to the midline along the same horizontal plane.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 7-13, labeled at the bottom right area of the image.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14, GB 15) and the occipitalis (e.g., BL 9) muscles.

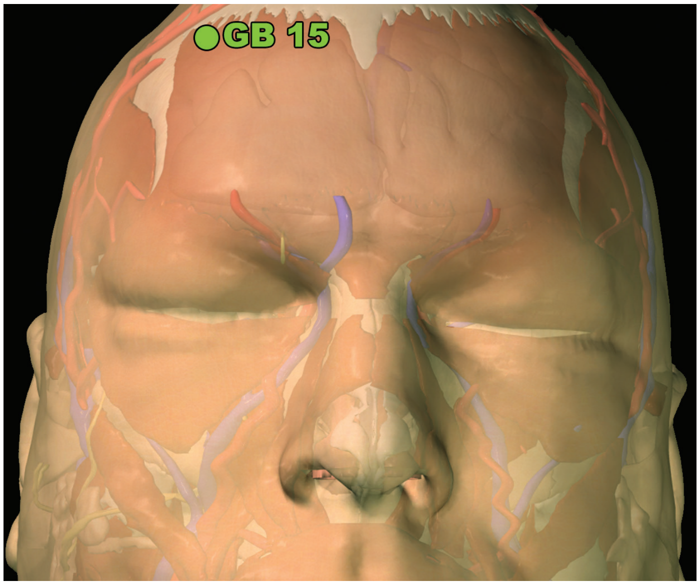


Figure 11-45. As a local point, GB 15 treats pain in the forehead from myofascial dysfunction and/or supraorbital nerve irritation. The supraorbital nerve may become neuropathic due to sinusitis, ongoing eye pain, or nerve entrapment by the frontalis. The name "Head Overlooking Tears" refers to the point's location directly in line with the pupil. It further suggests the ability of the trigeminal nerve to reflexively stimulate tear production. Insofar as the name "Tears Control", trying to hold back tears would cause frontalis muscle contraction. This image exposes the relationship of the frontal sinuses to GB 15, as seen thru semi-translucent muscle and skin layers.

Muscles

- **Frontal belly of the occipitofrontalis muscle:** Elevates the eyebrows and causes transverse wrinkles to appear in the forehead during frowning.

The trigger point for the frontalis muscles sits at GB 14. It refers fingerlike projections of pain toward the hairline from the midline to the superior temporal region. The pain extends to GB 13 and GB 15 (i.e., frontalis muscle attachment trigger points) where the muscle meets the hairline at the galea aponeurotica.

Tension in the frontalis muscle can entrap the supraorbital nerve, leading to a unilateral frontal headache. Frontalis trigger points worsen with anxiety and consternation, emotional states that cause tension in the forehead.

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp, as well as the frontal sinus and upper eyelid (palpebral conjunctiva). The supraorbital nerve joins with the supratrochlear nerve to form the frontal nerve. As the frontal nerve enters the superior part of the orbit, a small sensory twig from the frontal sinus latches on. By the time the frontal nerve reaches and enters the superior orbital fissure, the lacrimal and nasociliary nerves have banded together with the frontal nerve, coalescing into the ophthalmic division of the trigeminal nerve.
- **Facial nerve (CN VII), temporal branch:** Supplies the auricularis superior and auricularis anterior muscles, the frontal belly of the occipitofrontalis muscle, and the superior portion of the orbicularis oculi muscle.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[1] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of GB 15, BL 2, BL 6, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Supraorbital artery:** A terminal branch of the ophthalmic artery, which is a branch of the internal carotid artery, the supraorbital artery supplies the muscles and skin of the forehead and scalp.
- **Supraorbital vein:** Begins by anastomosing with a tributary

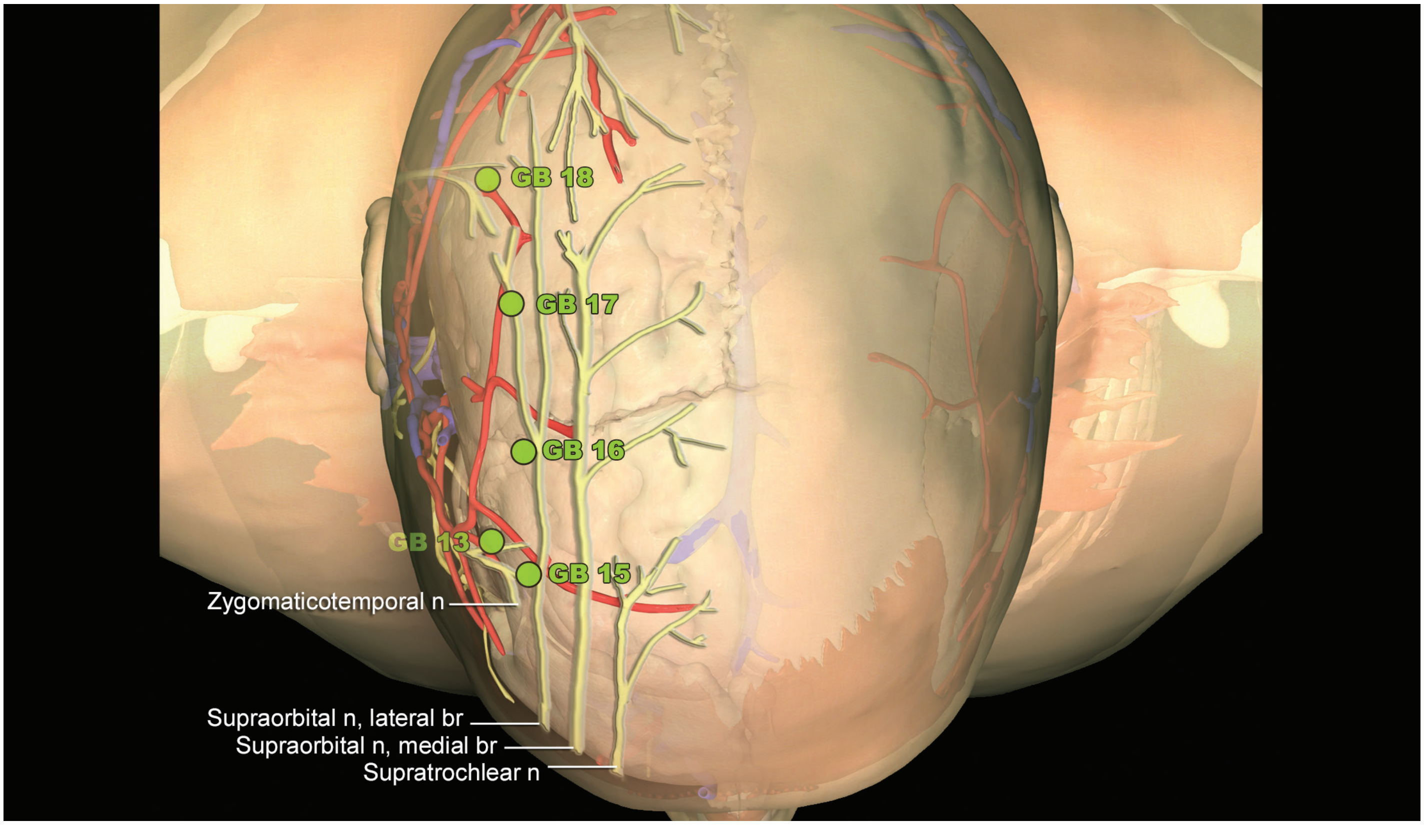


Figure 11-46. GB 15 marks the beginning of the GB line's journey across the skull in conjunction with the supraorbital nerve, a branch of the trigeminal nerve. The trigeminal nerve also supplies the meninges of the rostral and middle cranial fossae. Cutaneous, musculoskeletal, visceral, and dural afferents, converge onto nociceptive neurons in the dorsal horn of the first cervical spinal segment. This helps explain the precipitation of migraine and other types of headache from musculoskeletal dysfunction, visceral upset, and dural irritation. It also provides a mechanism through which to understand how neuromodulation by means of acupuncture benefits migraineurs.

of the superficial temporal vein, joins the supratrochlear and superior ophthalmic veins, and ends as the angular vein, at the root of the nose. It drains the forehead and anterior part of the scalp.

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: The supraorbital vessels anastomose with superficial temporalis structures. Figure 11-46 reveals the proximity of the superficial temporal artery and GB 15. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 15, considering the limited responses to conventional methods often seen.[2]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and carotid arteries.[3]

Indications and Potential Point Combinations

- **Frontal headache:** Address trigger points in the frontalis portion of the epicranius (occipitofrontalis) muscle, including GB 15 and GB 13 as attachment trigger points (ATrP's) and GB 14 as the central trigger point.
- **Migraine:** GB 15 if tender, other trigger points on the head and neck as found, LI 4, LR 3, ST 36, GV 20, BL 10.
- **Eye problems:** Excessive tearing in the wind, eye pain, especially in the lateral canthus: GB 15, GB 1, TH 23, GV 20.
- **Rhinitis:** GB 15, Yintang, LI 20.
- **Seizures:** GB 15, ST 36, LR 3, LI 4, BL7, BL 8, GV 20.

References

1. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
2. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
3. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

GB 16

Mu Chuang "Window of the Eye", "Eye Window"

On the frontal region, 1.5 cun caudal to GB 15 on a line connecting GB 15 and GB 20, 2.25 cun lateral to the midline. After locating GB 15 0.5 cun caudal to the rostral hairline, locate GV 20. Next, find GB 18 directly lateral to GV 20, on the GB channel you described by connecting GB 15 and GB 20. Find GB 16 one-third the distance from GB 15 to GB 18.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 11-48.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14, GB 15), the occipitalis (e.g., BL 9) muscles, and the border of the aponeurotica (e.g., GB 16, GB 17, and GB 18).

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp, as well as the frontal sinus and upper eyelid (palpebral conjunctiva). The supraorbital nerve joins with the supratrochlear nerve to form the frontal nerve. As the frontal nerve enters the superior part of the orbit, a small sensory twig from the frontal sinus latches on. By the time the frontal nerve reaches and enters the superior orbital fissure, the lacrimal and nasociliary nerves have banded together with the frontal nerve, coalescing into the ophthalmic division of the trigeminal nerve.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel) to the vertex.[1] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of GB 16, GB 15, BL 6, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

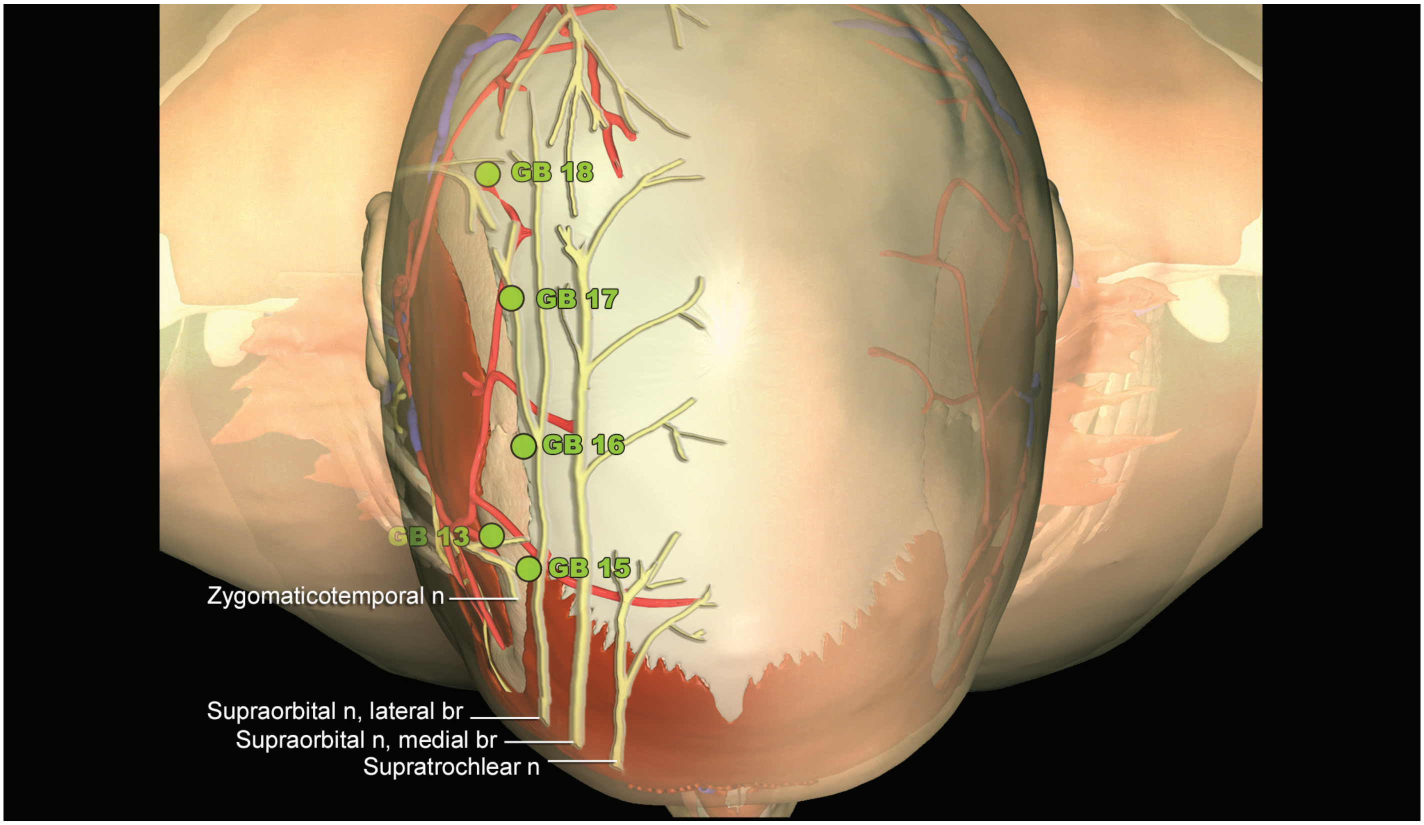


Figure 11-47. GB 16 relates to the supraorbital nerve and thus has indirect effects on eye pain, providing a neuroanatomic basis for its descriptive name of "Eye Window". Some patients develop a palpable groove over the coronal suture near GB 16. This "post-coronal sulcus" appears to form due to the persistence of a transverse band of epicranial aponeurosis.[4] Thus, the GB line follows both the lateral branch of the supraorbital nerve as well as the aponeurotic border. Both anatomical features may account for tenderness to palpation.

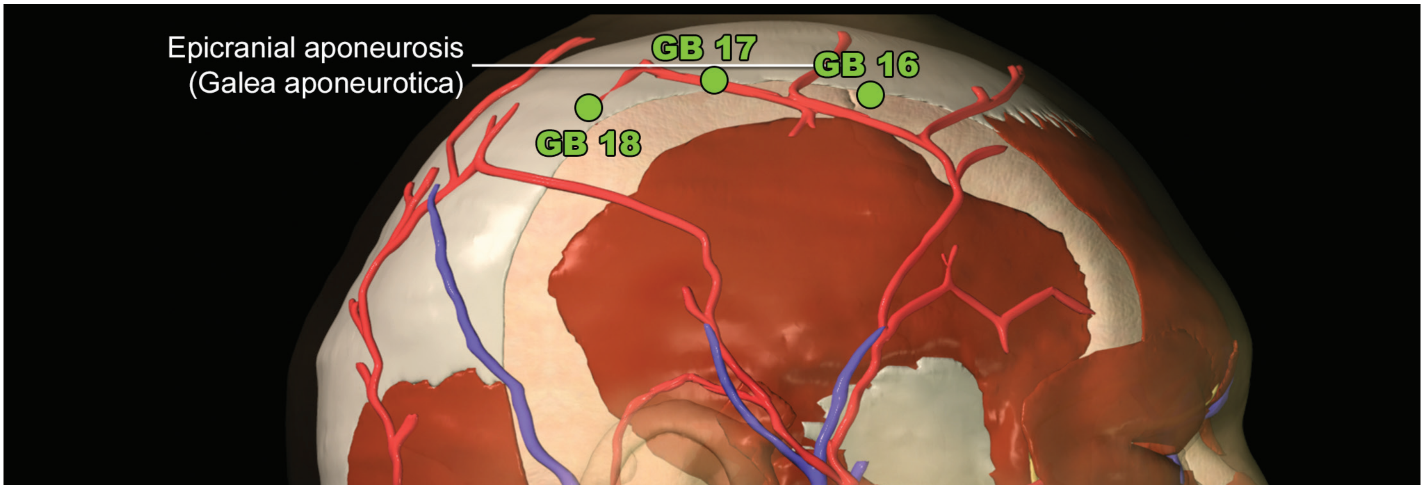


Figure 11-48. This soft tissue view depicts the location of GB 16, GB 17, and GB 18 along the lateral border of the epicranial aponeurosis. These points may or may not fall along the border in each individual. Decide on their inclusion and location based on palpation.

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle. Joins the maxillary vein to form the retromandibular vein.

Clinical Relevance: Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 16, considering the limited responses to conventional methods often seen.[2]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and carotid arteries.[3]

Indications and Potential Point Combinations

- **Tension headache:** Palpate for trigger points in the epicranius muscle as well as along the galea aponeurotica border, at GB 16, GB 17, and GB 18. Add GB 20 and GB 21 if trigger points occur in those regions.
- **Eye pain:** GB 16, GB 14, BL 2, TH 23, GB 20, LR 3.
- **Jetlag:** GB 16, GV 20, Yintang.

References

1. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575

2. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.

3. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.

4. Blair DM. A note on the post-coronal sulcus, with dissections of the epicranial aponeurosis in two cases of its occurrence. *J Anat.* 1921;56(Pt 1):44-47.

GB 17

Zheng Ying "Upright Nutrition", "Upright Construction", "Right Meeting"

On the parietal region, 1.5 cun caudal to GB16, on the line connecting GB 15 and GB 20, 2.25 cun lateral to the midline. After locating GB 15, 0.5 cun caudal to the rostral hairline, find GV 20. Next, locate GB18 directly lateral to GV 20, on the GB channel you delineated by connecting GB 15 to GB 20. Now, find GB 16 two-thirds the distance from GB 15 to GB 18.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 11-49A.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14, GB 15), the occipitalis (e.g., BL 9) muscles, and the border of the aponeurotica (e.g., GB 16, GB 17, and GB 18).

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp as well as the frontal sinus and upper eyelid (palpebral conjunctiva). The supraorbital nerve joins with the supratrochlear nerve to form the frontal nerve. As the frontal nerve enters the superior part of the orbit, a small sensory twig from the frontal sinus latches on. By the time the frontal nerve reaches and enters the superior orbital fissure, the lacrimal and nasociliary nerves have banded together with the frontal nerve, coalescing into the ophthalmic division of the trigeminal nerve.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve, which follows the BL and GB channels with its medial and lateral branches, respectively, to the vertex.[1] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of GB 17, GB 15, BL 6, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Superficial temporal artery:** Supplies the skin over the frontal and temporal regions along muscles of the face. Arises from the external carotid artery, posterior to the neck of the mandible. Divides into frontal and parietal branches. Other branches include the transverse facial, middle temporal, and anterior auricular arteries.
- **Superficial temporal vein:** Drains the side of the scalp, the external ear, and the superficial levels of the temporal muscle.

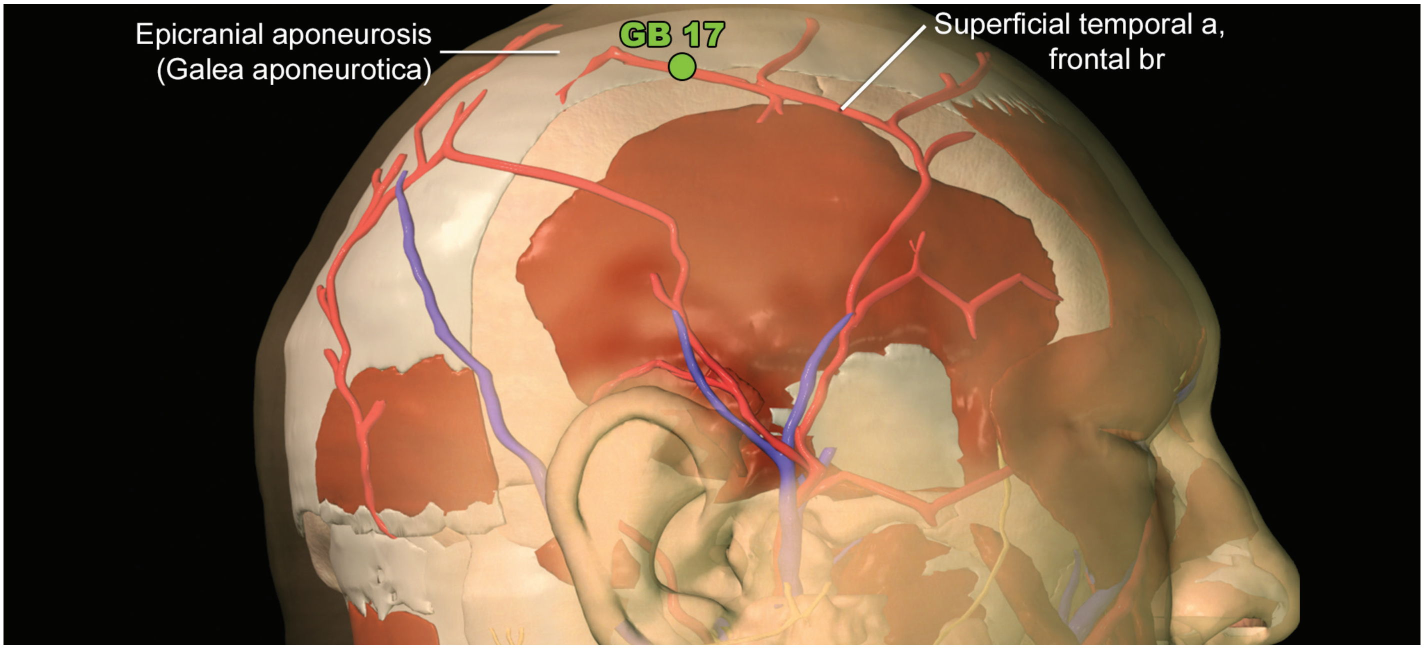


Figure 11-49A. The various names forx GB 17, including "Upright Construction", "Right Meeting", and "Upright Nutrition" indicate the intersection of the superficial temporal artery, the supraorbital nerve (not shown in this image), and the border of the galea aponeurotica.

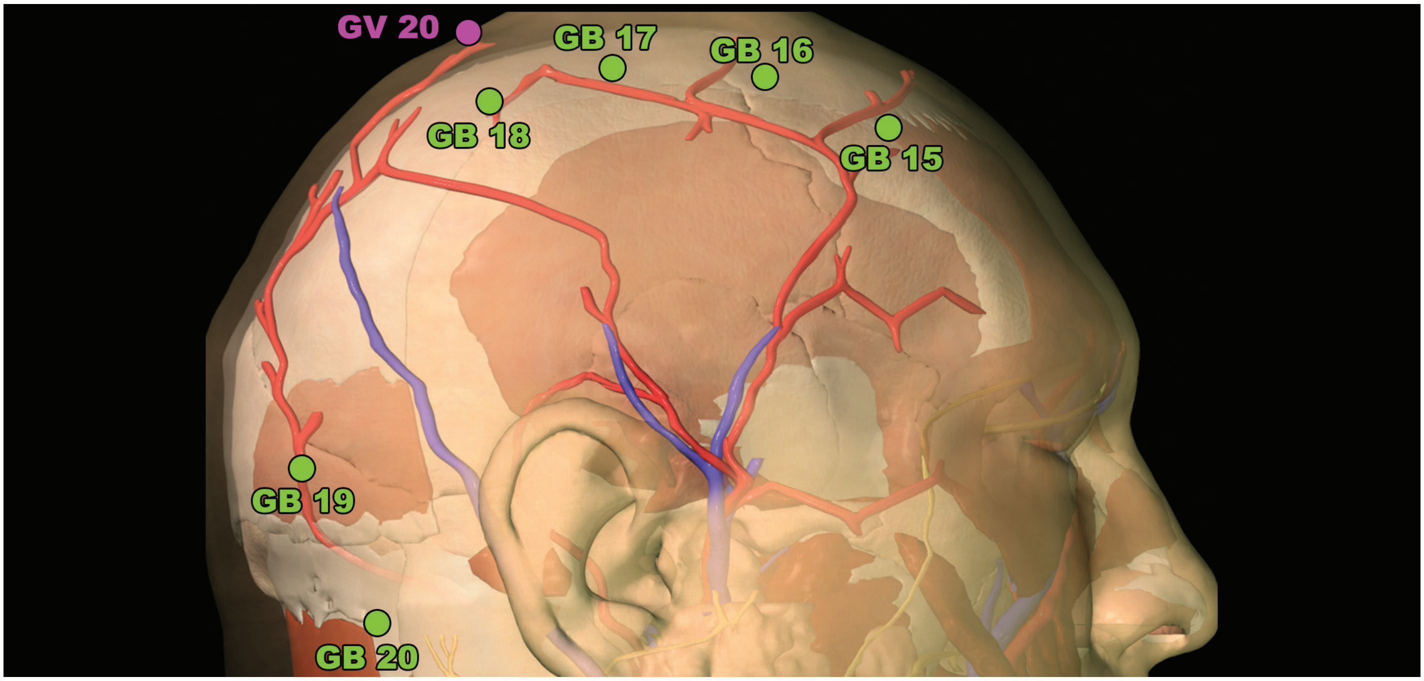


Figure 11-49B. Finding GB 17 and GB 16 utilizes proportional measurements. That is, one first draws the GB line by connecting GB 15 to GB 20. Then, one locates GB 18 lateral to GV 20. GB 17 and GB 16 land at equidistant thirds along a line connecting GB 18 to GB 15. This image also outlines the proximity of GB 15 through GB 18 to the temporal line of the skull, denoting the perimeter of the temporal fossa. This region can become tender to palpation in individuals with chronic headaches and TMJ dysfunction.

Joins the maxillary vein to form the retromandibular vein.

- **Occipital artery:** Arises from the external carotid artery and accompanies the occipital nerve in the occipital region. Its distribution includes the scalp at the back of the head.
- **Occipital vein:** Drains the occipital region of the scalp.

Clinical Relevance: Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

Acupuncture and related techniques should be attempted prior to surgical or other invasive maneuvers for non-atherosclerotic vascular disease, including conditions affecting extracranial vessels such as those located near GB 17, considering the limited responses to conventional methods often seen.[2]

The vasa nervorum of the peripheral facial nerve arise from a network of vessels formed mainly by the superficial temporal, facial, transverse facial, and zygomatico-orbital arteries. These small vessels also derive from collateral branches of the supraorbital, deep temporal, buccal and carotid arteries.[3]

The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[4] Blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[5] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Local head pain:** GB 17 plus other local trigger points. Add GB 19 and GB 14 to relax the occipitofrontalis muscle.

References

1. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
2. Schellong SM. Special aspects of therapy of non-atherosclerotic vascular diseases. *Z Arztl Forbild Qualitatssich.* 1999; 93(9):645-649.
3. Ishibe K, Tamatsu Y, iura M, et al. Morphological study of the vasa nervorum in the peripheral branch of human facial nerve. *Okajimas Folia Anat Jpn.* 2011;88(3):111-119.
4. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.
5. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.
6. Takahama S, Miyauchi S, and Saiki J. Neural basis for dynamic updating of object representation in visual working memory. *Neuroimage.* 2010;49(4):3394-3403.

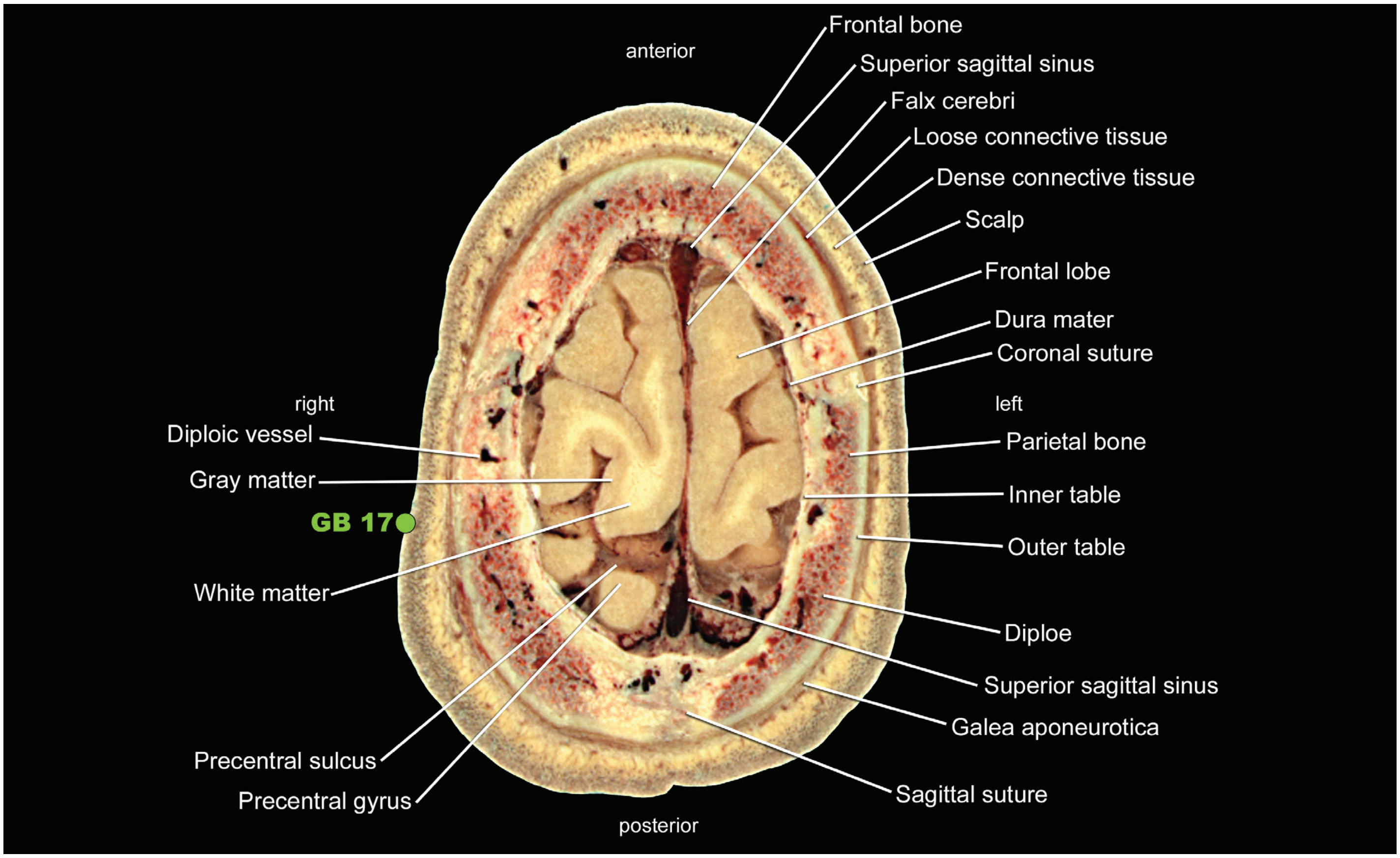

anterior
Frontal bone
Superior sagittal sinus
Falx cerebri
Loose connective tissue
Dense connective tissue
Scalp
Frontal lobe
Dura mater
Coronal suture
right
left
Diploic vessel
Parietal bone
Gray matter
Inner table
GB 17
Outer table
White matter
Diploe
Superior sagittal sinus
Galea aponeurotica
Precentral sulcus
Precentral gyrus
Sagittal suture
posterior

Figure 11-50. Intracranial anatomy deep to GB 17 includes the precentral sulcus and precentral gyrus. The precentral sulcus works with a brain network involving frontal and parietal centers involved in dynamic updating of object representation in the visual working memory.[6] The arm and hand motor area for the homunculus (or "little man"), i.e., the somatotopic representation of body parts on the primary motor cortex, is located near this section of precentral gyrus.

GB 18

Cheng Ling "Spirit Support", "Contain Spirit", "Receive Spirit", "Cover of the Celestial Spirit"

On the parietal region, 1.5 cun behind GB 17 and 2.25 cun lateral to GV 20, on the line connecting GV 20 and the apex of the ear.

Connective Tissues

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Appears in Figure 11-49A.

Clinical Relevance: Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as BL 6, as well as deactivating trigger points in the frontalis (e.g., GB 14, GB 15), the occipitalis (e.g., BL 9) muscles, and the border of the aponeurotica (e.g., GB 16, GB 17, and GB 18).

From a trigger point perspective, although muscles are largely absent from the vertex region, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature, calling for palpation of the entire head and neck region.

Nerves

- **Supraorbital nerve (CN V_1):** Provides sensation to the forehead and scalp, as well as the frontal sinus and upper eyelid (palpebral conjunctiva).
- **Greater occipital nerve (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[1,2]
- **Lesser occipital nerve (C2, C3):** Supplies the skin behind the ear, the superior ear, the mastoid area, and possibly a small portion of the skin of the neck. May receive communicating branches from the greater occipital nerve. The lesser and greater occipital nerves pierce the trapezius at the base of the skull and are therefore subject to compression by cervical muscle tension, producing an occipital neuralgia. When this occurs, it may produce further cervical tension, perpetuating occipital head pain.

Clinical Relevance: Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve, which follows the BL and GB channels with its medial and lateral branches, respectively, to the vertex.[3] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes. However, differential diagnoses for SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, or other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (the supraorbital notch). Dry needling of GB 18, GB 17, GB 15, BL 6, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

GB 18 receives innervation from the greater occipital nerve, as shown in Figure 11-52. Thus, a compressed or otherwise irritated greater occipital nerve secondary to cervical spinal arthritis or head trauma could derive benefit from neuromodulation through acupuncture and related techniques at this site. The greater occipital nerve has been identified as a contributor to several types of headaches, including cluster, cervicogenic, migraine, medication-overuse, tension, and hemicrania continua.[4]

Functional connectivity between trigeminal and cervical afferents exists in the brain stem where afferent fibers from the three most cranial cervical spinal nerve roots converge onto neurons in the spinal nucleus of the trigeminal nerve.[5] This explains the widespread sensory, motor, and autonomic phenomena that arise in various headache states, including migraine and occipital neuralgia.

At GB 18, the innervation of the GB line shifts from predominantly

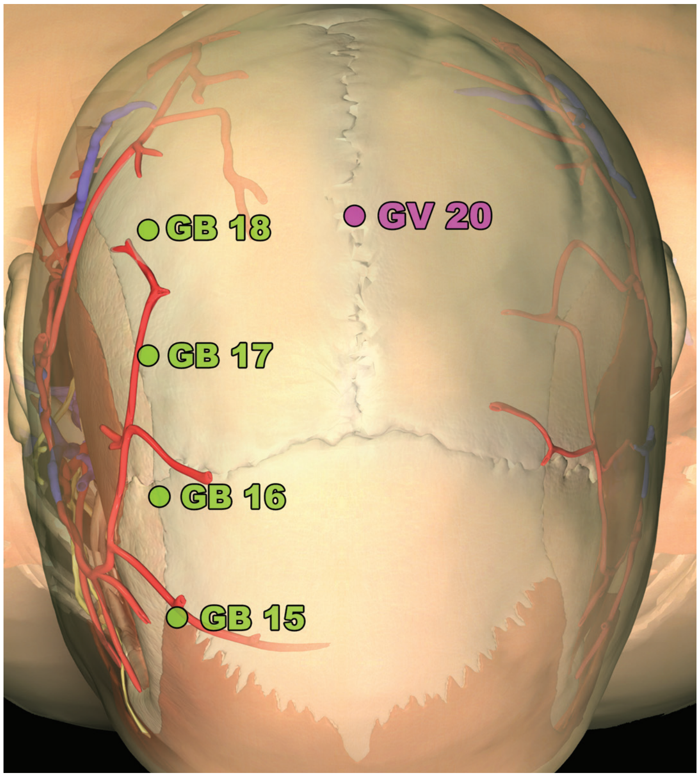


Figure 11-51. GB 18, "Spirit Support", lands lateral to GV 20 and the vertex of the skull, regarded as a central locus of mental processes, as they relate to mind and spirit.ce

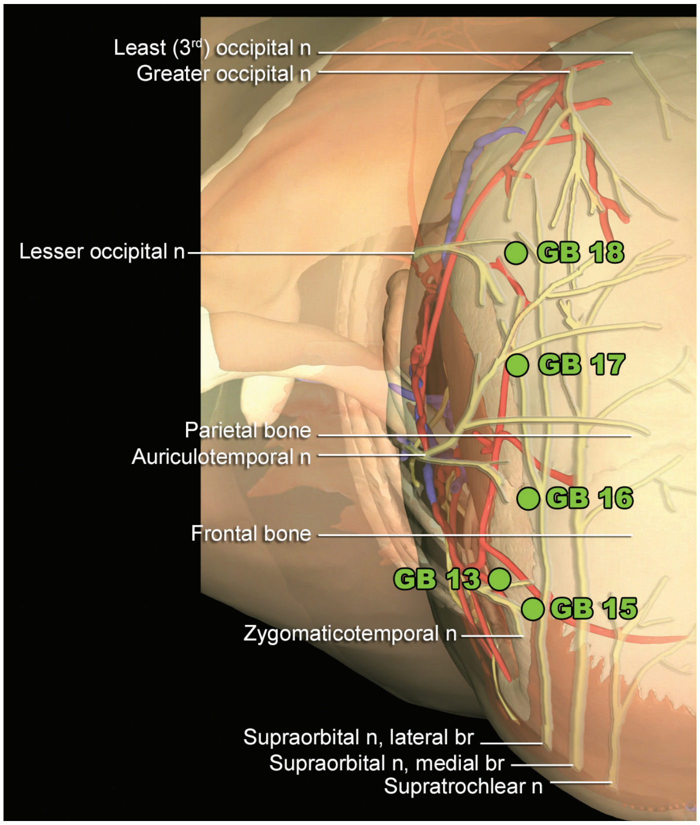


Figure 11-52. GB 18 overlies the parietal bone, which in Chinese means "Heaven Support", further accounting for its name.[17] GB 18, and to some extent GB 17, occupy a region near the vertex that receives convergent sensory input from both trigeminal and cervical nerve sources; these two sensory pathways then crosstalk with the vagal centers, providing autonomic neuromodulation.

trigeminal nerve-based (GB 13 to GB 17) to a much larger greater occipital nerve influence (GB 18 - GB 19). Thus, these points may better address cervicogenic headaches than those arising from trigeminal nerve irritation. That said, however, if one considers the convergence of upper cervical spinal nerve afferents onto the spinal nucleus of the trigeminal nerve, an anatomical basis manifests for crosstalk occurring between nerves supplying both the rostral and caudal cranium.[6] Furthermore, tension in the occipitofrontalis muscle worsens nerve irritation; relaxing both the occipitalis and frontalis with dry needling suggests treatment of rostral and caudal GB (and/or BL) loci.

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[7] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[8] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[9,10]

As a differential diagnosis for migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[11] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[12] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[13]

Functional brain imaging reveals how neuromodulation affects cerebral activation levels, whether the stimulation arrives by cranial, spinal, or peripheral neural avenues. Functional magnetic resonance imaging (fMRI) research evaluating the effects of acupuncture on the brain has compared stimulation of scalp and body loci. Findings expose unique signal activations between the two groups, most likely resulting from the different afferent endings stimulated by each approach.[14] The scalp acupuncture group (needled at left-side only TH 20, GB 18, GB 9, and Sishencong) demonstrated more activity in the contralateral somatosensory association cortex, the postcentral gyrus, and the parietal lobe as compared to the limb acupuncture group, who received treatment at right-side only LI 1, LI 10, LR 3, and ST 36. Perhaps unsurprisingly, the latter points produced activation in the right occipital lobe, lingual gyrus, visual association cortex, right parahippocampal gyrus, limbic lobe, hippocampus, left anterior lobe, culmen, and cerebellum.

Vessels

- **Occipital artery:** Arises from the external carotid artery and accompanies the occipital nerve in the occipital region. Its distribution includes the scalp at the back of the head.
- **Occipital vein:** Drains the occipital region of the scalp.

Clinical Relevance: Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and sensitizing nerves.

The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[15] Blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[16] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Indications and Potential Point Combinations

- **Headache:** Check for trigger points in the occipitofrontalis, temporalis, and trapezius muscles. Add GB 18 for tenderness to palpation along the epicranial aponeurosis.
- **Fever:** GB 18, GV 20, LI 4.
- **Rhinitis:** GB 18, GV 20, Yintang, BL 10.
- **Epistaxis:** GB 18, GV 20.

References

1. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain*. 2002;125:1496-1509.

2. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain*. 2003;126:1801-1813.

3. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia*. 2012. DOI: 10.1177/0333102412459575

4. Guerrero AL, Herrero-Velazquez S, Penas ML, et al. Peripheral nerve blocks: a therapeutic alternative for hemicrania continua. *Cephalalgia*. 2012;32(6):505-508.

5. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci*. 2010;31(Suppl 1): S179-S180.

6. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci*. 2010;31(Suppl 1):S179-S180.

7. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci*. 2012;33(Suppl 1):S29-S31.

8. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache*. 2008;48(2): 319-327.

9. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia*. 2007;27(2):153-157.

10. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol*. 2010;9(3):285-293.

11. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

12. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

13. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci*. 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.

14. Park SU, Shin AS, Jahng GH, et al. Effects of scalp acupuncture versus upper and lower limb acupuncture on signal activation of blood oxygen level dependent (BOLD) fMRI of the brain and somatosensory cortex. *J Altern Complement Med*. 2009;15(11):1193-2000.

15. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol*. 2013;34(3):547-551.

16. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports*. 2012; 6:203.

17. Quirico PE. *Teaching Atlas of Acupuncture. Volume 2: Clinical Indications*. Stuttgart: Georg Thieme Verlag, 2008, p. 147

GB 19

Nao Kong "Brain Hollow"

On the occipital region, 2.25 cun lateral to the midline, level with the upper border of the external occipital protuberance (i.e., level with GV 17). Directly above GB 20. First locate GV 17, which is 1.5 cun directly above GV16, in the depression superior to the external occipital protuberance. If the external occipital protuberance is difficult to find, locate GB 19 one-fourth the distance from GB 20 to GB 18. Figure 11-53 illustrates the relationship of GB 19 to GV 17 and GB 18.

Muscles

- **Occipital belly of the occipitofrontalis muscle:** Moves the scalp backward by drawing back the galea aponeurotica. The occipital belly becomes active during smiling and yawning. Ear movements can also activate the occipital belly.[4]

Clinical Relevance: Myofascial trigger point pathology at GB 19 in the occipitalis muscle radiates pain strongly toward GB 18, GB 17, and GB 16. The referred pain pattern actually extends the entire GB trajectory over the skull to GB 13 and GB 15. It then hops to the upper lid and GB 1. This trigger point pain pattern explains at least in part how a headache caused by myofascial restriction at the back of the head causes one to feel pain in the eye.

Nerves

- **Greater occipital nerve (GON) (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[1,2]
- **Posterior auricular nerve (CN VII):** Innervates the occipital belly of the occipitofrontalis (or epicranius) muscle.

Clinical Relevance: The GON arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[5] (The occipital artery appears in Figure 11-53 deep to GB 19.) As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

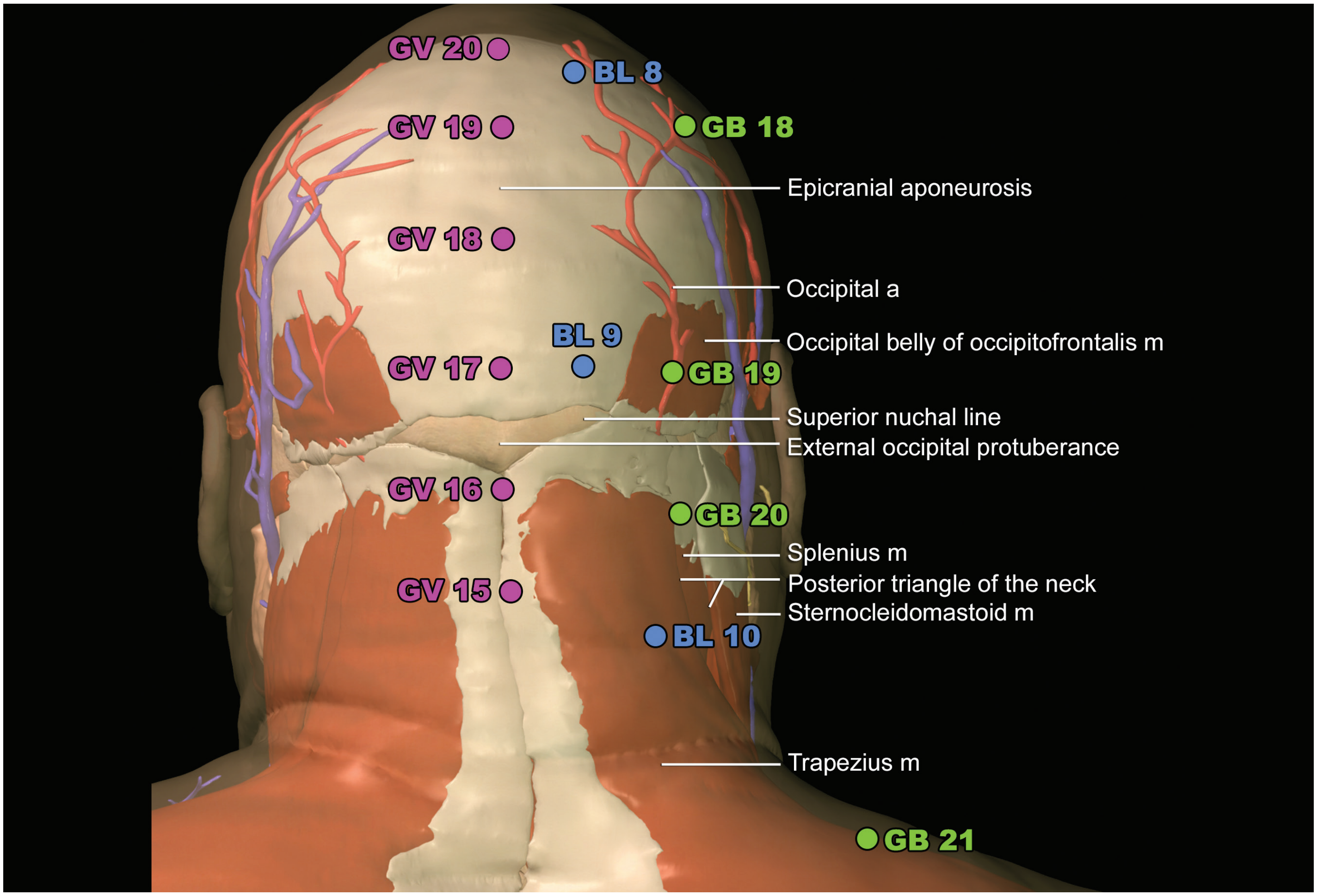


Figure 11-53. The trigger point within the occipitalis portion of the epicranius muscle lands at GB 19. It produces a referred pain pattern that arches over the skull along the GB line toward the eye between the brow and the upper lid. Patients suffering from the pain of a GB 19 trigger point may complain that they cannot bear the weight of the back of the head on a pillow at night because the pressure activates the pain.

GB 19 receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of GB 19 in point protocols addressing intracranial and extracranial sources of discomfort.

Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino-cervical convergence at the level of the trigeminal nucleus caudalis.[6]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[7] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[8] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[9,10]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[11] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[12] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[13]

Extracranial nerves of the caudal portion of the head such as the posterior auricular nerve or lesser occipital undergo entrapment and compression as a result of myofascial restriction in the SCM muscle or occipitofrontalis, producing a variety of headache patterns.[14]

Vessels

- **Occipital artery:** Arises from the external carotid artery and accompanies the occipital nerve in the occipital region. Its distri-

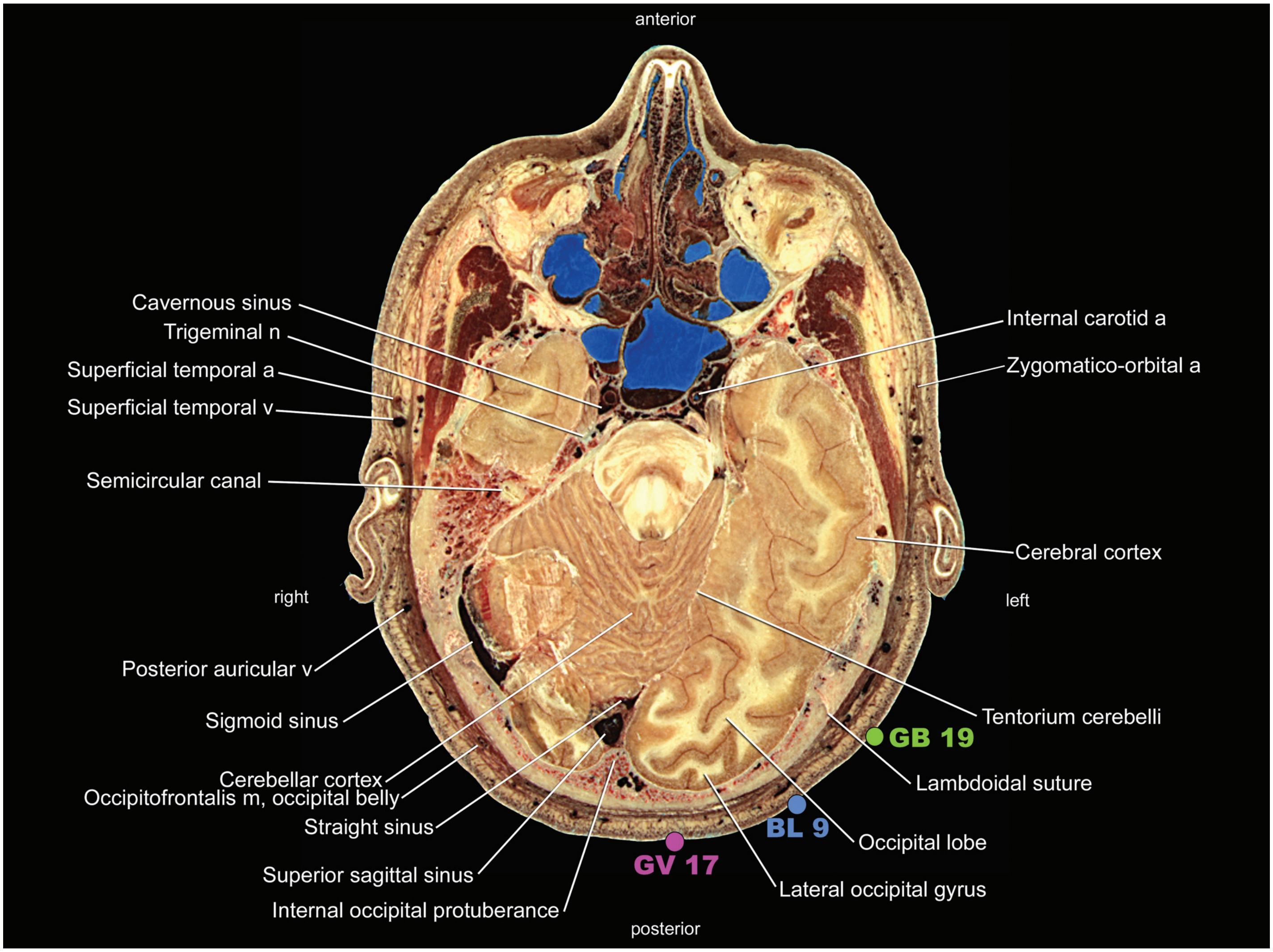

anterior
Cavernous sinus
Trigeminal n
Superficial temporal a
Superficial temporal v
Semicircular canal
Internal carotid a
Zygomatico-orbital a
Cerebral cortex
right
left
Posterior auricular v
Sigmoid sinus
Cerebellar cortex
Occipitofrontalis m, occipital belly
Straight sinus
Superior sagittal sinus
Internal occipital protuberance
Tentorium cerebelli
GB 19
Lambdoidal suture
BL 9
Occipital lobe
GV 17
Lateral occipital gyrus
posterior

Figure 11-54. GB 19 lands in a depression in the skull, pictured here deep to the point, thereby earning the point its name of "Brain Hollow". Feel this on your own head; the depression in the skull becomes immediately apparent.

bution includes the scalp at the back of the head.

- **Occipital vein:** Drains the occipital region of the scalp.

Clinical Relevance: The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[15] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[16] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites. The spatial relationships between GB 19, the posterior auricular vein, the mastoid bone, and the sigmoid sinus appear clearly in Figure 11-54.

Indications and Potential Point Combinations

- **Headache in patients with eye disorders such as decreased visual acuity or glaucoma, causing chronic activation of the epicranius muscle:** GB 19, GB 14, Yintang, select trigger points on the face, scalp, and neck that contribute to the head pain. Also, check the posterior digastrics and semispinalis cervicis for trigger point tenderness and stimulation of the pain pattern the patient recognizes. Consider occipital neuralgia as a concomitant pain-producing problem. Add BL 10, BL 9, and GV 29.

Evidence-Based Applications

- Case series illustrates application of GB 19 for **dizziness/ vertigo, infantile convulsion, senile dementia, and urinary incontinence.**[3]

References

1. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. Brain. 2002;125:1496-1509.
2. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. Brain. 2003;126:1801-1813.
3. Lu F. Experience in the clinical application of Naokong (GB 19). Journal of Traditional Chinese Medicine. 2005;25(1):10-12.
4. Berzin F. Occipitofrontalis muscle: functional analysis revealed by electromyography. *Electromyogr Clin Neurophysiol.* 1989;29(6):355-358.
5. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
6. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci.* 2010;31(Suppl 1):S179-S180.
7. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci.* 2012;33(Suppl 1):S29-S31.
8. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache.* 2008;48(2): 319-327.
9. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia.* 2007;27(2):153-157.
10. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol.* 2010;9(3):285-293.
11. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
12. Ward JB. Greater occipital nerve block. *Seminars in Neurology.* 2003;23(1):59-61.
13. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.
14. Becser N, Bovim G, and Sjaastad O. Extracranial nerves in the posterior part of the head. Anatomic variations and their possible clinical significance. *Spine.* 1998;23:1435-1441.
15. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.
16. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.

GB 20

Feng Chi "Wind Pool"

On the junction of occipital and nuchal regions, in the hollow between the origins of the trapezius and sternocleidomastoid muscles, approximately at the level of the lower margin of the external occipital protuberance, level with GV 16. Approximately midway between GV 16 and GB 12.

Caution: Some ancient texts advise angling the needle in the direction of the contralateral globe. Some have recommended aiming toward the apex of the nose.[1] While this may reduce the likelihood of entering the brainstem, deep needling at GB 20 may damage the vertebral artery or deep cervical veins, even when angled toward the nose. Review this anatomy in Figure 11-56.

Muscles

- **Splenius capitis muscle:** Working bilaterally, the splenius capitis muscles extend the head. Working unilaterally, the splenius capitis bends the head in a lateral direction. Liu et al regard GB 20 as the motor point of the splenius capitis.[2]
- **Semispinalis capitis muscle:** Working bilaterally, the semispinalis capitis muscles extend the head. Working unilaterally, the semispinalis capitis rotates the head.
- **Rectus capitis posterior major muscle:** Extends and rotates the head. However, its function as a proprioceptor may be more important than the motion it provides.
- **Obliquus capitis superior muscle:** The obliquus capitis superior muscle, along with its counterpart, the obliquus capitis inferior muscle, as well as the rectus capitis posterior major and minor muscles, are important in posture, and may function as kinesiological monitors, or organs of proprioception, for head position. The obliquus capitis superior muscle extends and laterally bends the atlanto-occipital joint.

Clinical Relevance: Myofascial trigger points in any of the muscles located near GB 20 contribute to head and neck pain. In addition, pain at the back of the head near GB 20 and BL 10 can arise from trigger points in the multifidi, levator scapulae, splenius cervicis, and infraspinatus muscles. Suboccipital trigger points send pain around the lateral cranium from the occipitotemporal region to the eye, traversing GB and TH territories rostral and caudal to the ear.

Both the rectus capitis posterior major and minor muscles help protect the spinal cord and may be implicated in causing head and neck pain. Atrophy of these muscles and inability to maintain standing balance may occur with chronic neck pain. That is, chronic somatic dysfunction in these muscles may cause muscle atrophy and reduced proprioceptive output, leading to loss of balance.[3]

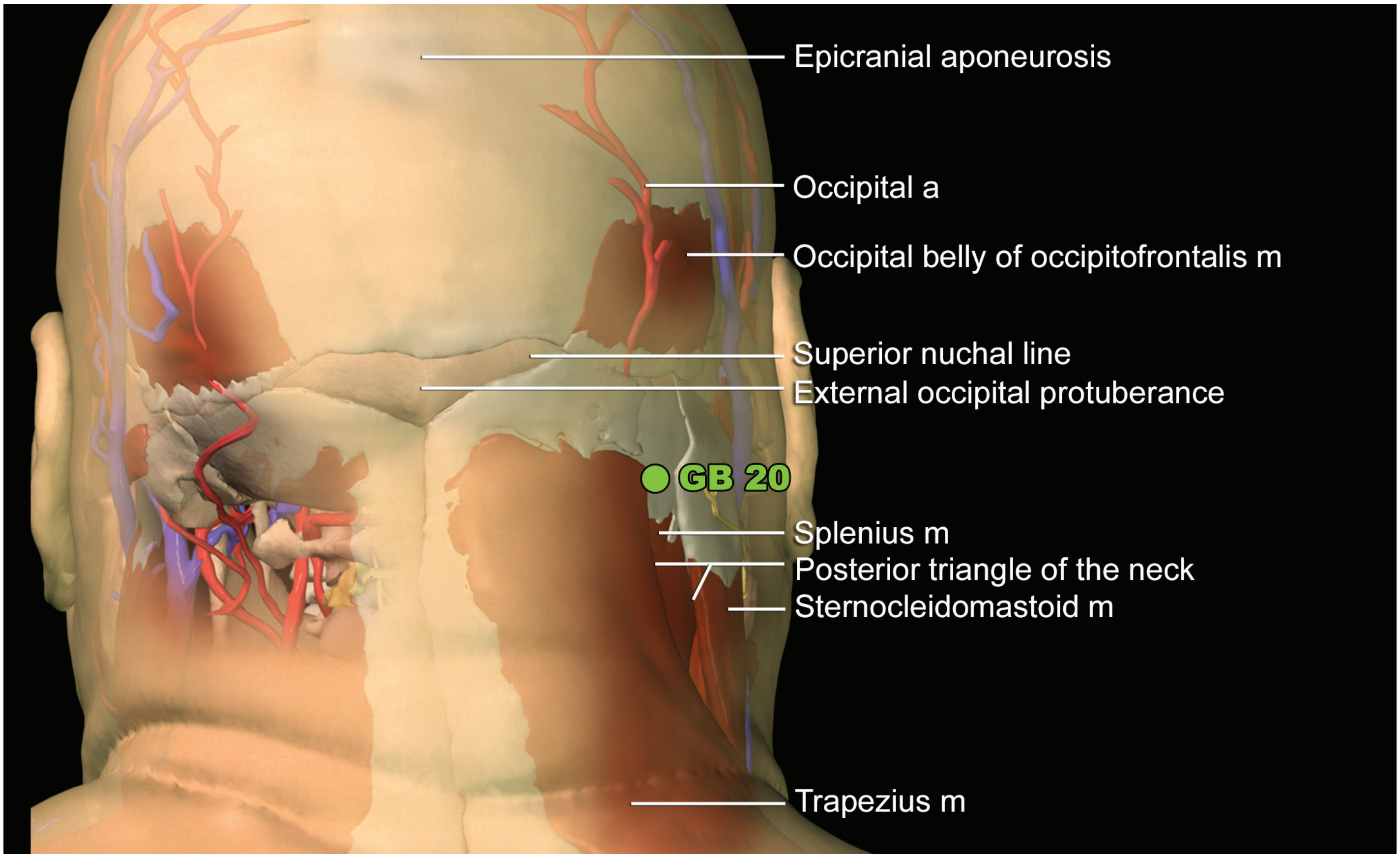


Figure 11-55. "Wind" supposedly "pools" in the depression between the trapezius and SCM at GB 20; hence its name, "Wind Pool". Many individuals exhibit tenderness to palpation at GB 20. GB 20 overlies the motor and trigger points of the splenius capitis muscle; myofascial dysfunction here radiates pain to the vertex. Trigger points in the trapezius muscle, especially from GB 21 in the upper trapezius, radiate pain to GB 20. Note on the left side the way in which the occipital artery makes its way across the superior nuchal line. The greater occipital nerve courses close to the occipital artery though not shown here. Both may incur compression by dint of compression by chronically contracted muscles at their attachment sites on the skull.

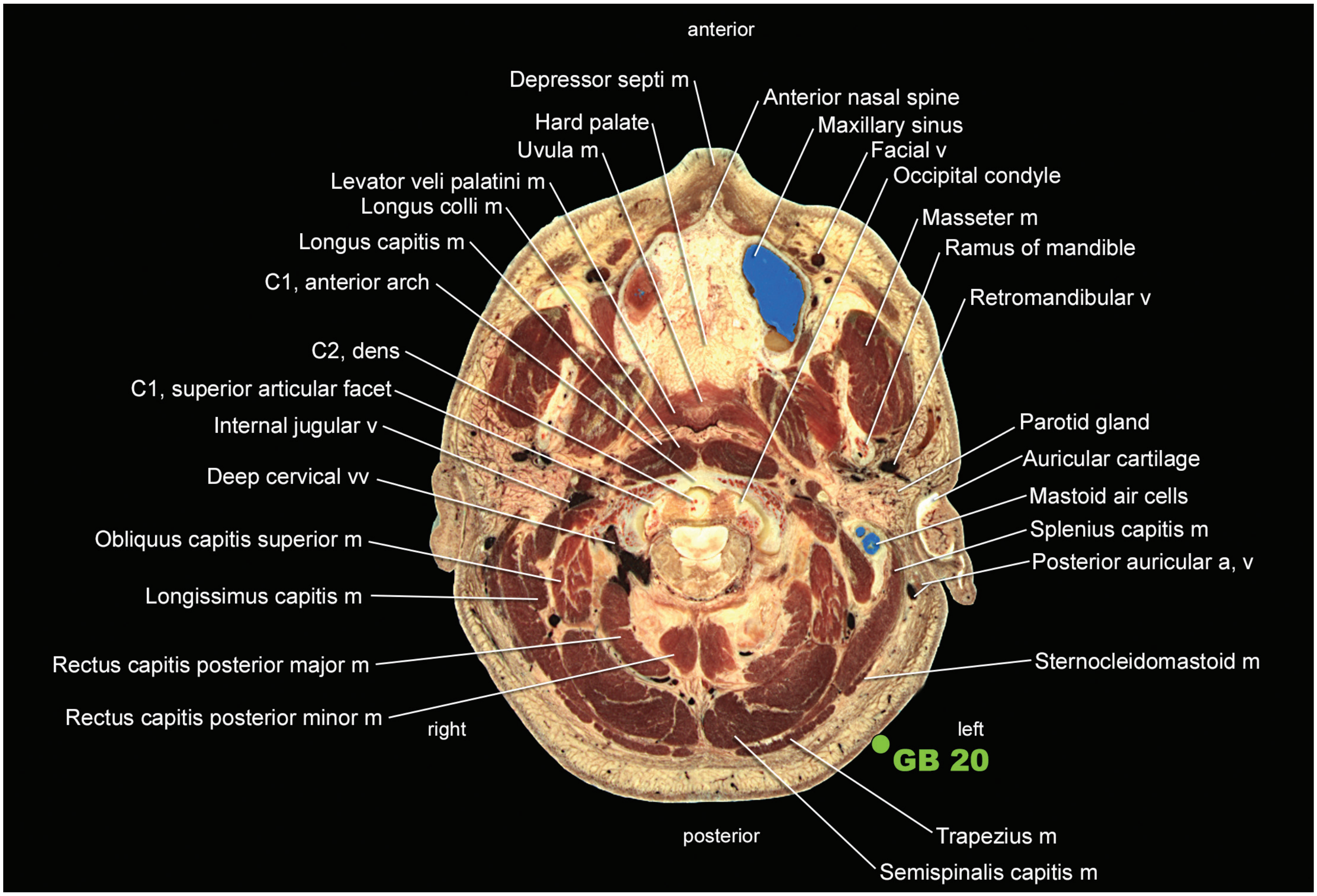

anterior
Depressor septi m
Hard palate
Uvula m
Levator veli palatini m
Longus colli m
Longus capitis m
C1, anterior arch
C2, dens
C1, superior articular facet
Internal jugular v
Deep cervical vv
Obliquus capitis superior m
Longissimus capitis m
Rectus capitis posterior major m
Rectus capitis posterior minor m
right
Anterior nasal spine
Maxillary sinus
Facial v
Occipital condyle
Masseter m
Ramus of mandible
Retromandibular v
Parotid gland
Auricular cartilage
Mastoid air cells
Splenius capitis m
Posterior auricular a, v
Sternocleidomastoid m
left
GB 20
posterior
Trapezius m
Semispinalis capitis m

Figure 11-56. A needle entering GB 20 would course between the SCM and the trapezius muscles to impact the splenius capitis and semispinalis capitis. Splenius capitis trigger points refer pain to the zone inhabited by GB 18 to GB 15 on either side and include the vertex (GV 20). Semispinalis capitis trigger points refer pain to the temporal region in a band-like fashion, wrapping around the head.

Restriction in the soft tissues in the neck increases the likelihood of compression of neural, vascular, and glandular components in the cervicocephalic region, thereby increasing the possibility for for pain and autonomic dysfunction.

Compare the relationships of GB 20, BL 10, and the suboccipital musculature in Figures 11-56 and 7-22, respectively. Note that while deep needling in these two sites can reach a variety of problematic muscles, it may also enter one or more large vessels, such as the deep cervical veins near the right side of the spine in Figure 11-56.

Nerves

- **Greater occipital nerve (GON) (C2, C3):** Supplies sensation to the skin from the occiput to the vertex. The dorsal roots of C1-C3 also supply sensation to the posterior cranial fossa, along with the vagus nerve. Convergent input between the greater occipital nerve and the trigeminal nerve (which supplies the anterior and middle cranial fossa may help explain why patients with headache often complain of pain in both the front of the head and the back of the upper neck.[4,5] Neuromodulatory inhibition of the greater occipital nerve by inhibiting the trigemino-cervical nociceptive convergence mechanism through somatic afferent stimulation helps reduce the intensity of migraine attacks.[6]
- **Lesser occipital nerve (C2, C3):** Supplies the skin behind the ear, the superior ear, the mastoid area, and possibly a small portion of the skin of the neck.
- **Dorsal rami of upper cervical nerves:** Innervate the semispinalis capitis and splenius capitis muscles.
- **Dorsal ramus of C1 (suboccipital nerve):** Innervates the rectus capitis posterior major and obliquus capitis superior muscle.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and sternocleidomastoid muscles.

Anterograde transport of horseradish peroxidase (HRP) suggested that GB 20 makes connections with the posterior auricular branch of the facial nerve (CN VII), the ventromedial division of the facial nucleus, the accessory facial nucleus, the ventral rami of C2-C3, and the ventral horn of the spinal cord segments C1-C4.[7] (Although GB 20 occurs between the SCM and the trapezius muscles, it may influence nerves supplying intervening fascia and thereby affect afferent input.)

Clinical Relevance: Any of the nerves supplying structures within reach of a needle entering GB 20 may become entrapped in the series of layers involved in cervical anatomy, apparent in Figure 11-56. Nerve entrapment leads to pain and myofascial dysfunction. The GON heads from BL 10 and GB 20 toward GV 20 and receives intensive attention based on its contribution to headaches of all sorts, including migraine (see below).

GON: The GON arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[20] This location coincides with GB 20. As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases. Thus, one of the most remarkable clinical attributes of GB 20 pertains to its proximity to the GON and occipital artery and, therefore, its ability to reduce fascial compression and recuperative neuromodulation.

Convergence between the cervical nerves and trigeminal inputs provides a strong neuroanatomic context supporting the inclusion of points within the upper cervical and trigeminal nerve distribution for head and face pain. This trigemino-cervical convergence can work in a nociceptive excitatory or inhibitory manner, depending on the nature of the stimulation entering the central nervous system. The trigemino-cervical complex forms the anatomic and physiologic basis for this convergence. The complex spans from the trigeminal nucleus caudalis to the C2 and C3 spinal cord segments. The GON provides afferent information from the posterior head to the complex, mainly through the C2 nerve root. Nociceptive input supplied by upper cervical nerves flowing into this neural intersection include afferent stimuli from blood vessels, the dura mater of the posterior cranial fossa, cervical spinal ligaments, joints, and muscles. Furthermore, a direct coupling takes place in the dorsal horn of the spinal cord between cervical afferents and input from the meninges, arguing again for targeting cervical acupuncture points (in addition to points innervated by the trigeminal nerve) in cases of head pain and dural irritation. Chronic pain states that induce neuroplastic changes and central sensitization accentuate the excitability of the synaptic meetings, leading to mutual changes and upregulation in the firing patterns of structures in the trigeminocervical distribution. Neck muscles may tense as a result of the sensorimotor integration facilitated by the central sensitization resulting from chronic nociceptive afferent aggravation of pain pathways. Heightened motor output through alpha- and gamma-motoneurons secondarily activates Ia and II muscle spindle afferents, producing even more motor tone through spinal reflex mechanisms. Irritated dural nociceptors further push the motoneurons to fire, contracting the suboccipital paraspinal muscles. Neuromodulation with acupuncture affects local and central pain modulation circuits and interrupts these reflexes. It reduces central sensitization and muscle tension and improves circulation to the local musculature, thereby reducing nociceptive afferent irritability.

Trigeminocervical neural crosstalk can cause patients to feel pain driven by nociceptive information from structures supplied by upper cervical nerve roots and trigeminal territories. This may confuse where the pain originated in cases of posterior fossa tumor, infratentorial dura mater, neuropathic cervical nerve roots, disturbances in the subcutaneous tissue supplied by the GON, and dissection of the vertebral artery.

Lesser occipital nerve: The lesser occipital nerve may receive communicating branches from the greater occipital nerve. Both occipital nerves pierce the trapezius at the base of the skull and are consequently subject to compression by cervical muscle tension, causing occipital neuralgia. When this occurs, it may worsen cervical tension and perpetuate pain in the occiput.

Cervical spinal nerves: Cervical zygopophysial joints cause chronic neck pain and headache in up to half of patients. Facet joints receive innervation from the medial branches of the spinal nerves C3 to C7; each nerve supplies the joint above and below.

Although percutaneous radiofrequency ablation (RFA) has become an accepted nonsurgical modality for chronic neck pain, serious advents may occur. RFA of the least (3rd) occipital nerve and the nerves supplying the C2-C4 facet joints has led to "dropped head syndrome" in which the patient became unable of extending her neck, inducing a debilitating complication.[21] While acupuncture and related techniques may not be able to repair nerves completely destroyed by RFA, the risk of permanent disability emphasizes the need to address pain and functional compromise with safe and effective approaches such as acupuncture and related techniques before pursuing modalities that can cause irreversible damage.

While several cervical spinal nerves supply the splenius and semispinalis muscles, the second cervical spinal nerve (C2) makes extensive direct connections with the vagus nerve. Thus, pain from hypertonic cervical muscles can provoke autonomic changes along with referred pain patterns, such as the nausea and feeling of "misery" that accompanies migraine by dint of crosstalk between C2 spinal nerve and the vagus.

Vessels

- **Occipital artery:** Arises from the external carotid artery and accompanies the occipital nerve in the occipital region. Its distribution includes the scalp at the back of the head.
- **Occipital vein:** Drains the occipital region of the scalp.
- **Deep cervical artery (from the costocervical trunk, which arises from the subclavian artery):** Supplies the deep cervical muscles.
- **Deep cervical vein:** Receives tributaries from the plexuses around the spinous processes of the cervical vertebrae, and terminates in the lower part of the vertebral vein.

Clinical Relevance: The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[22] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[23] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites. Figure 11-55 examines the spatial relationship between GB 20 and the occipital artery while Figure 11-56 exposes the presence of deep cervical veins along the potential course of a needle inserted at GB 20. (Not shown are the lateral internal jugular lymph nodes and the deep occipital lymph nodes that exist in the region.[24]) The deep cervical veins ascend the dorsal surface of the vertebral bodies and are vulnerable to damage with dorsal approaches to cervical spinal surgery.[25] When possible and prudent, nonsurgical approaches to neck pain should be tried before highly invasive maneuvers.

Indications and Potential Point Combinations

- **Myalgias associated with viral infection:** GB 20, GB 21, GV 20, LI 4, ST 36.
- **Headaches:** GB 20, BL 10, check for temporalis, occipitofrontalis, trapezius, and cervical muscle trigger points.
- **Cervical pain and tension:** GB 20, BL 10, additional trigger points depending on distribution of referred pain. SI 3, BL 60, GV 20.
- **Tense upper back:** GB 20, GB 21, associated trigger points. Painful or tense shoulder region: GB 20, palpate SI 11, SI 12, SI 13, TH 15 for trigger points, including LI 15, TH 14.
- **Occipital pain radiating to eye:** GB 20, TH 23, Taiyang.
- **Eye pain:** GB 20, TH 23, BL 2, GV 20.
- **Vertigo, dizziness:** GB 20, BL 10, GB 2, TH 20.
- **Hypertension:** GB 20, TH 18, TH 19, Groove Behind the Ear.
- **Seizures:** GB 20, GV 20, ST 36, Yintang.

Evidence-Based Applications

- Treatment for fever using GV 14, GB 20, and LI 11 in 57 patients with **common cold, influenza, acute tonsillitis, or acute bronchitis** helped normalize vital signs and increased T-lymphocytes.[8]
- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders**, prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.[9]
- A randomized, placebo-controlled trial suggested that treatment with laser acupuncture at LU 7, LI 4, GB 14, and GB 20 benefits **chronic tension headache**.[10]
- Electrical stimulation at GB 20, LI 4, and bilateral EX-HN5 provided pain relief in patients with **chronic tension headache** and did so without producing significant adverse outcomes.[26]
- Acupuncture at GV 14 and GB 20 effectively treated occipital **neuralgia** in a series of cases.[11]
- Pre-injury electroacupuncture at GB 20 or ST 36 can partly regulate the lipid peroxidation occurring as a consequence of **cerebral ischemia**.[12]
- Electroacupuncture at ST 36 or GB 20 may increase thioredoxin expression which could minimize oxidative modifications of thiol groups of surrounding proteins, thereby helping reduce oxidative damage following **brain ischemia**.[13]
- Case series reported electroacupuncture at GB 14, SI 18, ST 7, GB 20, and LI 4 was effective treatment for peripheral **facial paralysis**.[14]
- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in prophylaxis of **migraine** compared to flunarizine.[15]
- Acupuncture at LR 3, SP 6, LI 4, GB 20, GV 20, and Taiyang outperformed transcutaneous electrical nerve stimulation and laser therapy in reducing the frequency of **migraine**, although all three treatments were effective.[16]
- Acupuncture applied to GB 20, GB 34, TH 5 produced better results for the treatment of **migraine** than did ST 36, LI 6, and ST 8.[27]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[17]
- Helps **regulate blood flow** in the vertebral and basilar arteries.[18]
- Acupuncture at GB 20, GV 20, GV 14, LU 7, and ST 40 in a case series successfully treated **vertebrobasilar ischemic vertigo**.[19]
- Electroacupuncture applied to GB 20, GV 24, GV 20, and Sishencong outperformed medication for individuals with **posttraumatic stress disorder** after earthquake.[28]
- Electroacupuncture protocols, some of which include GB 20, can improve both **cell-mediated and humoral immunity during craniotomy**.[29]
- Electroacupuncture applied to GB 20, GB 21, LR 3, and LI 4, along with local tender points, reduced **myofascial pain in the upper trapezius muscle**.[30]
- Acupuncture at GB 20, GB 14, BL 2, TH 23, Ex1, ST 1, LI 4, LI 11, and GV 23 significantly benefited patients with **severe dry eye** as compared to artificial tears.[31]
- Acupuncture for **apoplectic aphasia** most often includes GB 20, PC 6, GV 20, HT 5, Yuye, Jinjin, CV 23, SP 6, GV 15, and scalp acupuncture sites called "No. 1, 2, and 3 language sections".[32]

References

1. Zhao J and Jiao BJ. Advances in research on the safety of acupuncture for acupoints GV 15, GV 16, and GB 20 in the treatment of cerebrovascular disease. *Medical Acupuncture*. 15(3). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol15_3/article5.html on 01-10-06.
2. Liu YK, Varela M, and Oswald R. The correspondence between some motor points and acupuncture loci. *Am J Chin Med*. 1975;3(4):347-358.
3. Tagil SM, Özcakar L, and Bozkurt MC. Insight into understanding the anatomical and clinical aspects of supernumerary rectus capitis posterior muscles. *Clinical Anatomy*. 2005;18:373-375.
4. Bartsch T and Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain*. 2002;125:1496-1509.
5. Bartsch T and Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain*. 2003;126:1801-1813.
6. Piovesan EJ, DiStani F, Kowacs PA, et al. Massaging over the greater occipital nerve reduces the intensity of migraine attacks. Evidence for inhibitory trigemino-cervical convergence mechanisms. *Arq Neuropsiquiatr*. 2007;65(3-A):599-604.
7. Xi G-M, Wang H-Q, He G-H, Huang C-F, Yuan Q-F, Wei G-Y, Li H, Liu W-W, and Fan H-Y. d *Journal of Gastroenterology*. 2005;11(20);3135-3138.
8. Tan D. Treatment of fever due to exopathic Wind-Cold by rapid acupuncture. *Journal of Traditional Chinese Medicine*. 1992;12(4):267-271.
9. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases*. 2001;7:109-115.
10. Ebneshahidi NS, Heshmatipour M, Moghaddami A, Eghtesadi-Araghi P. The effects of laser acupuncture on chronic tension headache – a randomised controlled trial. *Acupuncture in Medicine*. 2005;23(1):13-18.
11. Huang N. Acupuncture treatment of occipital neuralgia with Dazhui and Fengchi acupoints. *World J Acup-Mox*. 2002;12(3):29-31.

12. Siu FK, Lo SC, and Leung MC. Effectiveness of multiple pre-ischemia electro-acupuncture on attenuating lipid peroxidation induced by cerebral ischemia in adult rats. *Life Sciences*. 2004;75:1323-1332.

13. Siu FK, LO SC, and Leung MC. Electro-acupuncture potentiates the disulphide-reducing activities of thioredoxin system by increasing thioredoxin expression in ischemia-reperfused rat brains. *Life Sciences*. 2005;77:386-399.

14. Zhang X. Electric needle therapy for peripheral facial paralysis. *Journal of Traditional Chinese Medicine*. 1997;17(1):47-49.

15. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache*. 2002;42:855-861.

16. Allais G, De Lorenzo C, Quirico PE, Lupi G, Airola G, Mana O, and Benedetto C. Non-pharmacological approaches to chronic headaches: transcutaneous electrical nerve stimulation, lasertherapy, and acupuncture in transformed migraine treatment. *Neurol Sci*. 2003;24:S138-S142.

17. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ*. 2001;322:1-6.

18. Yuan X, Hao X, Lai Z, Zhao H, and Liu W. Effects of acupuncture at Fengshi point (GB20) on cerebral blood flow. *Journal of Traditional Chinese Medicine*. 1998;18(2):102-105.

19. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *Journal of Traditional Chinese Medicine*. 2009;29(2):87-89.

20. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

21. Stoker GE, Buchowski JM, and Kelly MP. Dropped head syndrome following multilevel cervical radiofrequency ablation: a case report. *J Spinal Disord Tech*. 2012; May 10. [Epub ahead of print].

22. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol*. 2012; Sep 13 [Epub ahead of print].

23. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports*. 2012; 6:203.

24. Pan W-R, Le Roux CM, and Briggs CA. Variations in the lymphatic drainage pattern of the head and neck: further anatomic studies and clinical implications. *Plast Reconstr Surg*. 2011;611-620.

25. Yue BYT, Le Roux CM, Corlett R, et al. The arterial supply of the cervical and thoracic spinal muscles and overlying skin: anatomical study with implications for surgical wound complications. *Clinical Anatomy*. 2012; Aug 7. doi: 10.1002/ca.22139 {Epub ahead of print].

26. Wng K, Svensson P, and Arendt-Nielsen L. Effect of acupuncture-like electrical stimulation on chronic tension-type headache: a randomized, double-blinded, placebo-controlled trial. *Clin J Pain*. 2007;23(4):316-322.

27. Yang J, Zeng F, Feng Y, et al. A PET-CT study on the specificity of acupoints through acupuncture treatment in migraine patients. *BMC Complementary and Alternative Medicine*. 2012;12:123.

28. Wang Y, Hu Y-P, Wang W-C, et al. Clinical studies on treatment of earthquake-caused posttraumatic stress disorder using electroacupuncture. *Evidence-Based Complementary and Alternative Medicine*. 2012; Article ID 431279. Doi: 10.1155/2012/431279.

29. Li G, Li S, An L, et al. Electroacupuncture alleviates intraoperative immunosuppression in patients undergoing supratentorial craniotomy. *Acupunct Med*. 2013;31:51-56.

30. Aranha MFM, Alves MC, Berzin F, et al. Efficacy of electroacupuncture for myofascial pain in the upper trapezius muscle: a case series. *Rev Bras. Fisioter, Sao Carlos*. 2011;15(5):371-379.

31. Kim T-H, Kang JW, Kim KH, et al. Acupuncture for the treatment of dry eye: a multicenter randomized controlled trial with active comparison intervention (artificial teardrops). *PLoS ONE*. 2012;7(5):e36638.

32. Sun Y, Xue SA, and Zuo Z. Acupuncture therapy on apoplectic aphasia rehabilitation. *J Tradit Chin Med*. 2012;32(3):314-321.

GB 21

Jian Jing "Shoulder Well", "Shoulder Fountain"

Midway between the tip of the spinous process of C7 (near GV 14) and the tip of the acromion, at the crest of the trapezius muscle. Usually treated at the point of maximum tenderness.

Caution: One of several acupuncture points (i.e., LU 2; ST 11-ST 18; KI 22-KI 27; GB 21; and BL 41-BL 50) through which deep needling can cause pneumothorax.[1] Therefore, avoid deep needle insertion due to presence of underlying lung and risk of pneumothorax.

Some consider needling GB 21 to be contraindicated during pregnancy because of potential to cause abortion.

Muscles

- **Trapezius muscle, upper fibers:** Elevates the scapula.

Clinical Relevance: The trapezius trigger point at GB 21 refers pain along the GB channel to TH 23 and GB 1. A small focus of pain may also appear at SI 17. Pain occasionally extends to the pinna or lower molars. It is not uncommon for trigger point pathology in the trapezius muscle to aggravate myofascial dysfunction in neighboring muscles, causing headache, TMJ-type pain, and neck stiffness.

A variety of interventions aid in alleviating trigger point pathology in the trapezius muscle, including manual pressure,[7] extracorporeal shock wave therapy,[8] acupuncture,[9] transcutaneous electrical point stimulation,[10] and laser therapy.[11,12]

Nerves

- **Supraclavicular nerve (C3, C4), lateral branches:** Supply the skin over the shoulder.
- **Spinal accessory nerve (CN XI):** Provides motor function to the trapezius.
- **Spinal nerves C2, C3, and C4:** Carry pain and proprioceptive information from the trapezius and SCM muscles.

Clinical Relevance: Neuromodulation applied to GB 21 improves local blood flow to the tissue located at GB 21.[13] This suggests that, at least in part, acupuncture reduces local pain by increasing blood flow and reducing neuropathic pain caused by low oxygenation in the tissue.

Spinal accessory neuropathy most commonly results from iatrogenic injury of the nerve in the posterior triangle.[14] This isolated spinal accessory neuropathy manifests as weakness of the SCM and trapezius. This unsupported shoulder places traction on the brachial plexus causing pain and "shoulder syndrome". If the nerve is not completely severed, acupuncture and related techniques may aid in the recovery of spinal accessory nerve function and shoulder strength.

Thoracic limb amputation can cause both somatic pain in the shoulder rotators as well as sympathetic dysfunction in the "stump" region. Neural blockade of the supraclavicular nerve has been found effective.[15] Likely, neuromodulation by means of acupuncture and related technique could also help. Points associated with the supraclavicular nerve include GB 21 and, more precisely, ST 12 and ST 13.

In the mid-1950s, injection at GB 21 was termed the "master control thoracic splanchnics" (MCTS) point. GB 26 received the

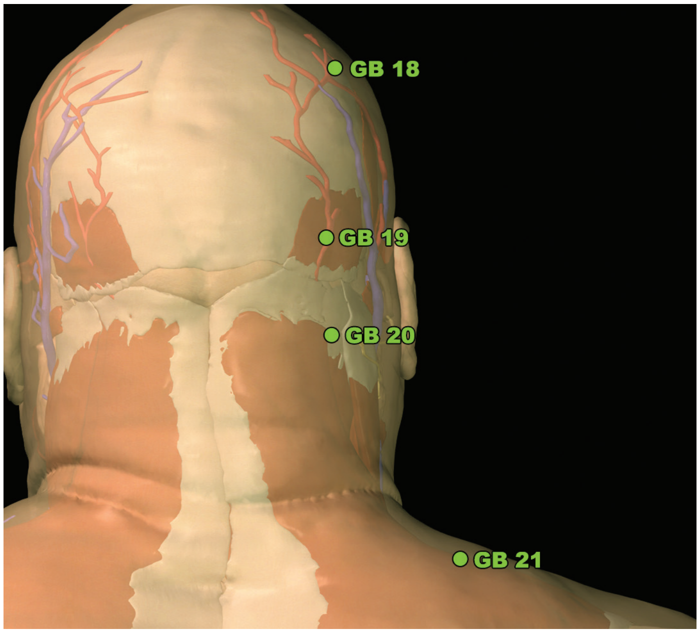


Figure 11-57A. Referred pain from trigger point pathology courses rostrad toward the eye along the GB channel.

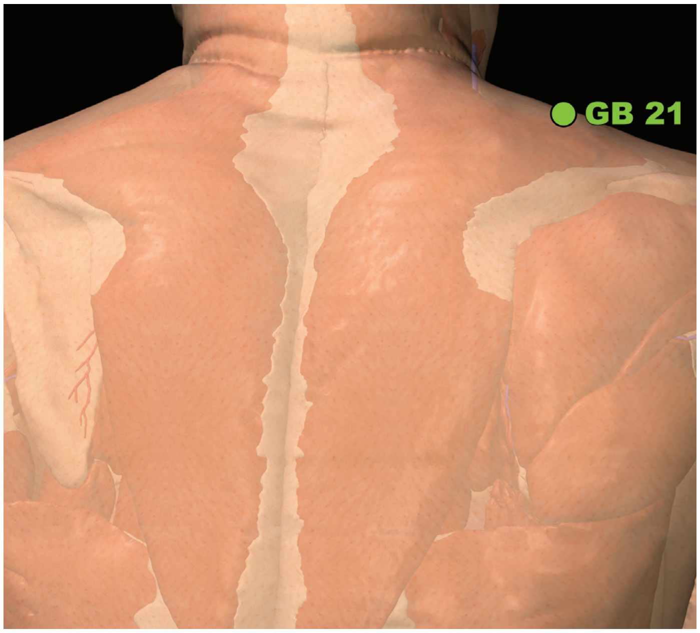


Figure 11-57B. The trapezius muscle extends from the occiput to the caudal thoracic vertebrae and out toward the clavicle, acromion process, and scapular spine bilaterally. The superior, upper, or most cranial fibers elevate the shoulders. They also work in conjunction with the serratus anterior muscle to upwardly rotate the scapulae, as when performing an overhead press exercise. When working with the middle fibers and muscles such as the rhomboids, the upper fibers of the trapezius assist with retracting or adducting the scapulae.

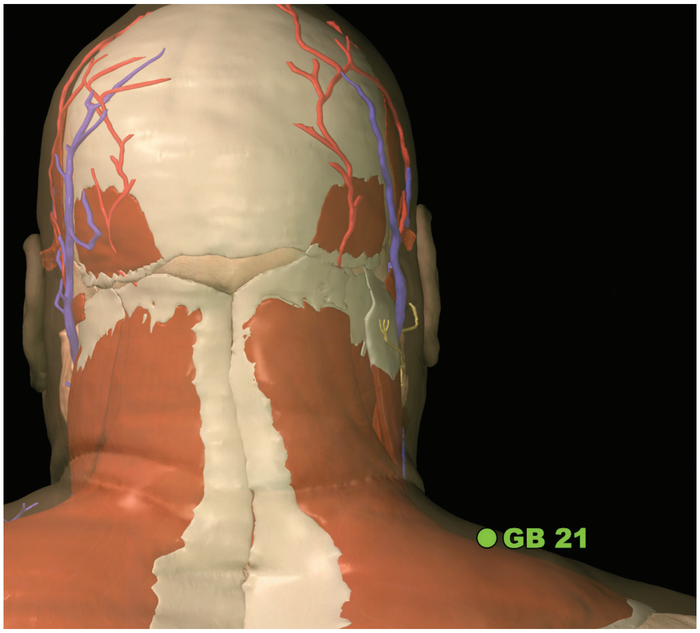


Figure 11-58A. The term "Shoulder Fountain" may refer to the mound of muscle that arises when the trapezius tenses.

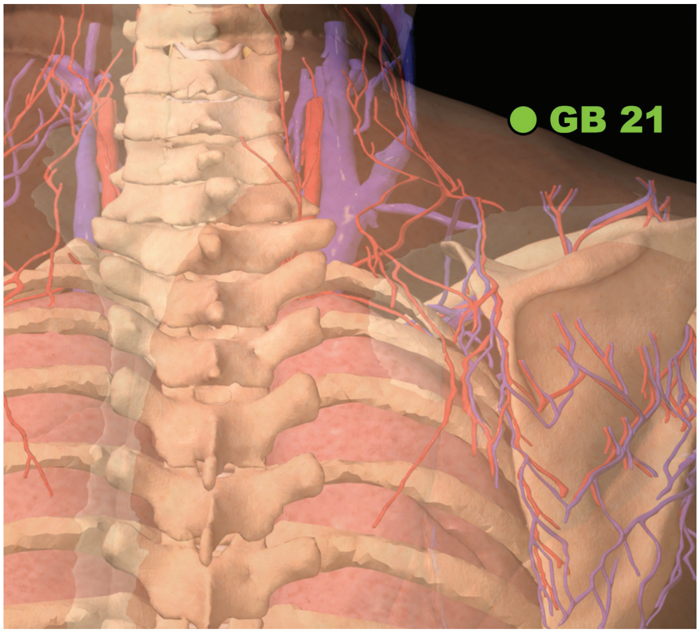


Figure 11-58B. The "basin" of bones beneath GB 21 explains the name, "Shoulder Well". Avoid needling too deeply into the well or you may puncture the lung, especially in emphysematous or thin individuals.

designation as "master control lumbar splanchnics" (MCLS) point. In his 1954 paper, "Further experiences with blocking of cutaneovisceral reflex arcs for relief of sympatheticotonic states; (II) Somatic nerve blocks performed *en passant*, Final Report", Skillern compiled an extensive account of cases he treated by interrupting reflex arcs throughout the body. Patients benefited by nerve blocks applied to GB 21 included those suffering from chronic suppurative sinusitis with accompanying headache, rhinosinusitis interfering with vision, abnormal glandular activity in the head and neck, asthma, angina pectoris, hypertension, pyloric dysfunction and constipation, and biliary colic. He attributed his results to blockade of afferent limbs of somatosympathetic reflex arcs. Nerve block at GB 26 provided relief of appendiceal pain, spastic colon, dysmenorrhea, and urinary discomfort.

The autonomic impact of neuromodulation applied to GB 21 likely arises from somatosympathetic reflexes through cranial thoracic spinal cord segments as well as somatoparasympathetic reflexes by dint of communication between the spinal accessory and vagus nerves. Cranial nerves IX, X, and IX relate to each other anatomically by all exiting the jugular foramen, as well as functionally due to the numerous intercommunicating branches they share and the anastomotic networks they form.[16]

Vessels

- **Transverse cervical artery:** A branch of the thyrocervical trunk, the transverse cervical artery supplies muscles in the posterior cervical triangle, the trapezius muscle, and the medial scapular muscles.
- **Transverse cervical vein:** Drains this region and empties into the external jugular vein.

Clinical Relevance: The transverse cervical artery crosses the phrenic nerve about 3 cm cranial to the clavicle at a right angle; hence the name "Red Cross Syndrome" when ischemic neuropraxia results from arterial compression of the nerve. While it stands anatomically apart from the well-defined prevertebral fascia, surgical, anesthetic, or chiropractic procedures applied to the neck can stretch or transect the nerve. Trauma to the fascia and nerve may result in fibrosis and scarring in the area. Loss of tissue plane separation and adhesion of normally separate anatomical layers invites nerve compression and/or dysfunction.[17] Iatrogenic or traumatic injury to the cervical fascia may similarly impact the transverse cervical artery. Changes to the course and caliber of the artery from anatomical changes, preceding trauma, and/or inflammation can induce further compression of the phrenic nerve that lies deep to it. Phrenic nerve injury in the neck from transverse cervical artery is one source of diaphragm paralysis from peripheral causes.

Needling in the vicinity of GB 21 may augment blood flow through the vertebral and transverse cervical artery.[18] This may aid patients with cerebral blood flow insufficiency.

Acupuncture and related techniques alleviate myofascial restriction in the shoulder to allow better blood flow and improve tissue impair. Points to treat include GB 21, TH 15, SI 14, SI 15, and other relevant trigger points.

Indications and Potential Point Combinations

- **Temporal and cervicogenic headaches:** GB 21, GB 20, TH 18, temporalis/trapezius/SCM trigger points, GV 20. With suspected greater occipital nerve shear stress from trapezius muscle restriction, add GB 19. Consider TH 5 or LI 11 as remote points.[2]
- **"Whiplash" injury:** GB 20, GB 21, SI 16.[19]
- **Tension headache:** GB 21, GB 20, GB 19, temporalis trigger points, GB 14, LR 3, LI 4.
- **Mastitis:** GB 21, SI 1, ST 18.
- **TMJ disorders:** GB 21, GB 2 (or TH 21, SI 19 if tender), tempo-

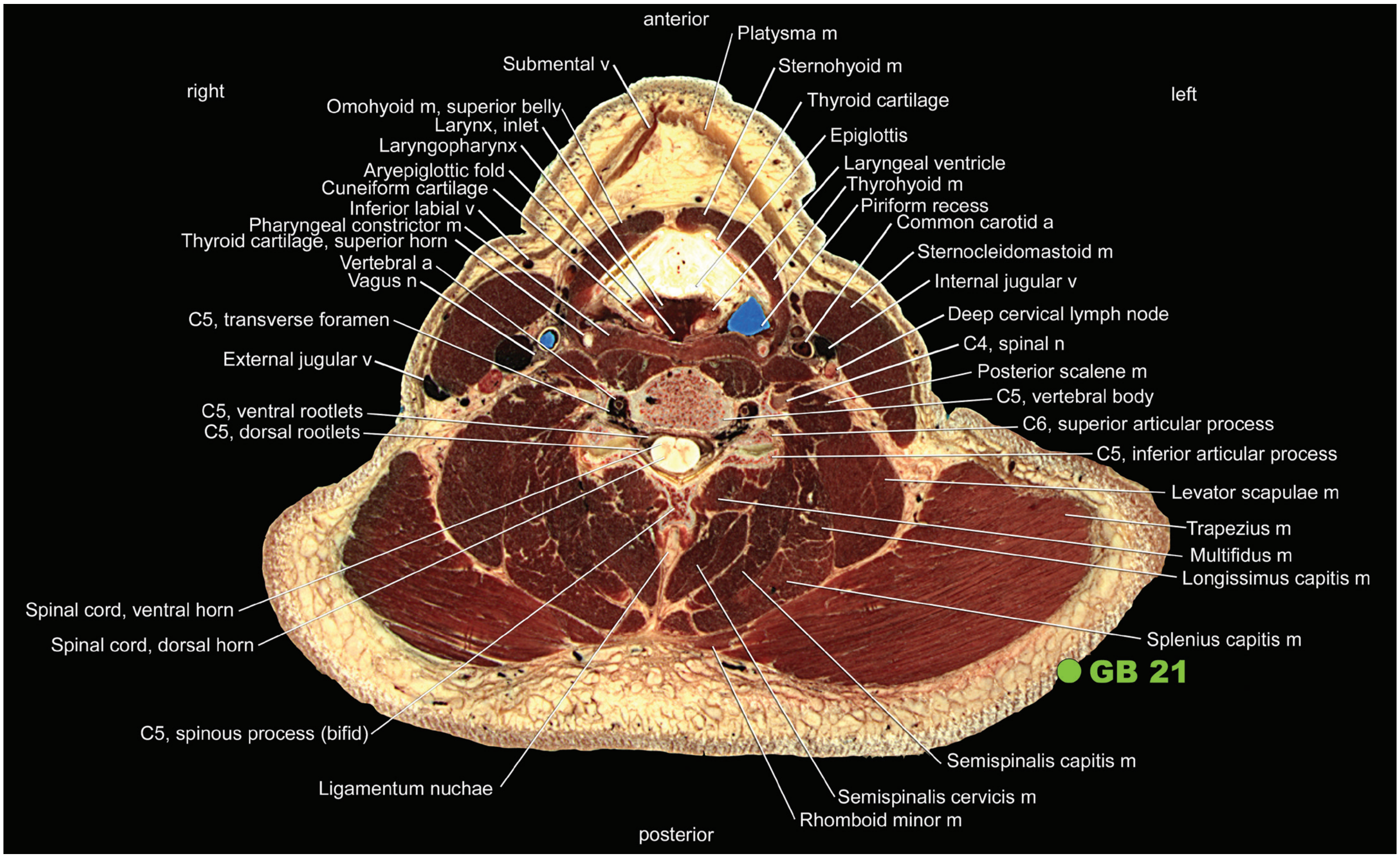

anterior
right
left
Submental v
Platysma m
Sternohyoid m
Omohyoid m, superior belly
Thyroid cartilage
Larynx, inlet
Laryngopharynx
Epiglottis
Aryepiglottic fold
Laryngeal ventricle
Cuneiform cartilage
Thyrohyoid m
Inferior labial v
Piriform recess
Pharyngeal constrictor m
Common carotid a
Thyroid cartilage, superior horn
Sternocleidomastoid m
Vertebral a
Vagus n
Internal jugular v
C5, transverse foramen
Deep cervical lymph node
C4, spinal n
External jugular v
Posterior scalene m
C5, vertebral body
C5, ventral rootlets
C5, dorsal rootlets
C6, superior articular process
C5, inferior articular process
Levator scapulae m
Trapezius m
Multifidus m
Longissimus capitis m
Spinal cord, ventral horn
Spinal cord, dorsal horn
Splenius capitis m
GB 21
C5, spinous process (bifid)
Semispinalis capitis m
Ligamentum nuchae
Semispinalis cervicis m
Rhomboid minor m
posterior

Figure 11-59. The thickness of the trapezius muscle in this individual would have helped protect the lung from pneumothorax during acupuncture. On the other hand, patients with atrophic musculature will not harbor this barricade to the portal of entry at GB 21 to the lung. Hyperinflated lungs increase the risk of inadvertent organ puncture.

ralis trigger points, consider ST 6.

- **Tension fatigue in singers:**[3] GB21, SCM trigger points
- **Asthma:** GB 21, BL 13, LI 10, LI 4, LU 2, GV 14. Assess the cervical accessory muscles of respiration (upper trapezius, scalenes, cervical paraspinal, and SCM muscles) and the masticatory muscles involved with mouth breathing (temporalis, masseter, pterygoid muscles) in order to reduce additional myofascial pain and stress.[4]
- **Dizziness or vertigo:** May result from a trigger point at GB 21; also consider triggers in the SCM.
- **Neck and shoulder tension:** GB 21 and local trigger points

Evidence-Based Applications

- GB 21 demonstrated higher **cutaneous and subcutaneous blood flow** compared to an adjacent asymptomatic reference point within the trapezius muscle.[5] This supports the contention that acupuncture points normally exhibit increased microcirculatory input than non-acupuncture points. It also provides a basis for noninvasively assessing blood flow to points that, when afflicted by myofascial dysfunction, experience reduced blood flow, as when trigger points coalesce the tissue at that site.
- Physicians in Germany considered GB 21, GB 20, and LR 3 to be three "basic" points for the treatment of **tension headache.** They frequently included LI 4, SP 6, and ST 36 as well.[6]
- Aquapuncture injection at GB 21, GB 20, and Taiyang using safflower seed solution significantly reduced morbidity from **chronic daily headache.**[20]
- Acupuncture at GB 21, LU 1, LI 11, LI 4, TH 3, and TH 5 **reduced postoperative pain in patients after arthroscopic shoulder surgery.** Patients receiving acupuncture also slept better.[21]
- Bee-venom injection aided in reducing **shoulder pain** when applied to GB 21.[22]
- Acupuncture at GB 21 alleviated shoulder, back pain, and abdominal pain as well as regulated gallbladder volume in patients with **chronic cholecystitis.**[23]
- Acupuncture at GB 21 regulates **gallbladder activity.**[24]
- Acupuncture at GB 21, SI 14, and SI 15 significantly influenced autonomic nervous system activity in patients with **chronic neck pain.**[25]

References

1. Lee WM, Leung HB, and Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *Journal of Orthopaedic Surgery.* 2005;13(3):300-302.
2. Chou L-W, Hsieh Y-L, Kao M-J, et al. Remote influences of acupuncture on the pain intensity and the amplitude changes of endplate noise in the myofascial trigger point of the upper trapezius muscle. *Arch Phys Med Rehabil.* 2009;90:905-912.
3. Pettersen V. Muscular patterns and activation levels of auxiliary breathing muscles and thorax movement in classical singing. *Folia Phoniatr Logop.* 2005;57:255-277.
4. Chaves TC, Grossi DB, de Oliveira AS, et al. Correlation between signs of temporomandibular (TMD) and cervical spine (CSD) disorders in asthmatic children. *J Clin Pediatr Dent.* 2005;29(4):287-292.
5. Burklein M and Banzer W. Noninvasive blood flow measurement over acupuncture points (Gb21): a pilot study. *Journal of Alternative and Complementary Medicine.* 2007;13(1):33-37.
6. Melchart D. Streng A, Hoppe A, et al. The acupuncture randomized trial (ART) for

tension-type headache – details of the treatment. *Acupunct Med.* 2005;23(4):157-165.
7. Fryer G and Hodgson L. The effect of manual pressure release on myofascial trigger points in the upper trapezius muscle. *Journal of Bodywork and Movement Therapies*. 2005;9:248-255.
8. Jeon JH, Jung YJ, Lee JY, et al. The effect of extracorporeal shock wave therapy on myofascial pain syndrome. *Ann Rehabil Med.* 2012;36(5):665-674.
9. Aranha MFM, Alves MC, Berzin F, et al. Efficacy of electroacupuncture for myofascial pain in the upper trapezius muscle: a case series. *Rev Bras Fisioter*. 2011;15(5):371-379.
10. Gemmell H and Hilland A. Immediate effect of electric point stimulation (TENS) in treating latent upper trapezius trigger points: a double blind randomised placebo-controlled trial. *J Bodyw Mov Ther*. 2011;15(3):348-354.
11. Ilbuldu E, Cakmak A, Disci R, et al. Comparison of laser, dry needling, and placebo laser treatments in myofascial pain syndrome. *Photomed Laser Surg.* 2004;22(4):306-311.
12. Altan L, Bingol U, Aykac M, et al. Investigation of the effect of GaAs laser therapy on cervical myofascial pain syndrome. *Rheumatol Int*. 2005;25:23-27.
13. Burklein M and Banzer W. Noninvasive blood flow measurement over acupuncture points (Gb21): a pilot study. *J Alt Complement Med.* 2007;13(1):33-37.
14. Kang OC and Hin CVF. The glossopharyngeal, vagus and spinal accessory nerves. *European Journal of Radiology.* 2010;74:359-367.
15. Skillern PG. Further experiences with blocking of cutaneovisceral reflex areas for relief of sympatheticotonic states. II. Somatic nerve blocks performed en passant, final report. *The Journal of Nervous and Mental Disease*. 1954;120(1-2):66-74.
16. Kang OC and Hin CVF. The glossopharyngeal, vagus and spinal accessory nerves. *European Journal of Radiology*. 2010;74:359-367.
17. Kaufman MR, Willekes LJ, Elkwood AI, et al. Diaphragm paralysis caused by transverse cervical artery compression of the phrenic nerve: The Red Cross syndrome. *Clinical Neurology and Neurosurgery*. 2012;114:502-505.
18. Qie ZW, Cheng FK, and Cheng LH. Blood flow capacity of the vertebra and cervical artery affected by propagated sensation with acupuncture excitation. *Zhong Xi Yi Jie He Za Zhi*. 1991;11(1):31-3, 5.
19. Rosted P and Jorgensen A. Acupuncture for a patient with whiplash-type injury. *Acupunct Med.* 2010;28(4):205-206.
20. Park JM, Park SU, Jung WS, et al. Carthami-semen acupuncture point injection for chronic daily headache: a pilot, randomised, double-blind, controlled trial. *Complement Ther Med.* 2011; 19 Suppl 1: S 19-S25.
21. Ward U and Nilsson UG. Acupuncture for postoperative pain in day surgery patients undergoing arthroscopic shoulder surgery. *Clin Nurs Res.* 2013;22(1):130-136.
22. An K, Kim YS, Kim HY, et al. Needle-free acupuncture benefits both patients and children. *Neurol Res.* 2010;32 Suppl 1: 22-6.
23. Wen FY, Li SC, Wang GM, et al. Effects of acupuncture of Jianjing (GB 21) on gallbladder volume and symptoms of cholecystitis patients. *Zhen Ci Yan Jiu.* 2012;37(5):398-402.
24. Wang GM, Wen FY, Li LX, et al. Observation of effect on contraction function of gallbladder by acupuncture at Jianjing (GB 21). *Zhongguo Zhen Jiu.* 2011;31(10):910-912.
25. Matsubara T, Arai Y-C P, Shiro Y, et al. Comparative effects of acupressure at local and distal acupuncture points on pain conditions and autonomic function in females with chronic neck pain. *Evidence-Based Complementary and Alternative Medicine.* 2011; Article ID 543291. Doi: 10.1155/2011/543291.

GB 22

Yuan Ye "Armpit Abyss"

On the mid-axillary line, at the level of the 4th intercostal space, approximately 3 cun caudal to the ventral axillary fold. Palpate for a tender point.

Some sources locate this point at the 5th intercostal space. To find the 5th intercostal space, first find the 2nd. It lands on the lateral border of the sternum, in the intercostal groove adjacent and caudal to the sternal angle. Identify the 5th intercostal space and follow it to the mid-axillary line.

Muscles

- **Serratus anterior muscle:** Protracts and rotates the scapula; holds it against the thoracic wall. Myofascial dysfunction of the serratus anterior can arise from long thoracic nerve injury.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: The serratus anterior muscle arises from the cranial eight or nine ribs and inserts on the medical scapular border. It exhibits three portions (upper, middle, and lower) that assist in controlling the scapulae during thoracic limb activities.[3] The serratus anterior stabilizes the scapula; denervation or compromise of the long thoracic nerve leads to scapular "winging". Unbeknownst to many, the serratus anterior may engender painful conditions of the neck and shoulder; this connection arises in part from the muscle's impact on posture of the upper back. Persons who experience neck pain secondary to thoracic limb movements should be examined for serratus anterior dysfunction.

Trigger points in the serratus anterior muscle at GB 22 and GB 23 cause intense local pain or local pain plus referred patterns from the chest to the palm along the PC and HT lines.

Trigger points in the intercostal muscles at GB 22 and GB 23 incite mainly local pain. When severe myofascial dysfunction exists, the pain travels toward the sternum rather than the back. Patients may complain of having a "stitch in the side", although diaphragmatic trigger points may also cause this symptom. Acupuncture of the intercostal muscles risks causing pneumothorax; acupressure, medical massage, soft tissue manipulation, and laser therapy are therefore preferred modalities to treat intercostal muscle trigger points. Stretching or yoga may also help, along with corrective deep breathing exercises.

Nerves

- **Long thoracic nerve (C5-C7):** Innervates the anterior serratus muscle.
- **4th (or 5th) intercostal nerve:** Innervates the external and internal intercostal muscles; innervates the skin via lateral cutaneous branches.

Clinical Relevance: Neuropathy of the long thoracic nerve can lead to notalgia paresthetica, a poorly understood condition characterized by pruritus and/or pain. Proposed etiologies of notalgia paresthetica include degenerative changes of the T2-T6 vertebrae, nerve entrapment of the posterior rami of the T2-T6 spinal nerves, or genetic predisposition. Serratus anterior dysfunction may also result from irritability of the long thoracic nerve.[1] The long thoracic nerve emerges through the middle

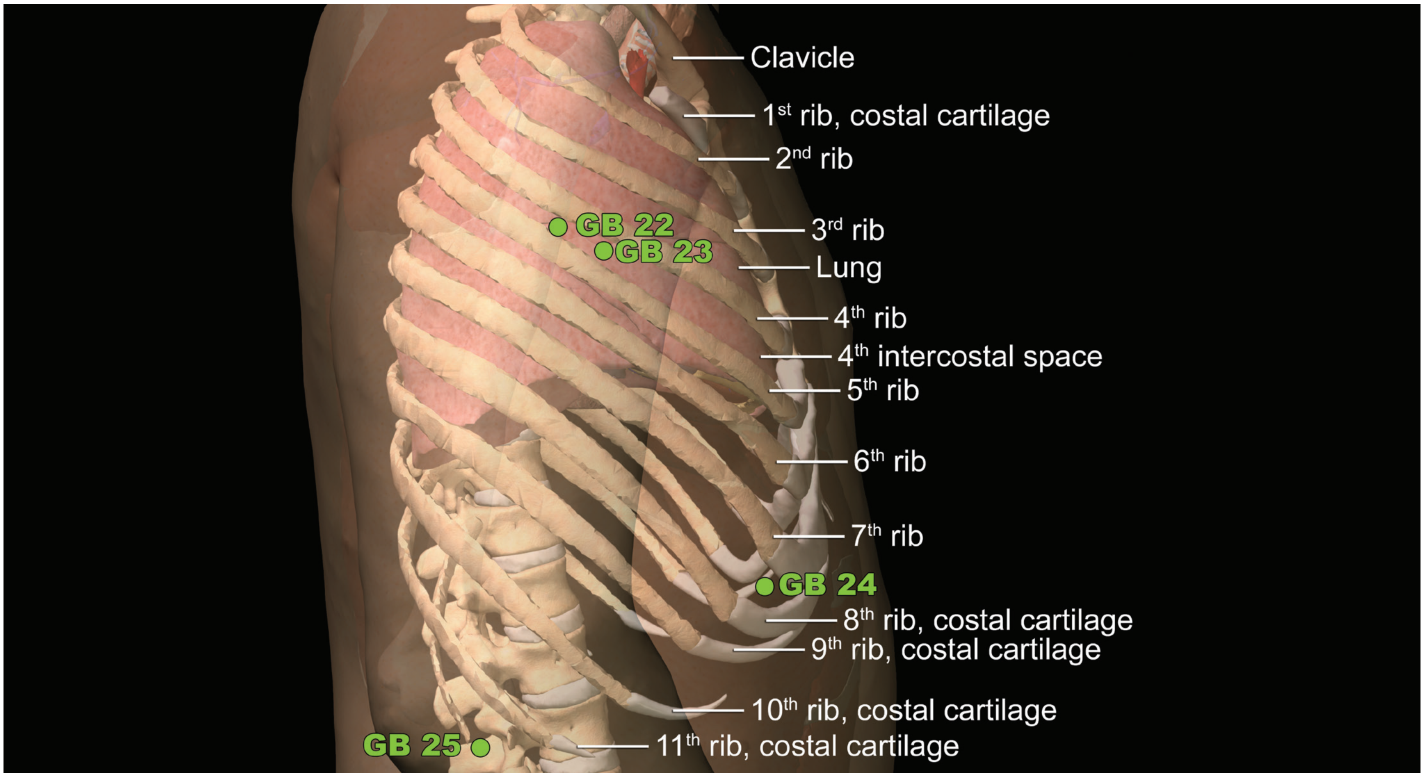

Clavicle
1st rib, costal cartilage
2nd rib
GB 22
GB 23
3rd rib
Lung
4th rib
4th intercostal space
5th rib
6th rib
7th rib
GB 24
8th rib, costal cartilage
9th rib, costal cartilage
10th rib, costal cartilage
GB 25
11th rib, costal cartilage

Figure 11-60. GB 22 and GB 23 sit side-by-side in the 4th intercostal space, adjacent to the lung as shown here. GB 22, with the alternate name of the "water source", was once regarded as an origin of perspiration. Intercostal nerves branch at the mid-axillary line, coincident with GB 22. Intercostal neuralgia may arise from gigantomastia secondary to chronic stretch and resultant neuropathy.

scalene muscle; myofascial dysfunction in the middle scalene may irritate the long thoracic nerve and lead to serratus anterior dysfunction and trigger points.

Intercostal nerves four through six course along the lateral pectoralis fascia and then branch into the breast parenchyma. Sensory branches separate from the intercostal nerves in the mid-axillary line,[4] which makes GB 22 and GB 23 relevant in this regard. Surgery, irradiation, or other procedures near the breast and GB 22 or GB 23 may damage local nerves and their supporting structures. This has the potential to induce chronic breast pain and neuroma formation.[5] Intercostal neuromas following breast surgery may affect one or more intercostal nerves along the lateral chest wall. Intercostal neuralgia produces pain of a burning, electrical, or stabbing type.[6] Causes include breast surgery, pregnancy, and herpes zoster infection. Intercostal neuralgia is frequently refractory to pharmaceutical and surgical interventions. While thoracic dorsal rhizotomy at multiple levels has been reported as successful, neuroablative procedures should be reserved for those cases where less invasive approaches have failed. Myofascial sources of chest wall pain have likely escaped notice by conventional practitioners who omit palpation and a search for trigger points from their patient examination.

Phantom breast pain following mastectomy causes an unpleasant sensation in the location of the removed breast. Patients may develop sympathetically medicate pain after reduction mammoplasty as well. Pathophysiology involves deafferentation of neurons with resultant evoked and spontaneous hyperexcitability.[7] Reflex sympathetic dystrophy perpetuates pain and circulatory abnormalities in the vicinity.

Acupuncture, massage, and related techniques may aid in reducing nerve-based pain and myofascial restriction contributing to the problem.

Vessels

- **Anterior intercostal artery:** Derived from the internal thoracic arteries, the 4th (or 5th) anterior intercostal arteries supply the 4th (or 5th) intercostal muscles, the pectoral muscles, the breasts, and the skin.
- **Anterior intercostal vein:** These are tributaries of the internal thoracic veins and accompany the intercostal arteries.

Clinical Relevance: Reduced blood supply from muscle tension and connective tissue fibrosis reduces arterial blood supply and venous and lymphatic drainage. This can compromise health of the regions supplied, including breast health.

Indications and Potential Point Combinations

- **Lateral costal pain:** GB 22, local trigger points. If radiating along ulnar aspect of the thoracic limb, examine serratus anterior for trigger points in the GB 23 and GB 22 region; add HT 3, HT 7, and SI 3. This type of pain my co-occur with myocardial infarction.
- **A feeling of fullness or weakness in the chest:** GB 22, CV 17, LU 2.
- **Mastalgia (abnormally sensitive breast):** Consider serratus anterior trigger point at GB 22, GB 23. Also examine pectoralis major muscle for trigger points near LU 1, LU 2.

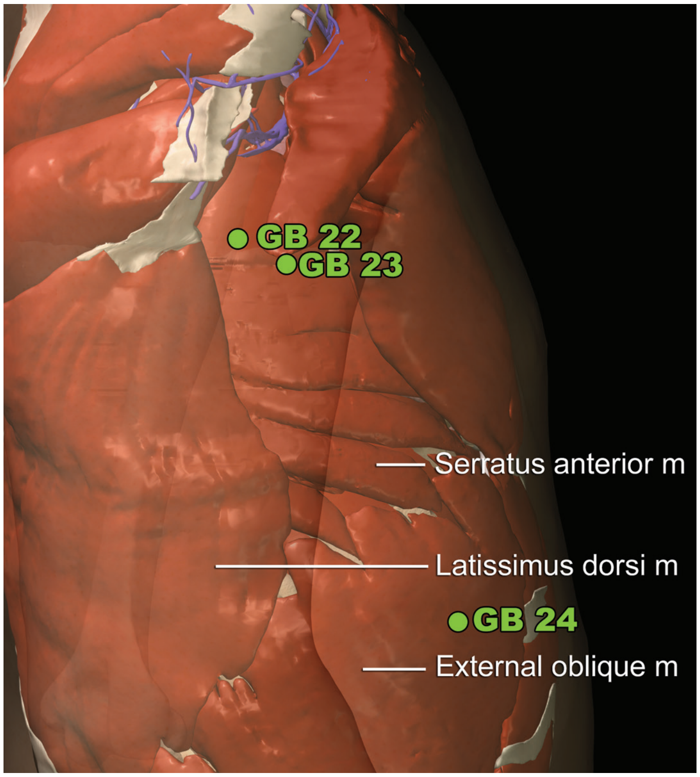


Figure 11-61. A tender spot in the serratus anterior muscle designates the location of GB 22, about a hand's breadth caudal to the axillary fold.

- **Pleuritic pain:** GB 22 or GB 23, LR 14, LU 2.
- **Intercostal neuralgia:** GB 22, trigger points along the involved intercostal level.
- **Feeling of air hunger, difficulty expressed concerning inability to fully inhale and expand the chest; worse when holding telephone up to the ear:** Consider serratus anterior trigger point at GB 22, GB 23. Examine pectoralis major muscle for trigger points at LU 1, LU 2. Add BL 16, BL 17 or BL 45 and BL 46.
- **Inability to fully adduct the scapula:** Consider serratus anterior trigger point at GB 22, GB 23.
- **Interscapular pain, potentially worsened by upper body exercise including fast running, push-ups, lifting heavy weights overhead, loading baggage into the overhead compartment on an airplane, or severe coughing from respiratory ailments:** Consider serratus anterior trigger point at GB 22, GB 23.
- **Notalgia paresthetica:** GB 22, GB 23, BL 12 through BL 16, BL 41 through BL 45. Examine middle scalene muscle for myofascial trigger points. Consider LI 18 or LI 19 if palpably tender.
- **Round-shouldered posture with prominence of the spine and superior border of the scapula:** Examine for serratus anterior trigger points at GB 22, GB 23. Recommend full body massage and stretching to restore proper alignment of the spine and more healthful posture. Consider yoga.

Evidence-Based Applications

- Electrical stimulation of the serratus anterior muscle in the vicinity of GB 22 and GB 23 provided relief of the pruritus and pain of **notalgia paresthetica.**[2]

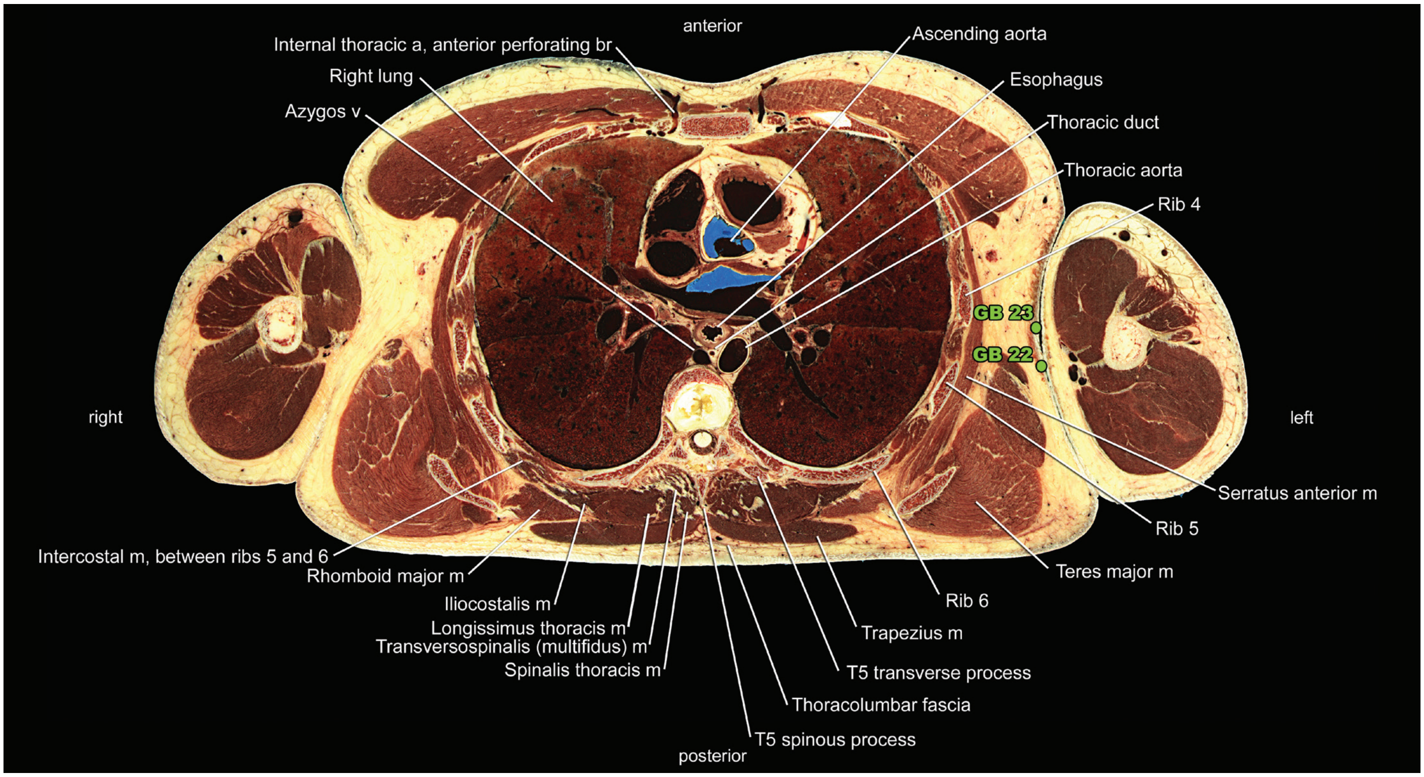

anterior
Internal thoracic a, anterior perforating br
Ascending aorta
Right lung
Esophagus
Azygos v
Thoracic duct
Thoracic aorta
Rib 4
GB 23
GB 22
right
left
Serratus anterior m
Rib 5
Intercostal m, between ribs 5 and 6
Teres major m
Rhomboid major m
Rib 6
Iliocostalis m
Longissimus thoracis m
Trapezius m
Transversospinalis (multifidus) m
T5 transverse process
Spinalis thoracis m
Thoracolumbar fascia
T5 spinous process
posterior

Figure 11-62. The clue to why GB 22 carries the name of "Armpit Abyss" appears in this cross section. Note the drop-off at the edge of the teres major muscle leading to this soft tissue cavern between the teres and the pectoralis major muscles.

References

1. Wang CK, Gowda A, Barad M, et al. Case report. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17.
2. Wang CK, Gowda A, Barad M, et al. Case report. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17.
3. Sheard B, Elliott J, Cagnie B, et al. Evaluating serratus anterior muscle function in neck pain using muscle functional magnetic resonance imaging. *J Manipulative Physiol Ther*. 2012;35:629-635.
4. Williams EH, Williams CG, Rosson GD, et al. Neurectomy for treatment of intercostal neuralgia. *Ann Thorac Surg*. 2008;85:1766-1770.
5. Ducic I, Seiboth LA, and Iorio ML. Chronic postoperative breast pain: danger zones for nerve injuries. *Plast Reconstr Surg*. 2011;127(1):41-46.
6. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.
7. Wong L. Intercostal neuromas: a treatable cause of postoperative breast surgery pain. *Annals of Plastic Surgery*. 2001;46(5):481-484.

GB 23

Zhe Jin "Sinew Seat"

On the lateral chest wall, in the 4th intercostal space, 1 cun ventral to GB 22. Refer to Figure 11-62 for its relationship to other structures in cross section.

Some sources locate GB 23, like GB 22, in the 5th intercostal space.

Muscles

- **Serratus anterior muscle:** Protracts and rotates the scapula; holds it against the thoracic wall. Myofascial dysfunction of the serratus anterior can arise from long thoracic nerve injury.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: The serratus anterior muscle arises from the cranial eight or nine ribs and inserts on the medical scapular border. It exhibits three portions (upper, middle, and lower) that assist in controlling the scapulae during thoracic limb activities.[3] The serratus anterior stabilizes the scapula; denervation or compromise of the long thoracic nerve leads to scapular "winging". Unbeknownst to many, the serratus anterior may engender painful conditions of the neck and shoulder; this connection arises in part from the muscle's impact on posture of the upper back. Persons who experience neck pain secondary to thoracic limb movements should be examined for serratus anterior dysfunction.

Trigger points in the serratus anterior muscle at GB 22 and GB 23 cause intense local pain or local pain plus referred patterns from the chest to the palm and fingers along the PC and HT lines.

Trigger points in the intercostal muscles at GB 22 and GB 23 incite mainly local pain. When severe myofascial dysfunction exists, the pain travels toward the sternum rather than the back. Patients may complain of having a "stitch in the side", although diaphragmatic trigger points may also cause this symptom. Acupuncture of the intercostal muscles risks causing pneumothorax; acupressure, medical massage, soft tissue manipulation, and laser therapy are therefore preferred modalities to treat intercostal muscle trigger points. Stretching or yoga may also help, along with corrective deep breathing exercises.

Nerves

- **Long thoracic nerve (C5-C7):** Innervates the anterior serratus muscle. Neuropathy of the long thoracic nerve can lead to notalgia paresthetica, a poorly understood condition characterized by pruritus and/or pain. Proposed etiologies of notalgia paresthetica include degenerative changes of the T2-T6 vertebrae, nerve entrapment of the posterior rami of the T2-T6 spinal nerves, or genetic predisposition. Serratus anterior dysfunction may also result from irritability of the long thoracic nerve.[1] The long thoracic nerve emerges through the middle scalene muscle; myofascial dysfunction in the middle scalene may irritate the long thoracic nerve and lead to serratus anterior dysfunction and trigger points.
- **Fourth (or 5th) intercostal nerve:** Innervates the external and internal intercostal muscles; innervates the skin via lateral cutaneous branches.

Clinical Relevance: Neuropathy of the long thoracic nerve can lead to notalgia paresthetica, a poorly understood condition characterized by pruritus and/or pain. Proposed etiologies of notalgia paresthetica include degenerative changes of the T2-T6 vertebrae, nerve entrapment of the posterior rami of the T2-T6 spinal nerves, or genetic predisposition. Serratus anterior dysfunction may also result from irritability of the long thoracic nerve.[1] The long thoracic nerve emerges through the middle scalene muscle; myofascial dysfunction in the middle scalene may irritate the long thoracic nerve and lead to serratus anterior dysfunction and trigger points.

Intercostal nerves four through six course along the lateral pectoralis fascia and then branch into the breast parenchyma. Sensory branches separate from the intercostal nerves in the mid-axillary line,[4] which makes GB 22 and GB 23 relevant in this regard. Surgery, irradiation, or other procedures near the breast and GB 22 or GB 23 may damage local nerves and their supporting structures. This has the potential to induce chronic breast pain and neuroma formation.[5] Intercostal neuromas following breast surgery may affect one or more intercostal nerves along the lateral chest wall. Intercostal neuralgia produces pain of a burning, electrical, or stabbing type.[6] Causes include breast surgery, pregnancy, and herpes zoster infection. Intercostal neuralgia is frequently refractory to pharmaceutical and surgical interventions. While thoracic dorsal rhizotomy at multiple levels has been reported as successful, neuroablative procedures should be reserved for those cases where less invasive approaches have failed. Myofascial sources of chest wall pain have likely escaped notice by conventional practitioners who

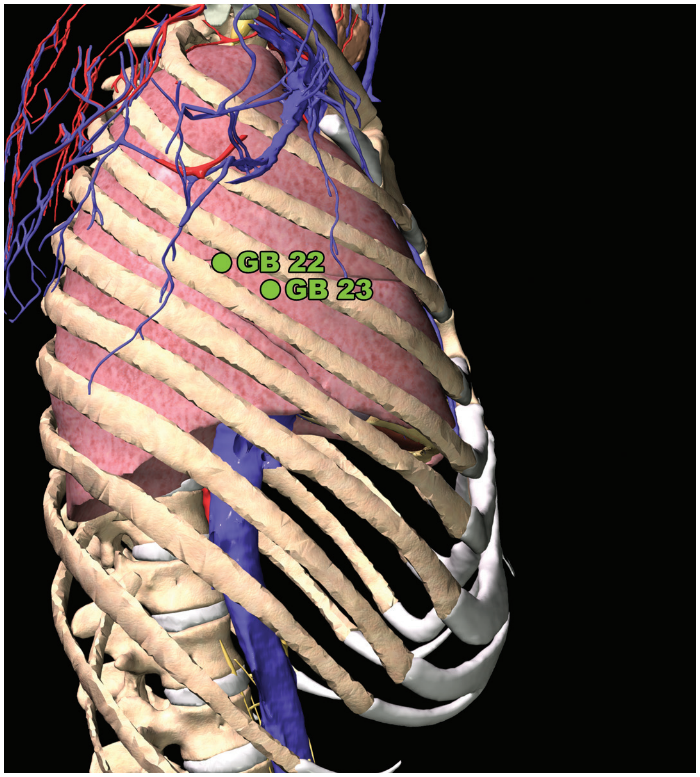


Figure 11-63. The name for GB 23 of "Sinew Seat" refers to the intercostal muscles riding between the ribs, as if in the seat of a chariot. To the ancient Chinese acupuncturists, the shape of the rib cage resembled that of a chariot as it rests on its wheels.

omit palpation and a search for trigger points from their patient examination.

Phantom breast pain following mastectomy causes an unpleasant sensation in the location of the removed breast. Patients may develop sympathetically medicate pain after reduction mammoplasty as well. Pathophysiology involves deafferentation of neurons with resultant evoked and spontaneous hyperexcitability.[7] Reflex sympathetic dystrophy perpetuates pain and circulatory abnormalities in the vicinity.

Acupuncture, massage, and related techniques may aid in reducing nerve-based pain and myofascial restriction contributing to the problem.

Vessels

- **Anterior intercostal artery:** Derived from the internal thoracic arteries, the 4th (or 5th) anterior intercostal arteries supply the 4th (or 5th) intercostal muscles, the pectoral muscles, the breasts, and the skin.
- **Anterior intercostal vein:** These are tributaries of the internal thoracic veins and accompany the intercostal arteries.

Clinical Relevance: Reduced blood supply from muscle tension and connective tissue fibrosis reduces arterial blood supply and venous and lymphatic drainage. This can compromise health of the regions supplied, including breast health.

Indications and Potential Point Combinations

- **Lateral costal pain:** GB 23, local trigger points. If radiating along ulnar aspect of the thoracic limb, examine serratus anterior for trigger points in the GB 23 and GB 22 region; add HT 3, HT 7, and SI 3.This type of pain my co-occur with myocardial infarction.
- **A feeling of fullness or weakness in the chest:** GB 23, CV 17, LU 2.
- **Mastalgia (abnormally sensitive breast):** Consider serratus anterior trigger point at GB 22, GB 23. Also examine pectoralis major muscle for trigger points near LU 1, LU 2.
- **Pleuritic pain:** GB 23, LR 14, LU 2.
- **Intercostal neuralgia:** GB 23, trigger points along the involved intercostal level.
- **Feeling of air hunger, difficulty expressed concerning inability to fully inhale and expand the chest; worse when holding telephone up to the ear:** Consider serratus anterior trigger point at GB 22, GB 23. Examine pectoralis major muscle for trigger points at LU 1, LU 2. Add BL 16, BL 17 or BL 45 and BL 46.
- **Axillary adenitis:** GB 23, HT 2, ST 36.
- **Inability to fully adduct the scapula:** Consider serratus anterior trigger point at GB 22, GB 23.
- **Interscapular pain, potentially worsened by upper body exercise including fast running, push-ups, lifting heavy weights overhead, loading baggage into the overhead compartment on an airplane, or severe coughing from respiratory ailments:** Consider serratus anterior trigger point at GB 22, GB 23.
- **Notalgia paresthetica:** GB 22, GB 23, BL 12 through BL 16, BL 41 through BL 45. Examine middle scalene muscle for myofascial trigger points. Consider LI 18 or LI 19 if palpably tender.
- **Round-shouldered posture with prominence of the spine and superior border of the scapula:** Examine for serratus anterior trigger points at GB 22, GB 23. Recommend full body massage and stretching to restore proper alignment of the spine and more healthful posture. Consider yoga.

Evidence-Based Application

- Electrical stimulation of the serratus anterior muscle in the vicinity **of GB 22 and GB 23 provided relief of the pruritus and pain of notalgia paresthetica.**[2]

References

1. Wang CK, Gowda A, Barad M, et al. Case report. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17.
2. Wang CK, Gowda A, Barad M, et al. Case report. Serratus muscle stimulation effectively treats notalgia paresthetica caused by long thoracic nerve dysfunction: a case series. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2009;4:17.
3. Sheard B, Elliott J, Cagnie B, et al. Evaluating serratus anterior muscle function in neck pain using muscle functional magnetic resonance imaging. *J Manipulative Physiol Ther*. 2012;35:629-635.
4. Williams EH, Williams CG, Rosson GD, et al. Neurectomy for treatment of intercostal neuralgia. *Ann Thorac Surg*. 2008;85:1766-1770.
5. Ducic I, Seiboth LA, and Iorio ML. Chronic postoperative breast pain: danger zones for nerve injuries. *Plast Reconstr Surg*. 2011;127(1):41-46.
6. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.
7. Wong L. Intercostal neuromas: a treatable cause of postoperative breast surgery pain. *Annals of Plastic Surgery*. 2001;46(5):481-484.

GB 24

Ri Yue "Sun and Moon"

Inferior to the nipple, on the mid-clavicular line, in the 7th intercostal space, 1 intercostal space caudal to and slightly lateral to LR 14.

Alternate location (GB 24′): Immediately caudal to the costal margin, on the mid-clavicular line. Compare the placement of GB 24 and "GB 24′ " in Figure 11-64.

Muscles

- **External oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.
- **Transversus abdominis muscle:** Compresses and supports the abdominal viscera. Since this is the deepest layer of the muscles of the abdominal wall, needling through this muscle may damage internal organs.

Clinical Relevance: Referred pain patterns from trigger points in the abdominal oblique and transversus muscles can cause visceral symptoms such as "heartburn" and epigastric distress.

Trigger point pathology in the abdominal oblique muscles may send referred pain in various directions across the abdomen, including toward the ipsilateral or contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia, leading to a variety of diagnostic enigmas and confusion. Attachment trigger points arise along the hypochondrial region as in GB 24, as well as along the iliac crest (GB 26 and GB 27). Trigger points near the subchondral region refer pain to the mid-epigastrium toward the opposite wing of the ilium.

Trigger points in the cranial portion of the transverses abdominis muscle refer pain across the epigastrium around the xyphoid process between the anterior costal margins. Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence that have difficulty exercising the pelvic floor muscles.[6] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence.

Trigger points in the intercostal muscles at GB 24, when the point is treated within the 7th intercostal space, incite mainly local pain. When severe myofascial dysfunction exists, the pain travels toward the sternum rather than the back. Patients may complain of having a "stitch in the side", although diaphragmatic trigger points may also cause this symptom. The external intercostal muscles contain more muscle spindles than the internal intercostal muscles; those in the first seven intercostal spaces exhibit a greater density of muscle spindles than do the muscles in the lower intercostal spaces.

Acupuncture of the intercostal muscles risks causing pneumothorax; acupressure, medical massage, soft tissue manipulation, and laser therapy are therefore preferred modalities to treat intercostal muscle trigger points. Stretching or yoga may also help, along with corrective deep breathing exercises.

Nerves

- **Thoracoabdominal nerves (T7-T11):** Innervate the external and internal oblique muscles and the transverse abdominal muscle.

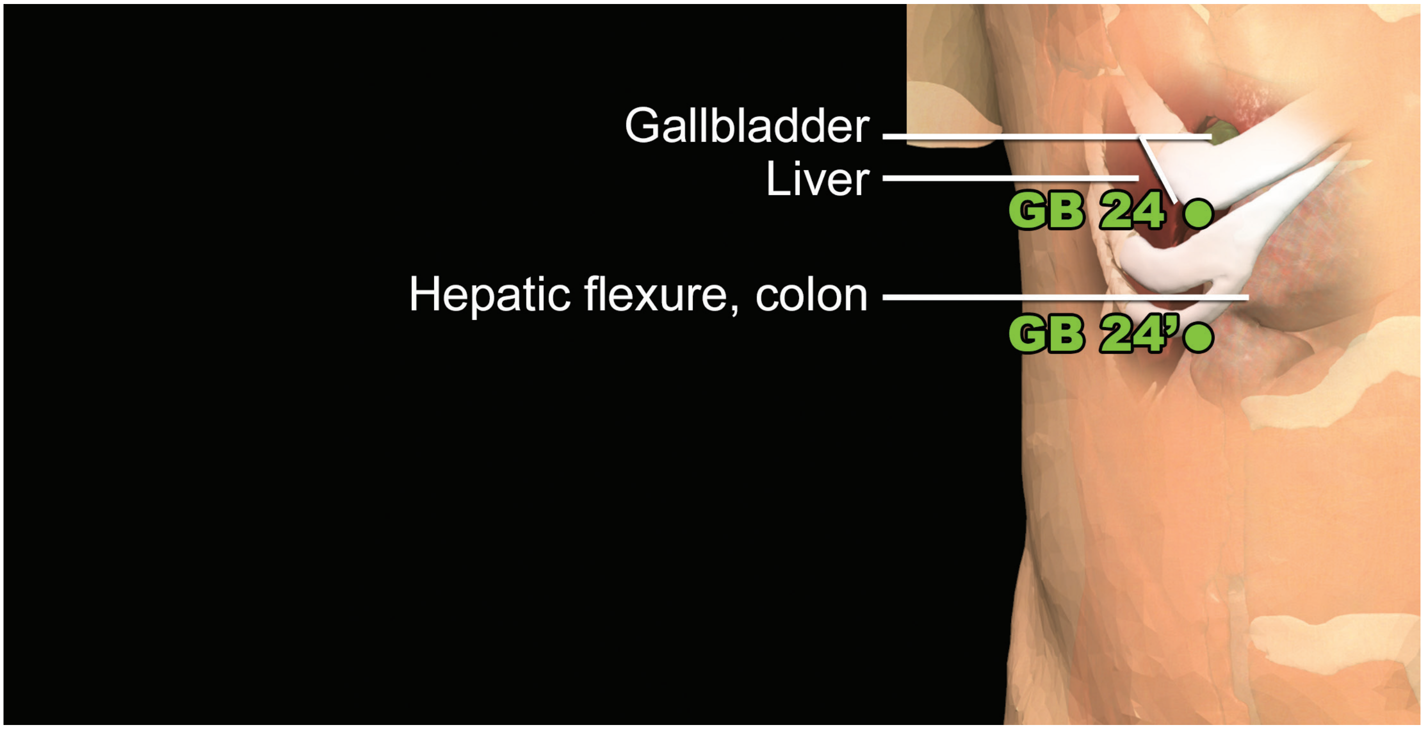


Figure 11-64. GB 24, the "Sun and Moon", lives either within the last full intercostal space on the mid-clavicular line (which may be the 7th intercostal space) or at the intersection of the mid-clavicular line and the subchondral border. Note in this image how the placement of the point affects the organ it overlies. Here, GB 24 lands directly over the gallbladder when located within the most caudal yet complete intercostal space. Subchondral placement puts it over the hepatic (right) colonic flexure, denoted by GB 24′.

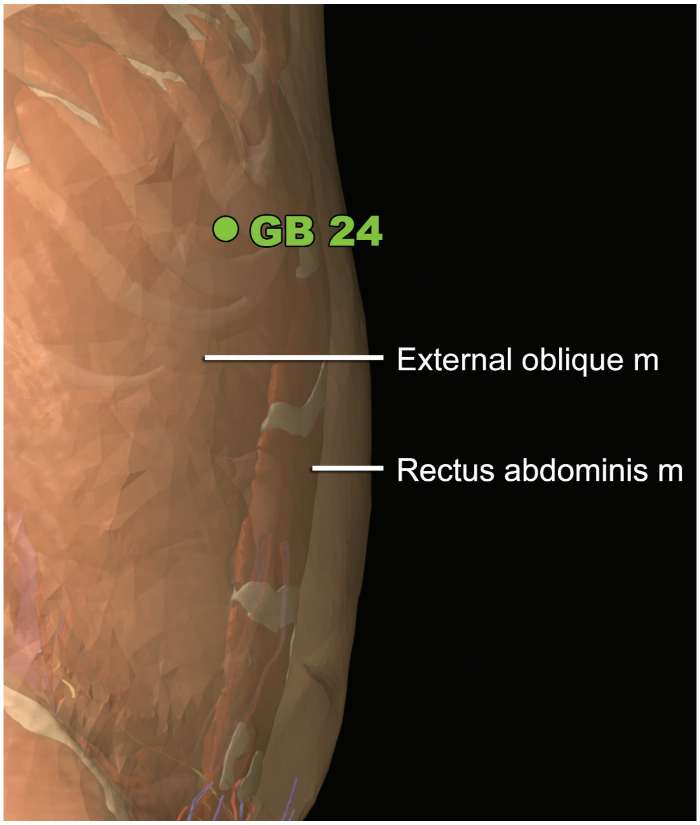


Figure 11-65. GB 24, whether below the ribs or within the 7th intercostal space, targets trigger points along the anterior abdominal wall.

- **Subcostal nerve:** Innervates the external oblique muscle.
- **7th intercostal nerve:** Innervates the external and internal intercostal nerves.
- **7th intercostal nerve:** Innervates the skin via lateral cutaneous branches.

Clinical Relevance: Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis plane, lying between the internal oblique muscle and the transverse abdominis muscle.[7] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from these plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively.

Having multiple sites of crosstalk among nerves of the abdominal wall impacts anesthetic procedures involving nerve blockade as well as neuromodulatory approaches such as acupuncture and related techniques. That is, inputs designed to influence somatovisceral reflexes through Front Mu points such as GB 24 or others actually cause changes in several spinal cord segments rather than only one level, which works toward the acupuncturist's advantage by distributing the neuromodulation to a broader territory.

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[8] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[10] Paresis of the abdominal wall may cause large swelling and mechanical complaints.

Intercostal neuralgia produces pain of a burning, electrical, or stabbing type.[11,12] When the 7th intercostal location is selected for GB 24, intercostal nerve pain may be the source of abdominal wall discomfort here.

Vessels

- **Anterior intercostal artery:** Derived from the musculophrenic arteries (branches of the internal thoracic arteries), the 7th anterior intercostal arteries supply the 7th intercostal muscles, the pectoral muscles, the breasts, and the skin.
- **Anterior intercostal vein:** These are tributaries of the internal thoracic veins and accompany the intercostal arteries.

Clinical Relevance: Reduced blood supply from muscle tension and connective tissue fibrosis reduces arterial blood supply and venous and lymphatic drainage.

Indications and Potential Point Combinations

- **Hepatobiliary problems such as cholecystitis, hepatitis:** GB 24, LR 14, ST 36, BL 18, BL 19.
- **Hiccup (Hiccough):** GB 24 and other points along the diaphragmatic attachment sites around the trunk that may be signaling or perpetuating hiccup. PC 6. Consider adding points in the concha of the ear to neuromodulate the auricular branch of the vagus nerve. For hiccup that is further provoked by trigeminal nerve afferents over the skin, add M-CP-18, or Jiachenjiang over the mental foramen.[1] Additional nerve pathways to explore include the phrenic nerve (originating from C2-C5 spinal nerves) and the recurrent laryngeal nerve. Given that the hiccup-reflex arc consists of several neural pathways, pinpointing the etiology and definitive neuromodulatory treatment can be challenging, especially in patients with advanced cancer. In those situations, the multifaceted contributions can include electrolyte disturbances, chemotherapy, esophagitis, or neoplastic involvement of the thoracoabdominal cavities and the nervous system.[2] The vagus nerve, phrenic nerve (C2-C4), and the sympathetic chain (T6-T12) all carry afferent signals to the central hiccup center. The vagus nerve could become irritated anywhere along its course from the abdomen to the brain; as such, trigger points in the anterior cervical region should be examined to determine whether they are compressing the vagus nerve on its way into the jugular foramen.

The auricular branch of the vagus nerve (i.e., Arnold's nerve) could also cause hiccups due to irritation within the auditory canal caused by excessive cerumen, foreign body, or hair.[3]

- **Intercostal neuralgia:** Locate source of pain through palpation; possibly GB 24.
- **Fullness under the ribs:** GB 24, CV 12.
- **Digestive discomfort:** GB 24, ST 36, ST 25, appropriate trigger points or autonomic points based on specific problem.
- **Vomiting:** GB 24, PC 6, GV 20.
- **Gastritis:** GB 24, CV 12, ST 36.

Evidence-Based Applications

- Aquapuncture with water as the fluid into the most sensitive location in a zone outlined by LR 14, GB 24, and CV 14 produced pain relief in a significant number of patients suffering from **biliary colic.**[4]
- A Chinese study compared electroacupuncture at GB 24, GB 34, LR 15, ST 21, BL 18, and Dannang (EX-LE 6) to a control intervention consisting of the Chinese herb Paishi Decoction, magnesium sulfate, hydrochloric acid, and a fat-laden diet for the treatment of **cholelithiasis** in the biliary tract. The study reported a significant difference between the two groups, with the electroacupuncture group showing better results.[5]

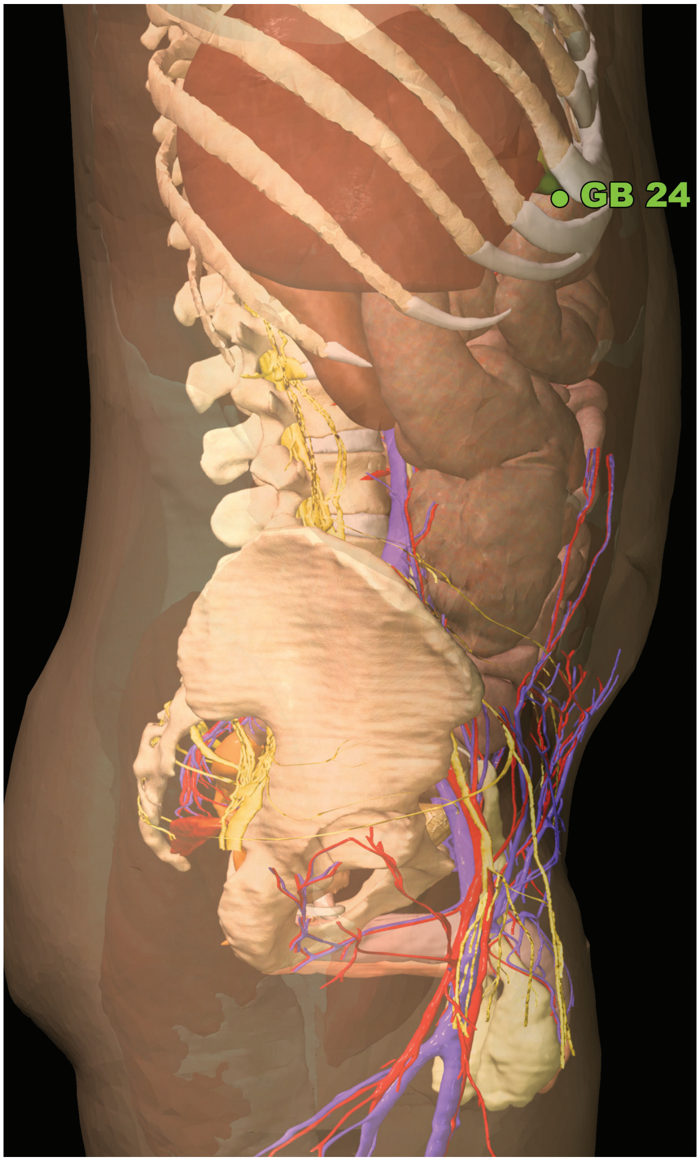


Figure 11-66. GB 24, the Front Mu or "Alarm" point of the gallbladder, resides near the actual gallbladder in the same way that LR 14, the Front Mu point of the liver, lands adjacent to its organ affiliate. With respect to the point's name, the gallbladder represents the "sun" and the liver the "moon" in this Yang-Yin pair.

References

1. Junior O, Araujo ALD, DaSilva CME, et al. Morphological and morphometric study of the mental foramen on the M-CP-18 Jiachenjiang point. *Int J Morphol*. 2009;27(1):231-238.
2. Marinella MA. Diagnosis and management of hiccups in the patient with advanced cancer. *The Journal of Supportive Oncology*. 2009;7:122-127, 130.
3. Marinella MA. Diagnosis and management of hiccups in the patient with advanced cancer. *The Journal of Supportive Oncology*. 2009;7:122-127, 130.
4. Jiang Y and Chen Y. Treatment of biliary colic by water injection in the region of Qimen, Riyue, and Juque points. *J Tradit Chin Med*. 1995;15(3):185-188.
5. Song MP. (Chinese) Clinical observation on frequency-changeable electroacupuncture for treatment of cholelithiasis. *Zhongguo Zhen Jiu*. 2006;26(11):772-774.
6. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics*. 2009;28:368-373.
7. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.
8. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.
9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.
10. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.
11. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.
12. Williams EH, Williams CG, Rosson GD, et al. Neurectomy for treatment of intercostal neuralgia. *Ann Thor Surg*. 2008;85:1766-1770.

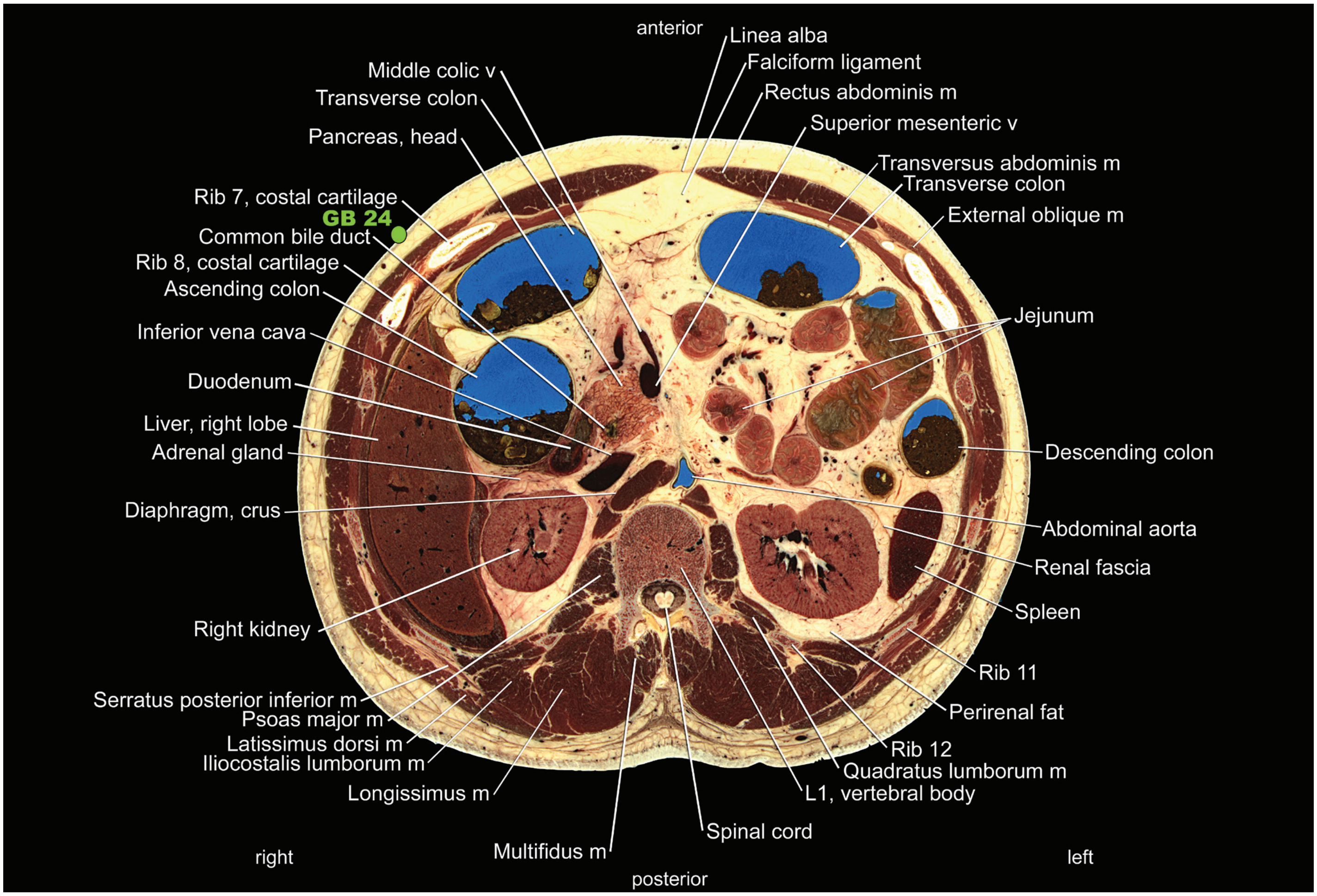

anterior
Linea alba
Middle colic v
Falciform ligament
Transverse colon
Rectus abdominis m
Superior mesenteric v
Pancreas, head
Transversus abdominis m
Transverse colon
Rib 7, costal cartilage
GB 24
External oblique m
Common bile duct
Rib 8, costal cartilage
Ascending colon
Jejunum
Inferior vena cava
Duodenum
Liver, right lobe
Descending colon
Adrenal gland
Diaphragm, crus
Abdominal aorta
Renal fascia
Spleen
Right kidney
Rib 11
Serratus posterior inferior m
Perirenal fat
Psoas major m
Latissimus dorsi m
Rib 12
Iliocostalis lumborum m
Quadratus lumborum m
Longissimus m
L1, vertebral body
Spinal cord
right
Multifidus m
left
posterior

Figure 11-67. The safe depth of needling for GB 24 depends on the thickness of the muscle and fat over the abdominal wall. As shown in this cross section, overzealous needling through the 7th intercostal space could enter the abdomen and cause damage to the liver or colon. Needling too deeply at a higher level could conceivably enter the gallbladder. On the other hand, cross sections such as this expose several opportunities to introduce laser therapy for organ benefit. Consider, too, the value of carefully applied manipulative therapy for visceral relief from restrictive adhesions and sluggish function.

GB 25

Jing Men "Capital Gate"

Near the mid-axillary line, ventral and caudal to the tip of the 12th (last) rib.

Muscles

- **External oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Internal oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Transverse abdominal muscle:** Compresses and supports the abdominal viscera. Since this is the deepest layer of the muscles of the abdominal wall, needling through this muscle may damage internal organs.

Clinical Relevance: Referred pain from trigger points in the abdominal oblique and transversus muscles can lead to visceral symptoms such as "heartburn" and epigastric distress.

Or, referred pain may course in various directions across the abdomen. It may travel toward the ipsilateral or contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia, leading to a variety of diagnostic enigmas and confusion.

Some evidence exists that the transversus abdominis and pelvic floor muscles contract together. Activating the transversus abdominis may increase urethral pressure and aid women with urinary incontinence that have difficulty exercising the pelvic floor muscles.[6] Stimulation of local afferents with acupuncture and related techniques may aid in recovery of continence. Points to consider include GB 25, BL 23, sacral nerve points (BL 31-34) and tibial nerve sites (SP 6, KI 3).

Nerves

- **Thoracoabdominal nerves (T7-T11):** Innervate the external and internal oblique muscles and the transverses abdominal.
- **Subcostal nerve (T12):** Innervates the external oblique muscle.
- **Iliohypogastric nerve (L1):** Supplies the skin over the iliac crest and in the hypogastric region. Supplies the internal oblique and transverse abdominal muscles.
- **Ilioinguinal nerve (L1):** Supplies the skin of the scrotum or labia majora, mons pubis, and that region of the medial thigh that is immediately adjacent. Penile nerves enter the Ilioinguinal nerves as well as the perineal, the dorsal penile, and pudendal nerves, terminating in the cord from T12 to S4.[2] Also innervates the internal oblique and transverse abdominal muscles. See also the iliohypogastric nerve.
- **11th intercostal nerve:** Innervates the skin and subcutaneous tissue.

Clinical Relevance: Patients with chronic low back pain exhibit a variety of neurophysiologic changes that includes autonomic nervous system imbalances. Neuromodulation by means of acupuncture and related techniques improves autonomic status as well as relieves the pain of myofascial dysfunction, thereby aiding back pain patients in a multi-mechanism fashion. GB and BL points aid in achieving this goal.[7]

Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[8] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[9] The nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction cause compression at vulnerable turning points. Abdominal scars can further nerve compression/entrapment. Acupuncture may benefit these patients by releasing tension in the tissues, thereby freeing the nerves. Note the anatomy of the body wall musculature at GB 25 in Figure 11-70. Nerves coursing from the spinal cord to the ventral midline make their way through several fascial layers that could potentially place excess pressure upon them.

When abdominal surgery injures nerves traveling through one or more of these planes, paresis of the rectus abdominis muscle may result, followed by bulging of the abdominal wall.[10] Paresis of the abdominal wall can cause large swelling and digestive or mechanical complaints.

About 10% of patients experience chronic inguinal pain following hernia repair; this pain ordinarily begins right after surgery.[1] While most post-hernia inguinal discomfort results from nociceptive pain arising from somatic or visceral sources, the second most frequent pain originates from surgical injury to the Ilioinguinal, iliohypogastric, or genitofemoral nerve. Acupuncture and related techniques may provide relief through

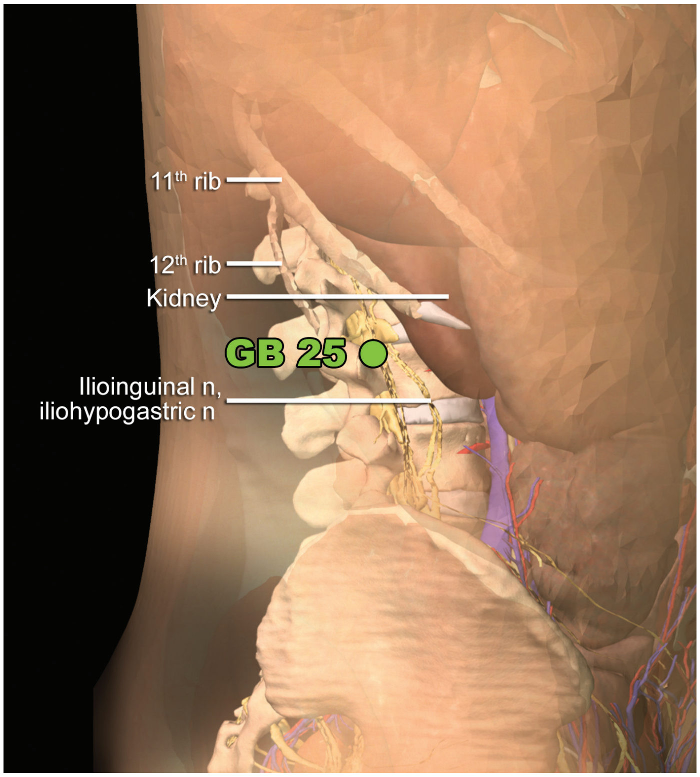


Figure 11-68. GB 25, "Capital Gate", refers to the position of GB 25 in relation to the kidney, considered one of the most important organs in Chinese medicine. This "door to the capital" (i.e., the kidney) sits on the abdominal wall as the Front Mu, or Alarm point for the organ. Front Mu points, like their Back Shu partners, occur on the thorax, abdomen, and pelvis. Ancient Chinese acupuncturists employed them to determine which organs may be impaired; they provide treatment sites as well. Neuroanatomic connections connect input from the body wall to the viscera.

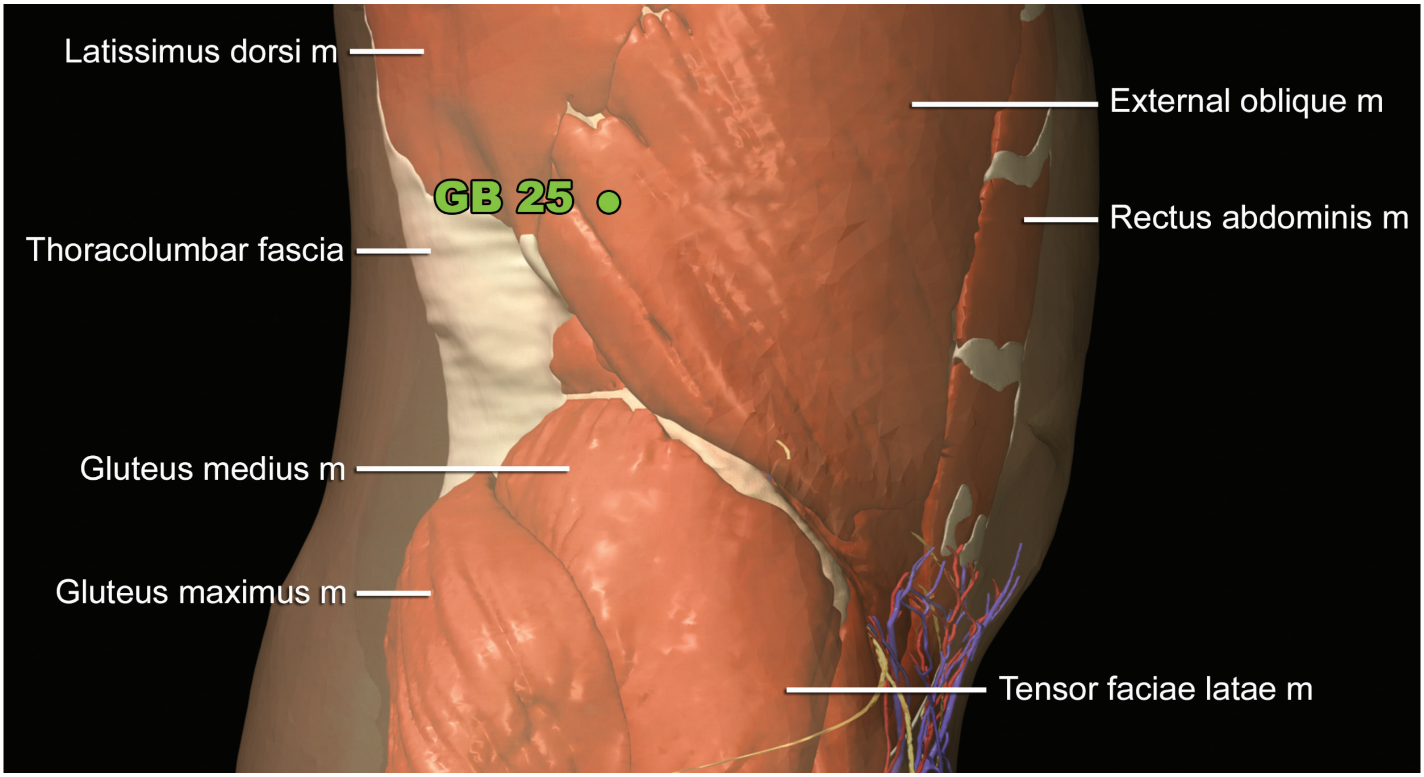


Figure 11-69. GB 25 may overlap with a myofascial trigger points in the external oblique and/or the latissimus dorsi muscle. Myofascial dysfunction in this region, when beset by trigger point pathology, may initiate somatovisceral responses that include spontaneous belching or in some cases projectile vomiting.[14] The muscles in this region, i.e., the latissimus dorsi and the external oblique together form an "unbroken sheet of muscle" as shown in this muscle layer and in the cross section of Figure 11-70.

neuromodulation and relaxation of compressive soft tissues.

Coupled with BL 23 and BL 52, GB 25 provides a dorsal and lateral input around the trunk to influence those spinal segments feeding the kidney. Its influence on genitourinary conditions springs from the proximity of GB 25 to intercostal, subcostal, ilioinguinal, and iliohypogastric nerves via spinal segmental overlap. This justifies the inclusion of GB 25 and neighboring points for the treatment of renal colic, as well as for postoperative pain following kidney surgery, and chronic pelvic pain.[11]

Expanding neuromodulation of the ilioinguinal and iliohypogastric nerves to include the genitofemoral, hypogastric, sacral, and tibial nerves as well as trigger points provides a comprehensive neuroanatomic intervention for both pelvic pain and coccygodynia.

Front Mu points such as GB 25 (along with Back Shu points such as BL 23) links the soma to the viscera by means of reflexes. These have been described to include viscerocutaneous and cutaneovisceral reflexes, though a myofascial contribution most certainly participates as well. Afferent information from the body wall (soma) converges with that from internal organs (viscera) in the dorsal horn of the spinal cord. From here, some neural signals ascend to the brain while others reflex to the viscera or soma, respectively, thereby adjoining neural activity from the body wall to that of internal structures.

GB 25 activates afferents along the T12 dermatome.[12] The kidney receives its sympathetic innervation from the T10 to L2 spinal cord segments. BL 23, the Back Shu point for the kidney, is situated along the L2 dermatome.[13] Chronic nociceptive bombardment of spinal cord segments by dint of afferent input from a dysfunctional organ such as the kidney may provoke myofascial dysfunction and cutaneous hypersensitivity at GB 25 and BL 23. Interneurons within the spinal cord mediate neuronal crosstalk from the visceral to the somatic neural pathways. Thus, tenderness to palpation discovered at the Front Mu and Back Shu points indicates associated organ disruption, soft tissue pathology, or both.

Vessels

- **Subcostal artery:** Derived from the internal thoracic arteries, the subcostal artery supplies the muscles of the anterolateral abdominal wall.
- **Subcostal vein:** Empties into the azygous venous system that drains into the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Kidney problems:** renal colic, postoperative pain relief in kidney recipients,[3] other kidney related pain: GB 25, BL 23, BL 52, GV 4, KI 3, KI 7.
- **Constipation:** GB 25, ST 25, SP 14, ST 36.
- **Lumbar and lateral costal pain:** GB 25, GB 22, and GB 23 (affecting trigger points in the latissimus dorsi muscle).

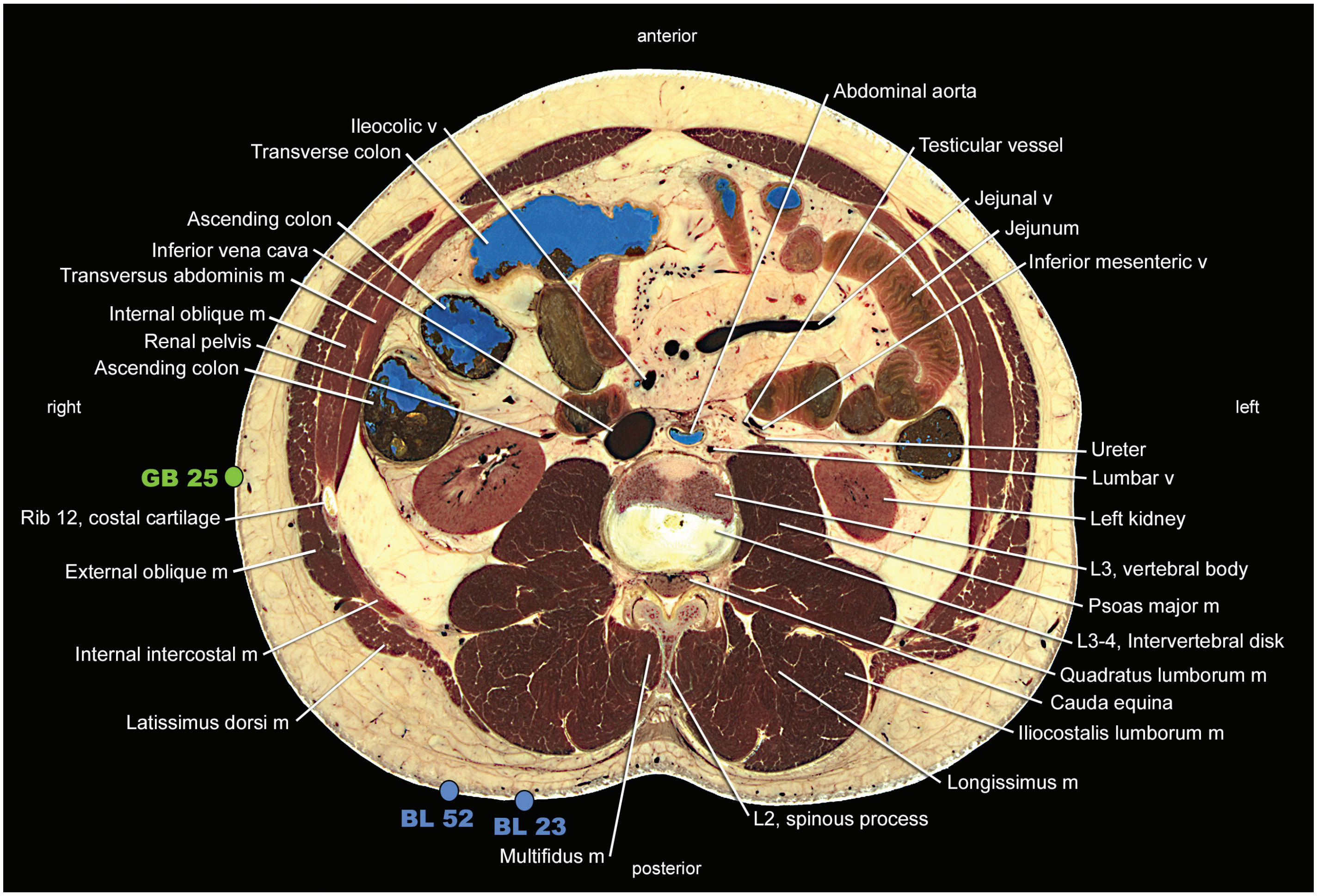

anterior
Abdominal aorta
Ileocolic v
Transverse colon
Testicular vessel
Jejunal v
Jejunum
Ascending colon
Inferior vena cava
Inferior mesenteric v
Transversus abdominis m
Internal oblique m
Renal pelvis
Ascending colon
right
left
Ureter
GB 25
Lumbar v
Rib 12, costal cartilage
Left kidney
L3, vertebral body
External oblique m
Psoas major m
L3-4, Intervertebral disk
Internal intercostal m
Quadratus lumborum m
Cauda equina
Latissimus dorsi m
Iliocostalis lumborum m
Longissimus m
BL 52
BL 23
L2, spinous process
Multifidus m
posterior

Figure 11-70. This cross section depicts the structures influenced by GB 25 needling. Direct effects include deactivation of trigger points in the external oblique or latissimus dorsi muscles. Spinal segmental influences impact the kidneys as well as intestinal function, inseparable due to overlapping spinal segmental nerve supply. Note the presence of intestines at this level, alongside the kidneys.

- **Ilioinguinal and/or iliohypogastric neuropathy after herniorraphy:**[4] GB 25, GB 26, ST 30, LR 12, SP 12, CV 2.
- **Ilioinguinal and/or iliohypogastric neuropathy after a low transverse Pfannenstiel incision:**[5] GB 25, GB 26, GB 27, local scar points (otherwise known as "surround the dragon".
- **Erectile dysfunction:** GB 25, GB 26, BL 32, CV 2, SP 6, LR 5.

References

1. Vuilleumier H, Hubner M, and Demartines N. Neuropathy after herniorraphy: indication for surgical treatment and outcome. *World J Surg*. 2009;33:841-845.

2. Lierse W. Blood vessels and nerves of the human penis. *Urol Int*. 1982;37(3):145-151.

3. Shoeibi G, Babakhani B, and Mohammadi SS. The efficacy of ilioinguinal-iliohypogastric and intercostal nerve co-blockade for postoperative pain relief in kidney recipients. *Anesth Analg*. 2009;108:330-333.

4. Vuilleumier H, Hubner M, and Demartines N. Neuropathy after herniorraphy: indication for surgical treatment and outcome. *World J Surg*. 2009;33:841-845.

5. Loos MJA, Scheltinga MRM, and Roumen RMH. Sugical management of inguinal neuralgia after a low transverse Pfannenstiel incision. *Ann Surg*. 2008;248:880-885.

6. Bo K, Morkved S, Frawley H, et al. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: a systematic review. *Neurourology and Urodynamics*. 2009;28:368-373.

7. Shankar N, Thakur M, Tandon OP, et al. Autonomic status and pain profile in patients of chronic low back pain and following electro acupuncture therapy: a randomized control trial. *Indian J Physiol Pharmacol*. 2011;55(1):25-36.

8. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.

9. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

10. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

11. Kothari S. Neuromodulatory approaches to chronic pelvic pain and coccygodynia. *Acta Neurochir Suppl*. 2007;97(1):365-371.

12. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy*. 2009;8:32-35.

13. Cabioglu MT and Arslan G. Neurophysiologic basis of Back-Shu and Huatuo-jiaji points. *Am J Chin Med*. 2008;36(3):473-479.

14. Simons DG, Travell JG, and Simons LS. *Myofascial Pain and Dysfunction, the Trigger Point Manual, Volume 1. Upper Half of Body,* 2nd edition. Baltimore: Williams & Wilkins. 1999, pp. 941-942, 946.

GB 26

Dai Mai "Belt Vessel", "Girdling Vessel"

On the mid-axillary line, cranial to the iliac crest, level with the umbilicus. Directly distal and caudal to the free end of the 11th rib and LR 13. The free end of the 11th rib typically lands at or near the mid-axillary line.

Muscles

- **External oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Internal oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Transverse abdominal muscle:** Compresses and supports the abdominal viscera. Since this is the deepest layer of the muscles of the abdominal wall, needling through this muscle may damage internal organs.

Clinical Relevance: Trigger point pathology in the lateral abdominal wall musculature at or near GB 26 and GB 27 may cause pain that focuses strongly in the ipsilateral groin and testis, up and over the abdomen toward the ipsilateral and even the contralateral subcostal margin, umbilicus, and lower abdomen, producing diagnostic enigmas and confusion.

Myofascial dysfunction in this zone can also upset neural regulation of the intestines through somatovisceral disturbances, producing diarrhea or colonic cramping.

Nerves

- **Thoracoabdominal nerves (T7-T11):** Innervate the external and internal oblique muscles and the transverses abdominal.
- **Iliohypogastric nerve (L1):** Supplies the skin over the iliac crest and in the hypogastric region. Supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve begins at L1, though it may receive some fibers from T12.
- **Ilioinguinal nerve (L1):** Supplies the skin of the scrotum or labia majora, mons pubis, and that region of the medial thigh that is immediately adjacent. Also innervates the internal oblique and transverse abdominal muscles. See also the iliohypogastric nerve.
- **Subcostal (12th intercostal) nerve:** This large ventral ramus of the T12 nerve runs along the inferior border of the 12th rib and supplies the lowest slip of the external oblique muscle as well as the skin over the anterior superior iliac spine (ASIS) and hip. It sends a branch to the pyrimidalis muscle.

Clinical Relevance: The iliohypogastric nerve, along with the Ilioinguinal, lateral femoral cutaneous, and femoral nerves all emerge from the lateral border of the psoas major muscle; the obturator nerves proceeds from the medial border, and the genitofemoral nerve actually passes through the center of the belly of the psoas. Occasionally, the iliohypogastric and Ilioinguinal nerves will accompany the genitofemoral nerve through the belly of the muscle. As such, all three nerves are vulnerable to entrapment by the psoas. Taut bands in this muscle could lead to pain and paresthesias felt in the regions of their influence. See Figures 11-73B and 11-73C.

For all of the intercostal nerves along with this subcostal finale, fibers from the ipsilateral sympathetic trunk join the ventral ramus of each spinal nerve and proceed along the intercostal space,

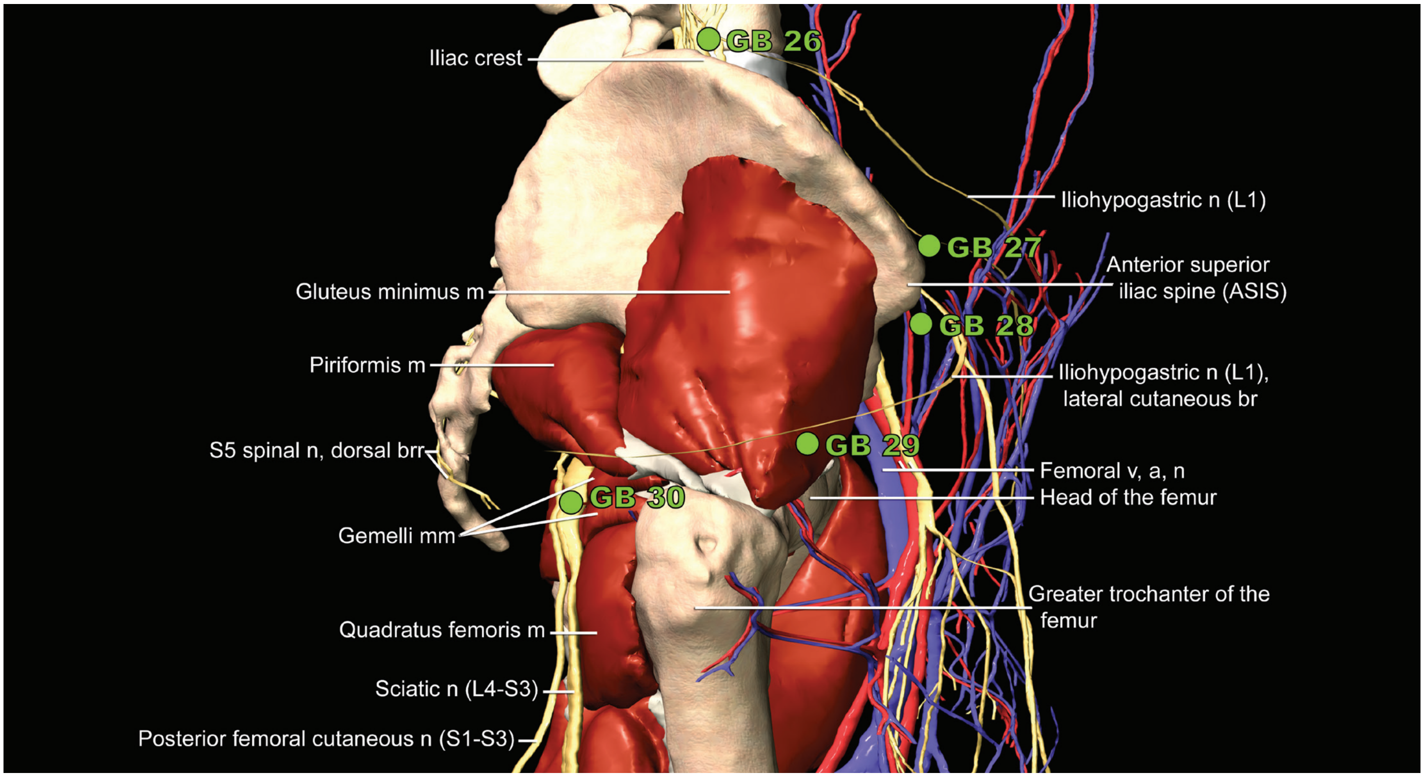


Figure 11-71. GB 26, named "Dai Mai", describes its intersection between the GB channel and the Dai Mai, or "Belt Meridian", or "Girdling Vessel". The anatomic basis for this singular vessel or "extra" channel is the iliohypogastric nerve and the subchondral neurovascular elements.

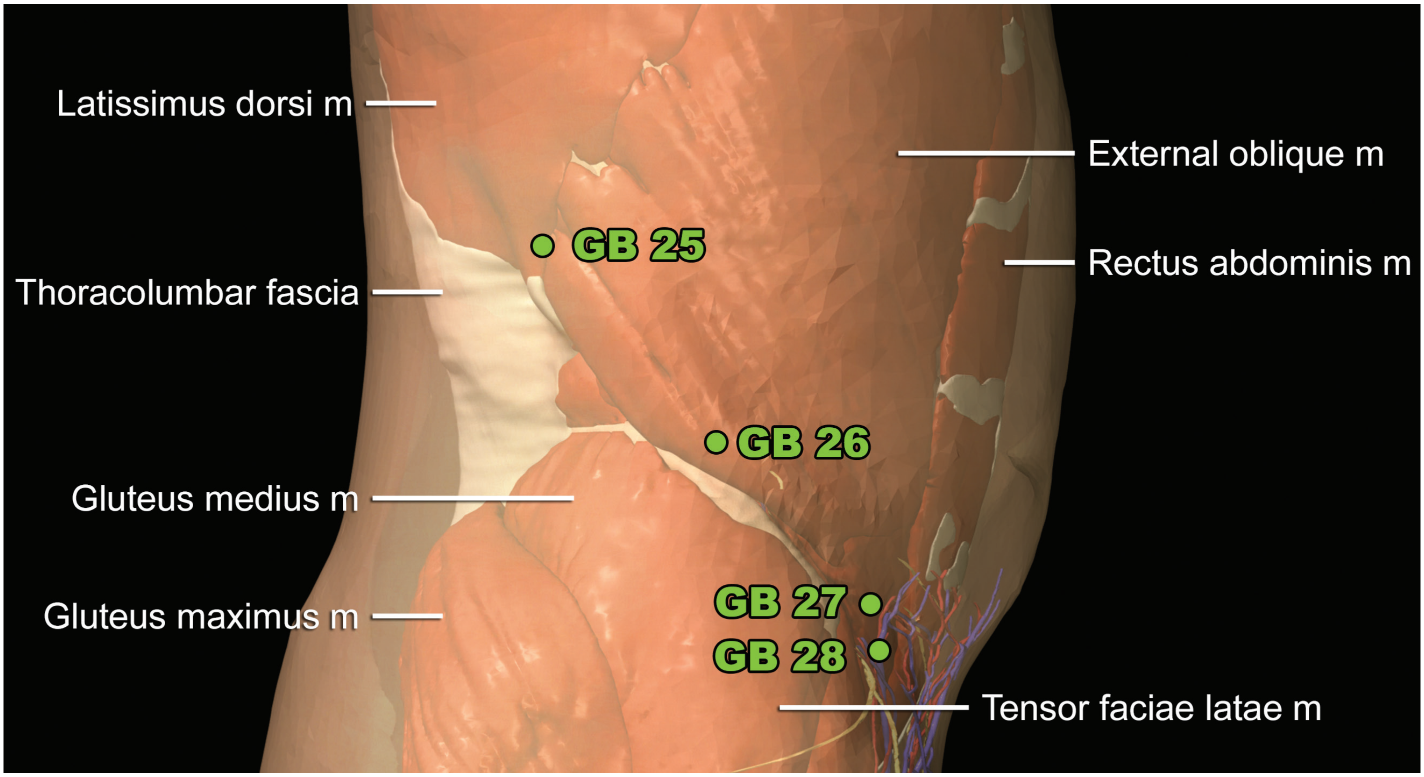

Latissimus dorsi m
External oblique m
GB 25
Rectus abdominis m
Thoracolumbar fascia
GB 26
Gluteus medius m
GB 27
Gluteus maximus m
GB 28
Tensor faciae latae m

Figure 11-72. Myofascial trigger points in the lateral abdominal wall muscles (the internal and external obliques and the transversus abdominis) can lead to diarrhea, urinary irritability, pelvic pain, or groin pain. In addition to the inguinal and genital pain from these trigger points, extensions of the referred pain pattern reach upward across the abdomen to the ipsilateral and contralateral ribs, the umbilicus, and the contralateral lower abdomen. Tension in the abdominal wall musculature may entrap the ventral branches of spinal nerves; specifically, entrapment here would likely involve the ilioinguinal or iliohypogastric nerve.

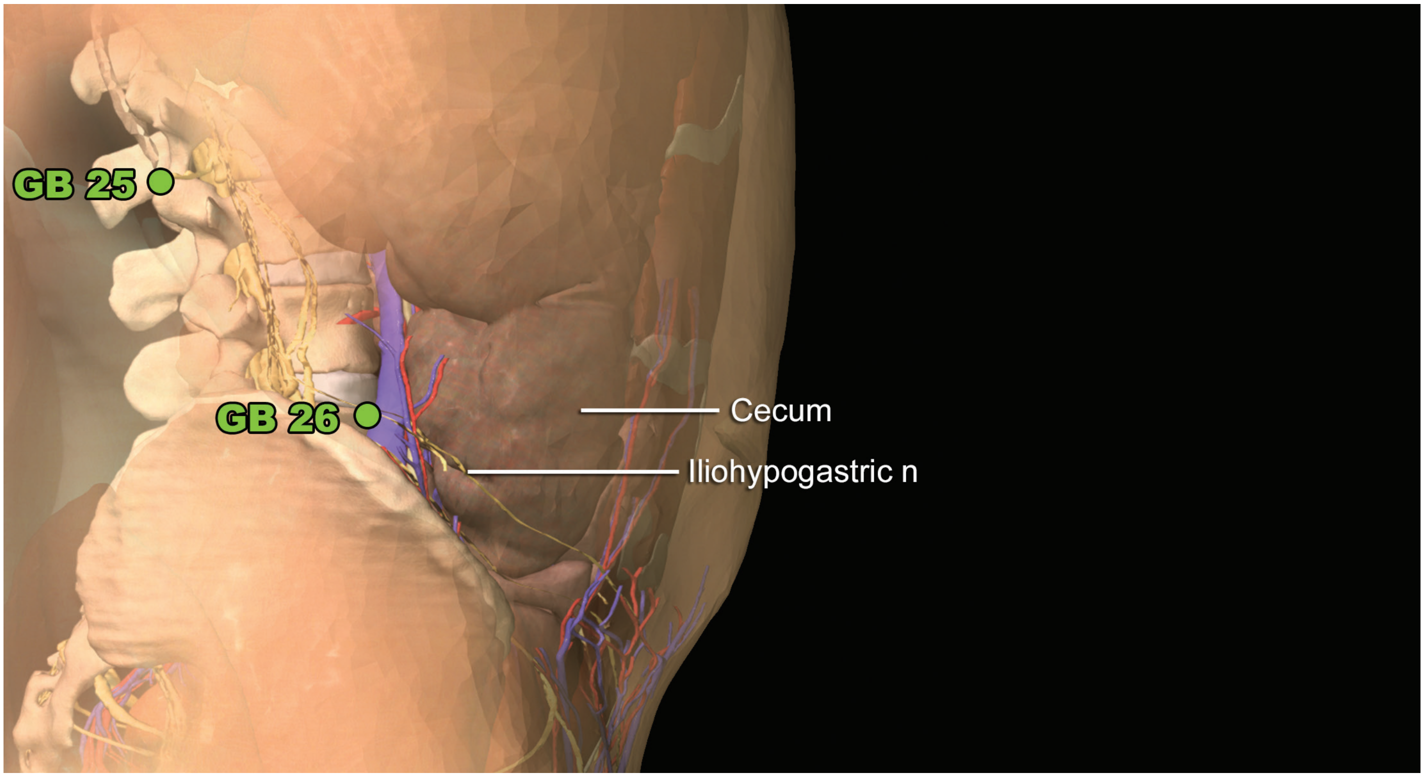

GB 25
GB 26
Cecum
Iliohypogastric n

Figure 11-73A. The course of the trajectory of the GB channel follows the Iliohypogastric nerve from its origin at the thoracolumbar junction to the iliac crest. The GB line will continue this pattern as it heads toward the anterior superior iliac spine (ASIS) where at that point it associates with the lateral cutaneous branch of the iliohypogastric nerve.

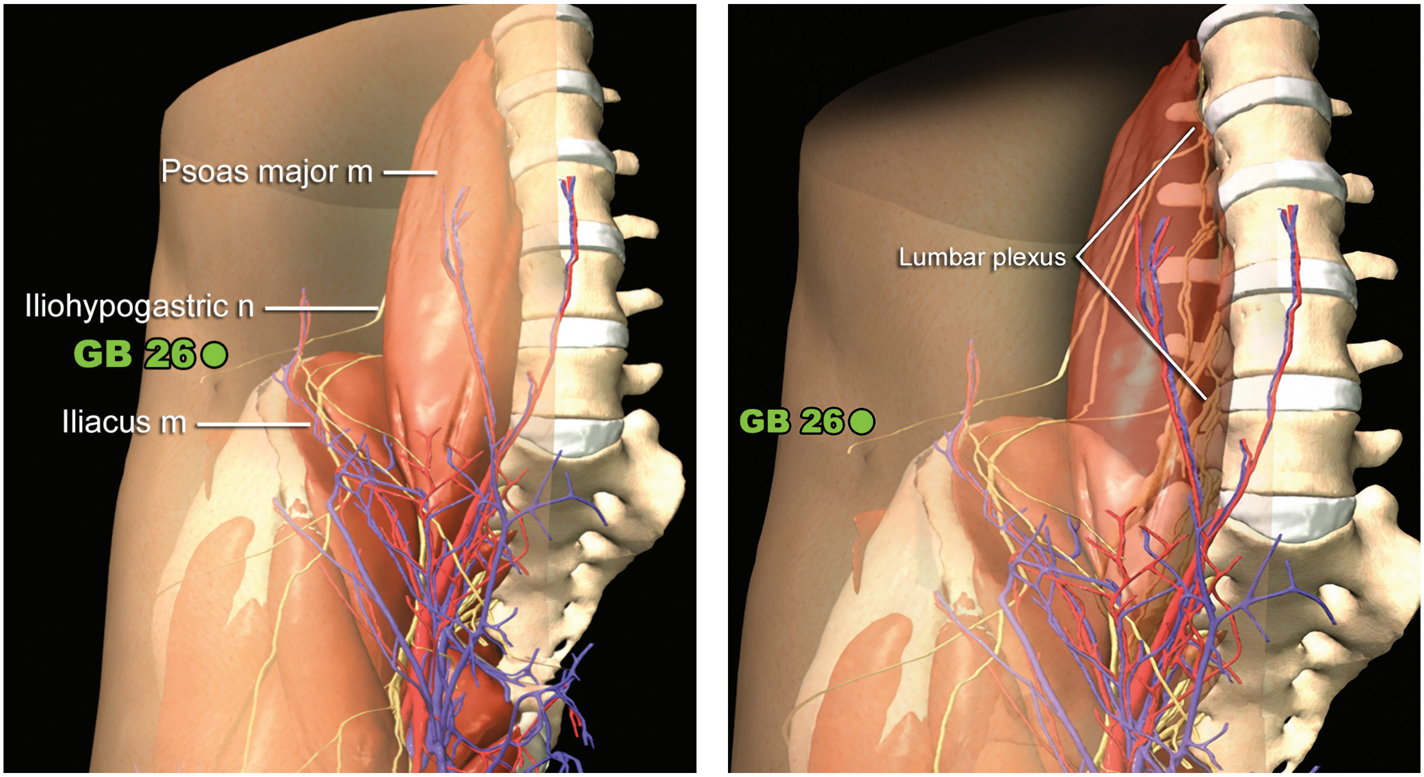


Figure 11-73B and C. The lumbar plexus, seen in 11-73C, arises from the L1 through L4 spinal nerves, with communicating branches from T12. The lumbar plexus may either reside within the posterior abdominal wall or wander through fascicles of the psoas major muscle ventral to the transverse processes of the lumbar vertebrae. The lumbar plexus gives off seven nerves, the iliohypogastric ((T12), L1), Ilioinguinal (L1), genitofemoral (L1, L2), lateral femoral cutaneous (L2, L3), obturator (L2, L3, L4), accessory obturator (L3, L4), and femoral (L2, L3, L4).

carried by the intercostal nerves, to supply blood vessels, sweat glands, and smooth muscle. The subcostal nerve communicates with the iliohypogastric nerve; together they form the neural substrate for the Dai Mai vessel, one of the eight singular vessels or "curious meridians". The subcostal nerve differs from its thoracoabdominal intercostal nerve counterparts (T7-T11 spinal nerve derivations) in terms of its larger size and the fact that its lateral cutaneous branch does not divide into anterior and posterior branches as do its compatriots. Instead, this branch, skims across the iliac crest accompanying the iliohypogastric nerve as it distributes offshoots to the skin of the groin and hip.

When it reaches the pelvis, the GB channel follows the iliac crest. It partners with the iliohypogastric nerve to the anterior superior iliac spine (ASIS) where it changes direction to backtrack to the buttocks. The Dai Mai channel, from which this point derives its name, constitutes one of the eight singular distribution vessels, otherwise defined as the "extraordinary channels" or "curious meridians". In addition to Dai Mai, the eight singular vessels include Du Mai (Governing Vessel), Ren Mai (Conception Vessel), Chong Mai (Thoroughfare Vessel), Yang Wei Mai (Yang Linking Vessel), Yin Wei Mai (Yin Linking Vessel), Yang Qiao Mai (Yang Heel Vessel) and Yin Qiao Mai (Yin Heel Vessel). Although many mistakenly view these vessels as having metaphorical, mysterious energy-based origins and difficult-to-identify trajectories, the eight singular vessels actually embody tangible neurovascular passageways. They differ from the twelve main, or principal, channels in that they have unique, or singular, aspects. Sometimes these vessels exist as a sole structure (e.g., the aorta, vena cava, or venous sinus network) which qualifies them as a "singular" vessel. Or, if they exist in a bilateral pair, their nature differs from others like them, as in the case of the subchondral vessels and nerves being set apart anatomically and functionally from their intercostal neighbors. That is, The subcostal nerve is "singular" or unique, in that it does not live between the ribs as its intercostal partners do; it is also larger and often communicates with the L1 nerve.

The term "Belt Vessel" or "Girdling Vessel" connotes a belt or sash draped loosely around the waist and hips. Figure 11-71 shows the iliohypogastric nerve and how it defines this portion of the GB channel and relates to the Dai Mai vessel. The region supplied by the T12-L1 nerves extends to the inguinal, genital, and buttock region, overlapping tightly with sphere of influence attributed to the Dai Mai vessel.[3]

In the 1940s and 1950s, Penn-Gaskell Skillern published papers on the treatment of a spectrum of autonomic and visceral dysfunctions by means of neuromodulating cutaneosympathetic and cutaneovisceral reflexes by stimulating points in the skin or blocking nerves with local anesthetic. Although his terminology differed, the sites he stimulated coincide with acupuncture points. Treatments performed at GB 26 alleviated the following conditions: "lumbar plexus neuralgia; spasm of appendix and colon with constipation; tympanites (with subsequent belching or passage of flatus); spasm of internal vesical sphincter and prostatism; spasm of internal rectal sphincter; dysmenorrhea and vasospastic menopausal disturbances; nervous fatigue."[4]

Skillern's description of the etiopathogenesis of these disturbances proceeds as follows: "Obscuring of the parasympathetic by stimulation of the sympathetic system so alters the physiology as to give rise to pathologic symptoms and signs from whatever part of the autonomic nervous system that may be involved…

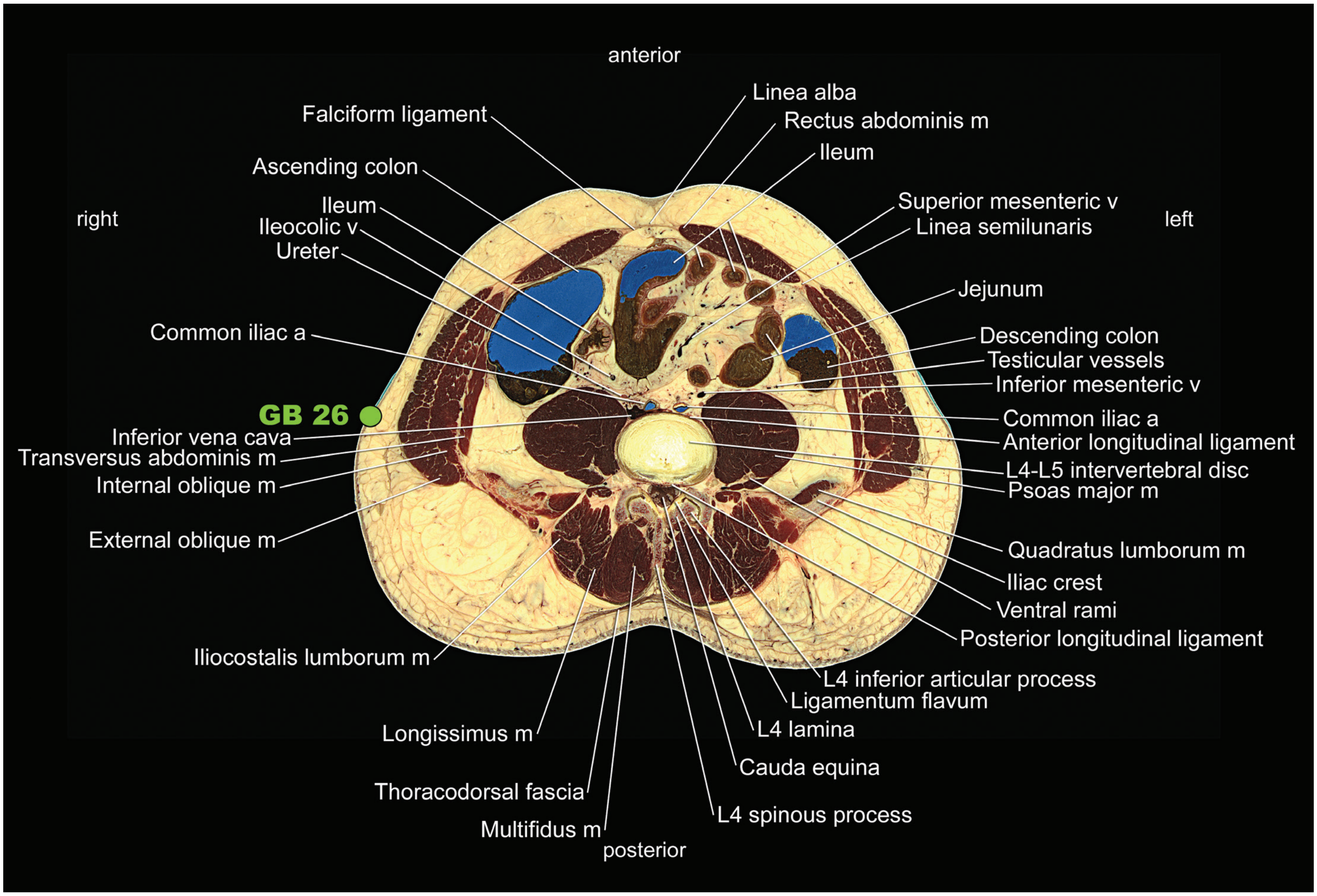

anterior
Falciform ligament
Linea alba
Rectus abdominis m
Ileum
Ascending colon
Superior mesenteric v
right
Ileum
Ileocolic v
Linea semilunaris
left
Ureter
Jejunum
Common iliac a
Descending colon
Testicular vessels
Inferior mesenteric v
GB 26
Common iliac a
Inferior vena cava
Anterior longitudinal ligament
Transversus abdominis m
L4-L5 intervertebral disc
Internal oblique m
Psoas major m
External oblique m
Quadratus lumborum m
Iliac crest
Ventral rami
Posterior longitudinal ligament
Iliocostalis lumborum m
L4 inferior articular process
Ligamentum flavum
L4 lamina
Longissimus m
Cauda equina
Thoracodorsal fascia
L4 spinous process
Multifidus m
posterior

Figure 11-74. The three-ply construction of the abdominal wall appears clearly in this cross section, deep and adjacent to GB 26.

It seems as though, once inaugurated, proprioceptive muscular stimuli are liable to set up a vicious circle in maintaining episodes of pain in these various neuralgias until the somatic afferent limb of the reflex arc is blocked or the muscle infiltrated with procaine directly. At the same time nociceptive bombardment of the sensorium via the spinothalamic tract is held in check.…The goal is to shrink the perimeter of these "echo" pains, etc., from intersegmental to segmental to the central focus point, leaving stranded either pain alone or a definite pathologic lesion (e.g., antral polyp) which is causing the pain."

Vessels

- **Subcostal artery:** Derived from the internal thoracic arteries, the subcostal artery supplies the muscles of the anterolateral abdominal wall.
- **Subcostal vein:** Empties into the azygous venous system that drains into the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and the mediastinal, esophageal, and bronchial veins.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Pain that radiates in a belt-like pattern from the lumbar region to the front of the body:** GB 26, CV 2, BL 25.
- **Gynecologic and menstrual disorders:** GB 26, SP 6, SP 10, BL 23, LI 4.
- **Low lumbar or abdominal pain:** GB 26, GB 25, BL 23, BL 26, palpate for trigger point involvement and treat accordingly.
- **Sense of heaviness deep in pelvis with cold buttocks:** GB 26, GB 28, LR 13, CV 4, GB 41, TH 5.
- **Pain or nerve injury after autologous bone harvesting:**[1] GB 26, GB 27, GB 29, BL 21-BL 23. For neuropathic pain after bone harvesting from the iliac crest, consider the possible mechanism(s) of pain (i.e., entrapment neuropathy by suture ligature strangulation or injury from intraoperative electrocautery, dissection, stretch, laceration, crush, or secondary trauma from high-speed bone saws). If neuropathic pain seems likely, the injury could involve one or more nerves because several lie in close proximity to the site of iliac crest harvesting. Potentially affected nerves include: the lateral cutaneous branch of the subcostal nerve, the lateral cutaneous branch of the iliohypogastric nerve, the lateral femoral cutaneous nerve, and the cluneal nerves.

Evidence-Based Applications

- Acupuncture at GB 26, ST 36, SP 6, and bilateral auricular Shen-Men with 40 minutes of electrostimulation added produced an **analgesic effect** equivalent to 30 mg pentazocine, as well as a net **increase of vital capacity** that pentazocine did not provide.[2]

References

1. Chou D, Storm PB, and Campbell JN. Vulnerability of the subcostal nerve to injury during bone graft harvesting from the iliac crest. J Neurosurg Spine 1) 2004;1:87-89.
2. Facco E, Manani G, Angel A, et al. Comparison study between acupuncture and pentazocine analgesic and respiratory post-operative effects. Am J Chin Med. 19919(3):225-235.
3. Robinson N. The anatomical basis of the eight extraordinary vessels: How to translate the Qi Jing Ba Mai. *American Journal of Traditional Chinese Veterinary Medicine.* 2009;4(2):7-13
4. Skillern P-G. Clinical observations on: (I) cutaneovisceral (somato-sympathetic) reflex arcs; (II) the role of hypermyotonia in bodily aches and pains.*The Journal of Nervous and Mental Disease.* 1947;105(5):449-464.

GB 27

Wu Shu “Fifth Pivot”

On the abdomen, just medial to the anterior superior iliac spine, in a depression approximately 3 cun caudal to the umbilicus.

Muscles

- **External oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Internal oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Transverse abdominal muscle:** Compresses and supports the abdominal viscera. Since this is the deepest layer of the muscles of the abdominal wall, needling through this muscle may damage internal organs.
- **Iliacus muscle:** Lies lateral to the inferior part of the psoas major muscle; it then joins with the psoas to become the iliopsoas muscle, the main flexor of the thigh. It also assists the standing individual maintain an erect posture.

Clinical Relevance: Trigger point pathology in the lateral abdominal wall musculature at or near GB 26 and GB 27 may cause pain that focuses strongly in the ipsilateral groin and testis, up and over the abdomen toward the ipsilateral and even the contralateral subcostal margin, umbilicus, and lower abdomen, producing diagnostic enigmas and confusion.

Myofascial dysfunction in this zone can also upset neural regulation of the intestines through somatovisceral disturbances, producing diarrhea or colonic cramping.

Myofascial pathology in the iliacus muscle (at GB 27 and GB 28) refers pain to the proximal cranial thigh and ipsilateral paraspinal lumbar region and buttock. Note the depth at which the iliacus sits in the pelvis as seen in cross section, Figure 11-77. Safe treatment argues for non-needling techniques for iliacus trigger points.

Nerves

- **Thoracoabdominal nerves (T7-T11):** Innervate the external and internal oblique muscles and the transverses abdominal.
- **Iliohypogastric nerve (L1):** Supplies the skin over the iliac crest and in the hypogastric region. Supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve begins at L1, though it may receive some fibers from T12.
- **Ilioinguinal nerve (L1):** This mixed nerve supplies the skin of the scrotum or labia majora, mons pubis, and that region of the medial thigh that is immediately adjacent. Also innervates the internal oblique and transverse abdominal muscles. See also the iliohypogastric nerve.
- **Subcostal (12th intercostal) nerve:** This large ventral ramus of the T12 nerve runs along the inferior border of the 12th rib and supplies the lowest slip of the external oblique muscle as well as the skin over the anterior superior iliac spine (ASIS) and hip. It sends a branch to the pyrimidalis muscle.
- **Spinal nerves (L2, L3):** Supply the iliacus muscle.

Clinical Relevance: The iliohypogastric nerve, along with the Ilioinguinal, lateral femoral cutaneous, and femoral nerves all emerge from the lateral border of the psoas major muscle; the obturator nerves proceeds from the medial border, and the genitofemoral nerve actually passes through the center of the belly of the psoas. Occasionally, the iliohypogastric and Ilioinguinal nerves will accompany the genitofemoral nerve through the belly of the muscle. As such, all three nerves are vulnerable to entrapment by the psoas. Taut bands in this muscle could lead to pain and paresthesias felt in the regions of their influence. Review Figures 11-73B and 11-73C.

At the pelvis, the GB channel follows the iliac crest. It follows the iliohypogastric nerve to the anterior superior iliac spine (ASIS) where it changes direction to backtrack to the buttocks. GB 27 and GB 28 land along this ventral arc.

For the subcostal nerve as well as the eleven intercostals, nerve fibers from the ipsilateral sympathetic trunk join the ventral ramus of each spinal nerve. These autonomic fibers supply blood vessels, sweat glands, and smooth muscle. The subcostal nerve communicates with the iliohypogastric nerve; together they form the neural substrate for the Dai Mai vessel, more fully described in the previous point section for GB 26. The subcostal nerve differs from its thoracoabdominal intercostal nerve partners (from T7-T11) in terms of its larger size and the fact that its lateral cutaneous branch does not divide into anterior and

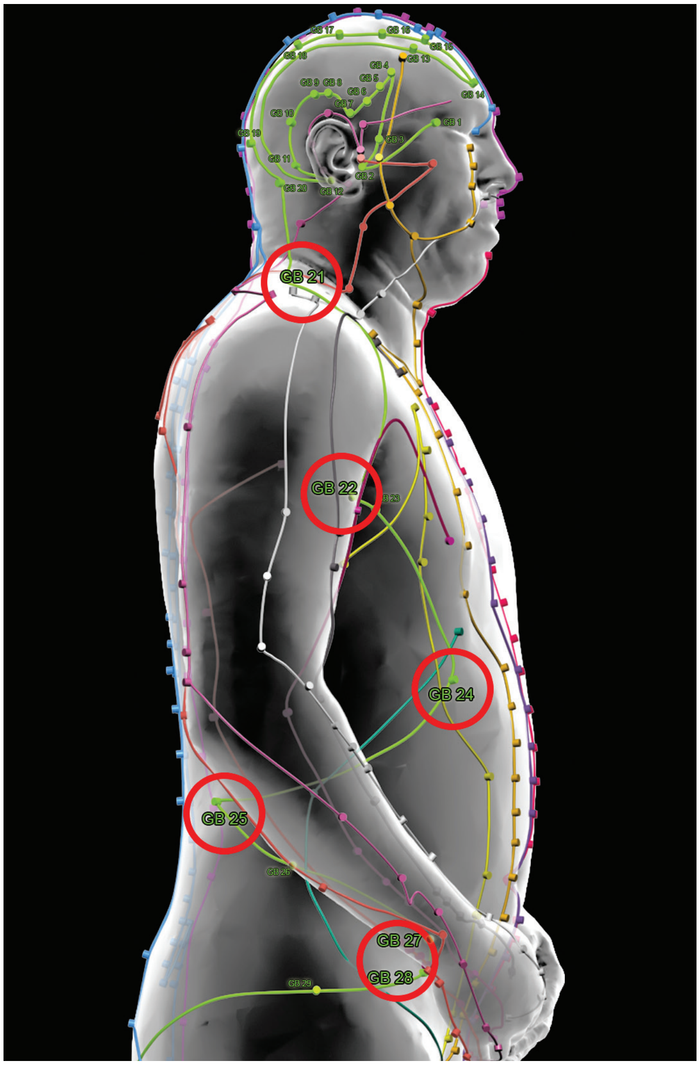


Figure 11-75. The nature of the GB line is to switch direction. From shoulder to hip, it does so five times. As the “Fifth Pivot”, GB 27 signals the final trajectory change before the channel embarks onto the pelvic limb.

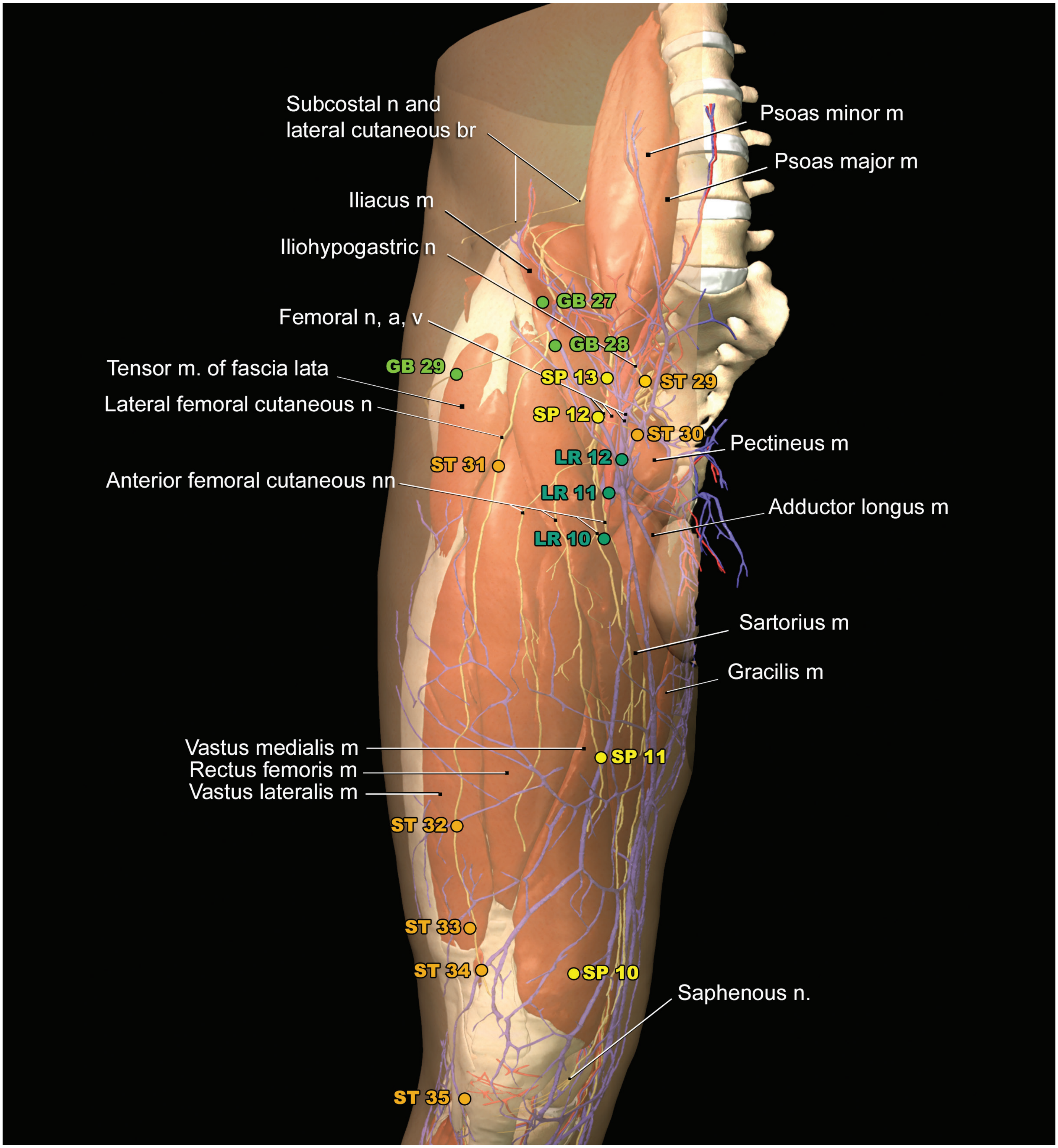

Subcostal n and lateral cutaneous br
Psoas minor m
Psoas major m
Iliacus m
Iliohypogastric n
GB 27
Femoral n, a, v
GB 28
Tensor m. of fascia lata
GB 29
SP 13
ST 29
Lateral femoral cutaneous n
SP 12
ST 30
Pectineus m
LR 12
ST 31
Anterior femoral cutaneous nn
LR 11
Adductor longus m
LR 10
Sartorius m
Gracilis m
Vastus medialis m
SP 11
Rectus femoris m
Vastus lateralis m
ST 32
ST 33
ST 34
SP 10
Saphenous n.
ST 35

Figure 11-76. The GB, SP, ST, and LR lines converge in the groin. The points GB 27 to LR 10 outline the referred pain pattern from iliopsoas trigger points. Note how their layout follows neurovascular networks.

posterior branches as do its compatriots. Instead, this branch, larger in size than the lateral cutaneous branches of the other lower intercostal nerves, instead passes over the iliac crest alongside the iliohypogastric nerve to distribute to the skin of the groin and hip.

The iliohypogastric nerve, one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen or inguinal canal. Surgeries with such incisions may include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of GB 27

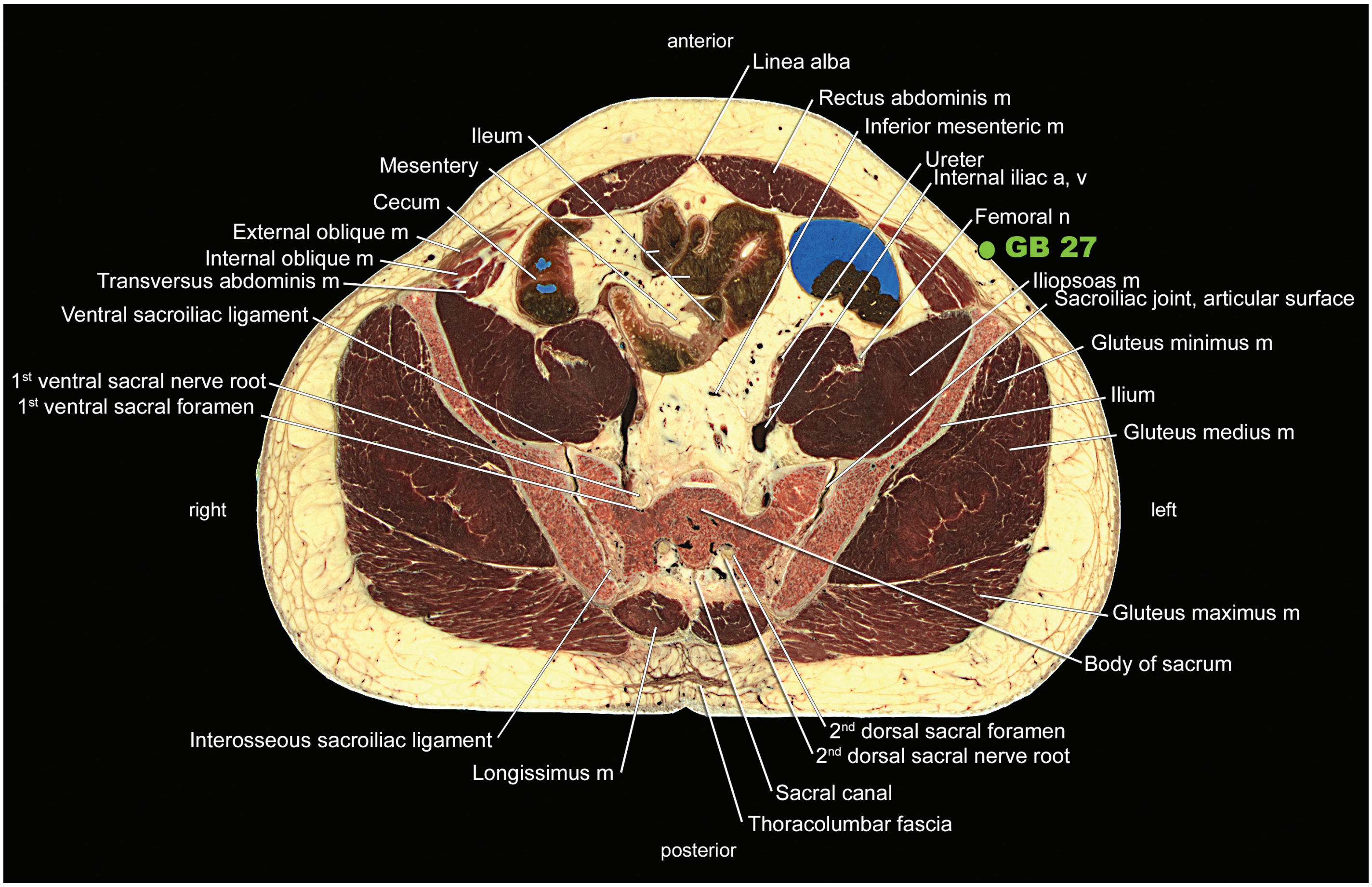

anterior
Linea alba
Rectus abdominis m
Ileum
Inferior mesenteric m
Mesentery
Ureter
Internal iliac a, v
Cecum
Femoral n
External oblique m
GB 27
Internal oblique m
Iliopsoas m
Transversus abdominis m
Sacroiliac joint, articular surface
Ventral sacroiliac ligament
Gluteus minimus m
1st ventral sacral nerve root
1st ventral sacral foramen
Ilium
Gluteus medius m
right
left
Gluteus maximus m
Body of sacrum
Interosseous sacroiliac ligament
2nd dorsal sacral foramen
2nd dorsal sacral nerve root
Longissimus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 11-77. In addition to the effects of GB 27 on the iliohypogastric nerve, GB 27 addresses attachment trigger points on the abdominal wall. Myofascial pathology in this multilayer structure may refer pain to the groin, bladder, or pelvis as a whole. It may also invoke autonomic dysregulation in digestive and genitourinary organs. Note the location of the iliacus muscle compared to those of the abdominal wall. Trigger points in the iliacus or psoas lie largely out of reach of dry needling. Instead, opt for massage, soft tissue manual therapy, laser therapy, and/or stretching to address restriction and pain.

and GB 28 may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[4] Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

The variability in spinal nerve origin for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy. Conversely, issues related to pain or dysfunction of somatic or visceral tissues served by the T12-L2 spinal segments may benefit from neuromodulation applied to GB 26, GB 27, and GB 28.

The multiplicity of nerves supplying this region speaks to the multifaceted effects of GB 27 and GB 28. Many of the nerves reflex to pelvic organs and genitourinary function through spinal segmental overlap of somatic and sympathetic pathways. The lumbar plexus, comprised of the ventral rami of L1 through L4 spinal nerves and accompanied by a branch of the T12 spinal nerve ventral ramus, forms several of the nerves that supply both GB 27 and GB 28. These include the: iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.[5] The jobs these nerves do in terms of communicating between the soma and viscera along with supplying sensation, motor function, and proprioception to muscles of the pelvis and lower limb, make GB 27, like its neighbor GB 28, a neural traffic highway ferrying signals up and down, in and out.

Vessels

- **Superficial circumflex iliac artery:** Arises from the femoral artery and courses along the inguinal ligament. Supplies the skin and subcutaneous tissue over the inferior portion of the anterolateral abdominal wall.
- **Deep circumflex iliac artery:** Arises from the external iliac artery, runs parallel to the inguinal ligament along the deep part of the anterior abdominal wall. Supplies the iliacus muscle and the inferior portion of the anterolateral abdominal wall.

Clinical Relevance: Entrapment of abdominal wall nerves after surgery or trauma likely injures vessels as well. Acupuncture, massage, and laser therapy can restore circulatory health and thereby facilitate recovery.

Indications and Potential Point Combinations

- **Reproductive system or pelvic problems:** Pain, leukorrhea, endometritis, epididymitis, orchitis, pain in groin or thigh, hernia pain: GB 27, GB 26, ST 29, ST 30, CV 2, SP 6.
- **Pain that radiates in a belt-like pattern from the lumbar region to the front of the body:** GB 27, GB 26, CV 2, BL 25.
- **Failed back syndrome from iliopsoas myofascial dysfunction:**[1] GB 27, GB 28, other trigger points as found that participate in the pain problem and functional restrictions.
- **Gynecologic and menstrual disorders:** GB 27, SP 6, SP 10, BL 23, LI 4.
- **Lower abdominal pain:** GB 27, GB 25, BL 23, BL 26, palpate for trigger point involvement and treat accordingly.
- **Inguinal neuralgia involving the iliohypogastric nerve:**[2] GB 27, GB 28, SP 13, ST 29, KI 11, CV 2.
- **Sense of heaviness deep in pelvis with cold buttocks:** GB 27, GB 26, GB 28, LR 13, CV 4, GB 41, TH 5.
- **Paraspinal lumbar pain and/or cranial midline proximal thigh pain:** GB 27, GB 28, ST 31, KI 16.
- **Pain or nerve injury after autologous bone harvesting:**[3] GB 27, GB 26, GB 29, BL 21-BL 23. For neuropathic pain after bone harvesting from the iliac crest, consider mechanism of pain (i.e., entrapment neuropathy by suture ligature strangulation or injury from intraoperative electrocautery, dissection, stretch, laceration, crush, or secondary trauma from high-speed bone saws). If neuropathic pain seems likely, the injury could involve one or more nerves because several lie in close proximity to the site of iliac crest harvesting. Potentially affected nerves include: the lateral cutaneous branch of the subcostal nerve, the lateral cutaneous branch of the iliohypogastric nerve, the lateral femoral cutaneous nerve, and the cluneal nerves.

References

1. Ingber RS. Iliopsoas myofascial dysfunction: a treatable cause of "failed" low back syndrome. *Arch Phys Med Rehabil*. 1989;70:382-386.
2. Viswanathan A, Kim DH, Reid N, et al. Surgical management of the pelvic plexus and lower abdominal nerves. *Neurosurgery*. 2009;65:A44-A51.
3. Chou D, Storm PB, and Campbell JN. Vulnerability of the subcostal nerve to injury during bone graft harvesting from the iliac crest. *(J Neurosurg Spine 1)* 2004;1:87-89.
4. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference.* November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
5. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *American Surgeon.* 2010;76(3):253-262.

GB 28

Wei Dao “Linking Path”

About .5 cun inferior to GB 27 and slightly more medial.

Muscles

- **External oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Internal oblique muscle:** Supports and compresses the abdominal viscera. Flexes and rotates the trunk.
- **Transverse abdominal muscle:** Compresses and supports the abdominal viscera. Since this is the deepest layer of the muscles of the abdominal wall, needling through this muscle may damage internal organs.
- **Iliacus/Iliopsoas muscle:** Lies lateral to the inferior part of the psoas major muscle; it then joins with the psoas to become the iliopsoas muscle, the main flexor of the thigh. It also assists the standing individual maintain an erect posture.
- **Sartorius muscle:** Attaches to the ASIS and the notch below it. It flexus, abducts, and laterally rotates the thigh at the hip. It also flexes the knee, allowing the individual to sit cross-legged.

Clinical Relevance: Trigger point pathology in the lateral abdominal wall musculature at or near GB 26 through GB 28 may cause pain that focuses strongly in the ipsilateral groin and testis, up and over the abdomen toward the ipsilateral and even the contralateral subcostal margin, umbilicus, and lower abdomen, producing diagnostic enigmas and confusion. Myofascial dysfunction in this zone can also upset neural regulation of the intestines through somatovisceral disturbances, producing diarrhea or colonic cramping.

An iliopsoas myofascial trigger point in the vicinity of GB 27 and GB 28 typically refers pain to the proximal cranial thigh and ipsilateral paraspinal lumbar region and buttock. Travell and Simons’ dubbed the iliopsoas combined muscle “the hidden prankster” in that this strong hip and lumbar flexor can upset upright posture. In so doing, it cultivates trigger points in the hamstring and gluteal groups, erector spinae, and caudal cervical musculature.

The sartorius muscle, known in trigger point terms as the “surreptitious accomplice”, earned its nickname due to the finding that trigger points rarely exist in this muscle alone. Rather, they develop as a consequence of myofascial dysfunction in other muscles comprising its functional unit.

Nerves

- **Thoracoabdominal nerves (T7-T11):** Innervate the external and internal oblique muscles and the transverses abdominal.
- **Iliohypogastric nerve (L1):** Supplies the skin over the iliac crest and in the hypogastric region. Supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve begins at L1, though it may receive some fibers from T12.
- **Ilioinguinal nerve (L1):** Supplies the skin of the scrotum or labia majora, mons pubis, and that region of the medial thigh that is immediately adjacent. Also innervates the internal oblique and transverse abdominal muscles. See also the iliohypogastric nerve.
- **Subcostal (12th intercostal) nerve:** This large ventral ramus of the T12 nerve runs along the inferior border of the 12th rib and supplies the lowest slip of the external oblique muscle as well as the skin over the anterior superior iliac spine (ASIS) and hip. It sends a branch to the pyrimidalis muscle.

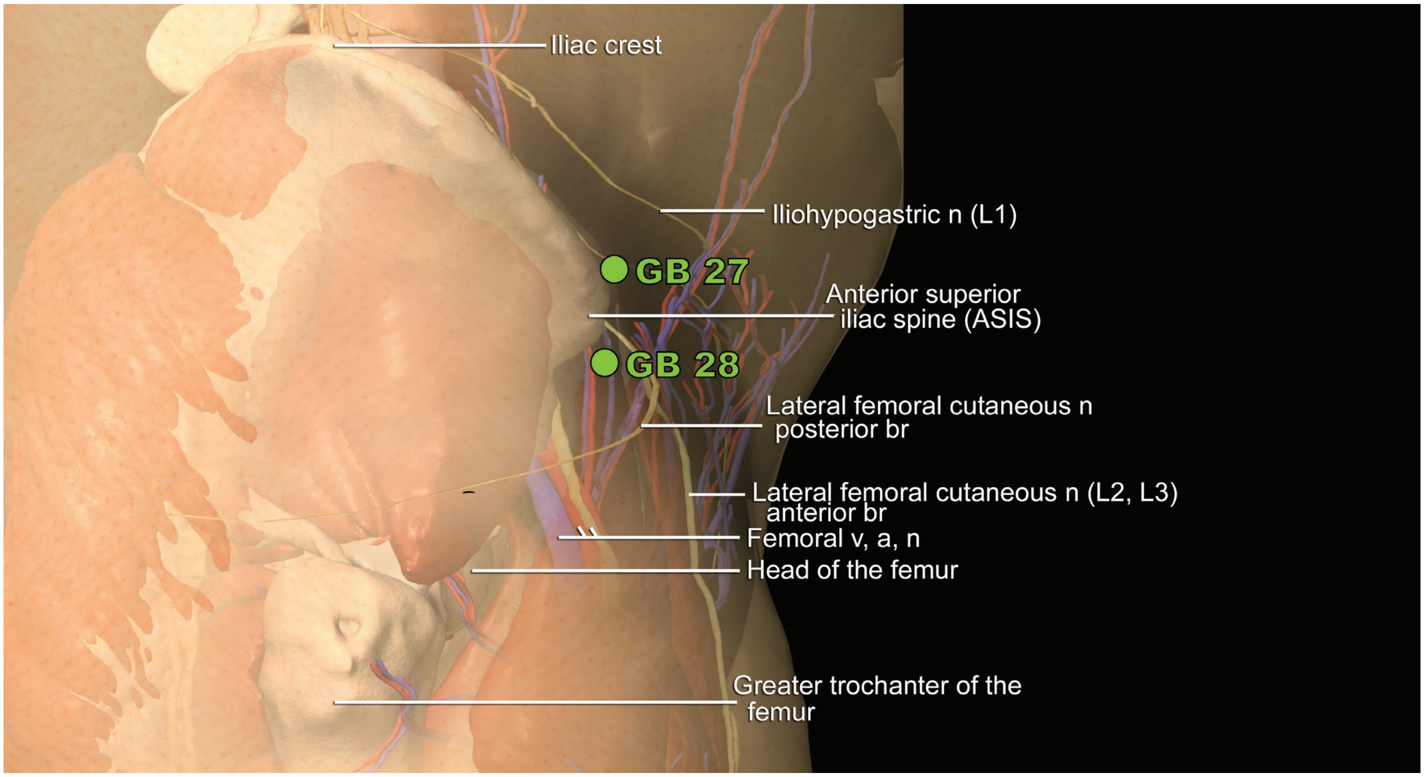

Iliac crest
Iliohypogastric n (L1)
GB 27
Anterior superior iliac spine (ASIS)
GB 28
Lateral femoral cutaneous n posterior br
Lateral femoral cutaneous n (L2, L3) anterior br
Femoral v, a, n
Head of the femur
Greater trochanter of the femur

Figure 11-78. The ASIS, a “pivot point” for the GB line (see description for GB 27, itself named “Fifth Point”), connects the lower abdomen to the pelvis. In this way, GB 28 provides a “Linking Path” between the trunk and limb.

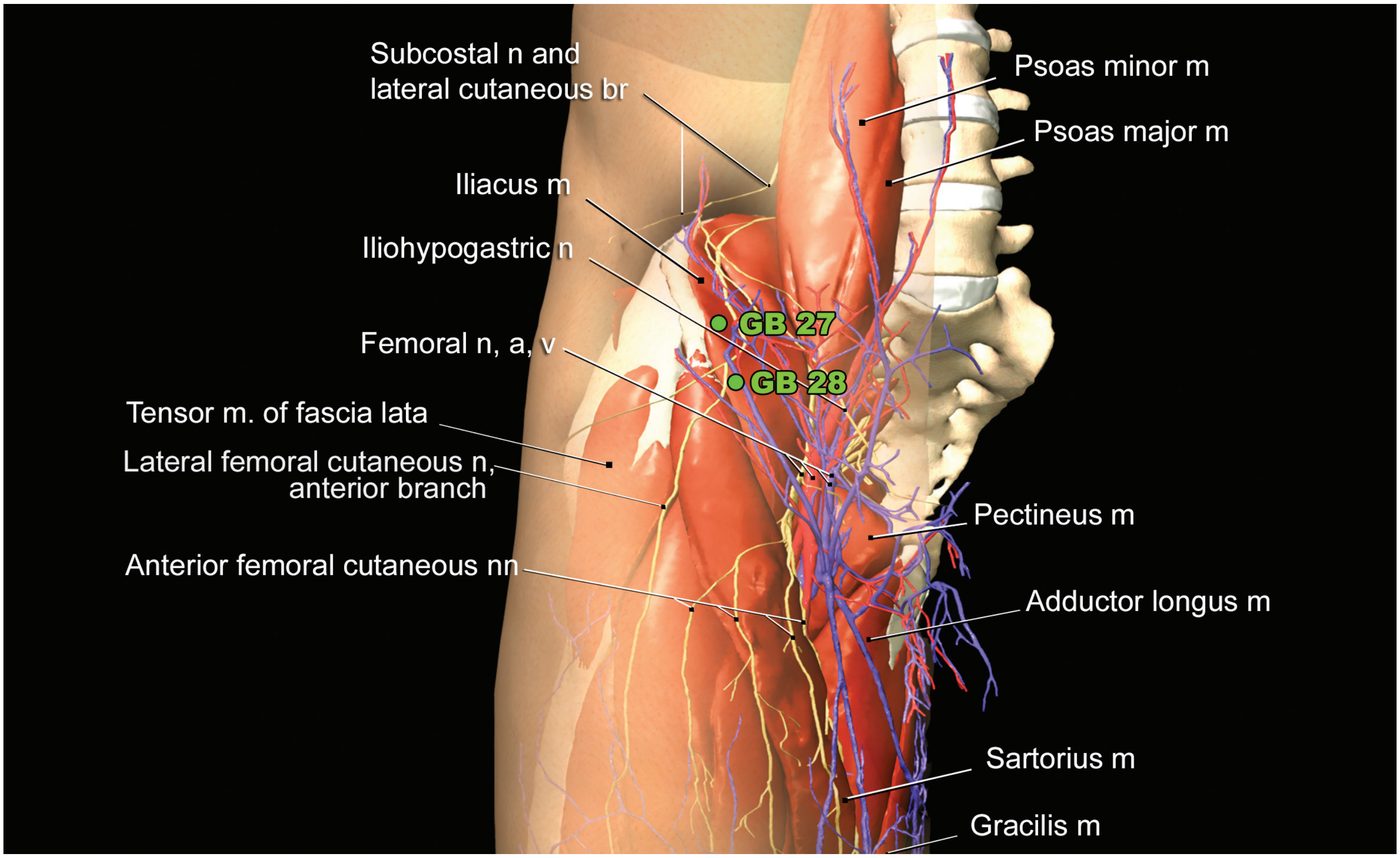


Figure 11-79. The sartorius and iliacus muscles near GB 28 can harbor attachment trigger points. Myofascial pathology in the iliacus muscle (at GB 27 and GB 28) refers pain to the proximal cranial (anterior) thigh and ipsilateral paraspinal lumbar region and buttock. Sartorius trigger points produce pain and paresthesias in the cranial (anterior) thigh along the muscle's course. See also Figure 11-76 to view the entire length of the cranial thigh. Note the branching of the lateral femoral cutaneous nerve into anterior (cranial) and posterior (caudal) components at GB 28 in this image.

- **Spinal nerves (L2, L3):** Supply the iliacus muscle.
- **Femoral nerve (L2-L3):** Innervates the sartorius muscle.
- **Lateral femoral cutaneous nerve (L2-L3):** Supplies the skin on the lateral thigh. (See Figures 11-79 and 11-76).

Clinical Relevance: The iliohypogastric nerve, along with the Ilioinguinal, lateral femoral cutaneous, and femoral nerves all emerge from the lateral border of the psoas major muscle; the obturator nerves proceeds from the medial border, and the genitofemoral nerve actually passes through the center of the belly of the psoas. Occasionally, the iliohypogastric and Ilioinguinal nerves will accompany the genitofemoral nerve through the belly of the muscle. As such, all three nerves are vulnerable to entrapment by the psoas. Taut bands in this muscle could lead to pain and paresthesias felt in the regions of their influence.

At the pelvis, the GB channel follows the iliac crest. The GB line then courses with the iliohypogastric nerve to the anterior superior iliac spine (ASIS) where it changes direction to backtrack to the buttocks. GB 27 and GB 28 land along this ventral arc.

For the subcostal nerve as well as the eleven intercostal nerves, fibers from the ipsilateral sympathetic trunk join the ventral ramus of each spinal nerve. These autonomic fibers supply blood vessels, sweat glands, and smooth muscle. The subcostal nerve communicates with the iliohypogastric nerve; together they form the neural substrate for the Dai Mai vessel, more fully described in the point section for GB 26. The subcostal nerve differs from its thoracoabdominal intercostal nerve partners (from T7-T11) in terms of its larger size and the fact that its lateral cutaneous branch does not divide into anterior and posterior branches as do its compatriots. Instead, this branch, larger in size than the lateral cutaneous branches of the other lower intercostal nerves, passes over the iliac crest alongside the iliohypogastric nerve to distribute to the skin of the groin and hip.

The iliohypogastric nerve, as one of the more caudal thoracoabdominal nerves, is susceptible to injury from surgical procedures to the lower abdomen or inguinal canal. Surgeries with such incisions may include hysterectomy, inguinal herniorrhaphy, and appendectomy. The nerves can be damaged when a suture passes around the nerve and it becomes bundled into the fascial repair. Scar tissue or neuroma formation can entrap the nerves postoperatively. Athletic injuries that traumatize or tear the lower abdominal muscles and fascia may similarly place traction on the nerve. Pregnancy can stretch the nerve as well. Acupuncture and related techniques in the vicinity of GB 27 and GB 28 may improve nerve function, reduce pain, relieve tenderness to palpation, and benefit sensation.

Procedures that may injure the ilioinguinal nerve include Pfannenstiel incisions, incisions for iliac crest harvesting, appendectomy, inguinal herniorrhaphy, inguinal lymph node biopsy, femoral catheter placement, orchiectomy, total abdominal hysterectomy, and abdominoplasty.[4]

Hockey players may tear the lower external oblique aponeurosis and injure the ilioinguinal nerve. Again, physical medicine approaches such as acupuncture may improve and normalize nerve function, which includes pain and tenderness with pressure where the nerve exits the inguinal canal as well as loss of sensation.

The variability in spinal nerve origin for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy. From a neuromodulation standpoint, pain or dysfunction in regions supplied by the T12-L2 spinal segments, whether somatic or visceral, may benefit from neuromodulation applied to GB 26, GB 27, and GB 28.

The multiplicity of nerves coursing throughout section of the GB channel introduces a variety of indications for points GB 26 through GB 28. Several nerves reflex to pelvic organs and influence genitourinary function by means of convergent somatic and sympathetic pathways in the spinal cord. The lumbar plexus, comprised of the ventral rami of L1 through L4 spinal nerves and accompanied by a branch of the T12 spinal nerve ventral ramus, gives off several of the nerves that supply both GB 27 and GB 28. These include the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.[5] The jobs these nerves do in terms of communicating between the soma and viscera along with supplying sensation, motor function, and proprioception to muscles of the pelvis and lower limb make GB 28 into a neural corridor or "Linking Path" for afferent and efferent information.

"Iliacus syndrome" pertains to the set of symptoms and signs arising from entrapment of the femoral nerve at in the GB 27/GB 28 region of the groin and pelvis.[6]

The lateral femoral cutaneous nerve emerges from the lumbar plexus at the lateral border of the psoas muscle, crosses the iliacus in an oblique fashion, and travels toward the ASIS. On its way to the thigh, it migrates deep to the inguinal ligament and across the sartorius muscle, whereupon it divides into anterior and posterior branches. Communications exist between the anterior branch of the lateral femoral cutaneous nerve and the anterior cutaneous branches of the femoral nerve itself. Communicating branches may also join from the lateral femoral to the infrapatellar branch of the saphenous nerve. When this occurs, the two create what is known as the "peripatellar plexus". This anatomical adjoining justifies inclusion of ST points as well as SP points for cranial knee pain. It also suggests considering GB 27 and GB 28 as proximal points to neuromodulate contribution from the lateral femoral cutaneous nerve to knee dysfunction.

Lateral femoral cutaneous neuropathy is also known as "meralgia paresthetica", or painful thigh. Causes include avulsion fracture of the ASIS, tumor in the pelvic cavity or retroperitoneal space, traction on the nerve due to prolonged hip and trunk hyperextension, leg length discrepancy, iatrogenic procedures, prolonged standing, weight gain, and external compression by heavy belts or tight clothing. Patients experience the burning pain and paresthesias associated with neuropathy. Pressure applied to GB 27, GB 28, and/or the ASIS may worsen the problems. Hip flexion alleviates the discomfort by providing more room for the nerve. Corrective actions include education on proper body mechanics, therapeutic exercise, elimination of heavy belts and avoidance of tight clothing, weight loss, and neuromodulation that allows the iliopsoas to relax and removes myofascial restriction compressing the nerve.

The posterior branch of the lateral femoral cutaneous nerve enters the fascia lata and divides into filaments that course laterad and caudad along the thigh. Figure 11-79 illustrates the caudal course that the posterior, or caudal, branch of the lateral femoral cutaneous nerve takes. At GB 28, this branch turns toward the hip and GB 29. These caudal branch fibers supply sensation to the skin from the greater trochanter to mid-thigh, following the GB line. Observe the location of the femoral nerve within the iliacus muscle shown by Figure 11-80. While the femoral nerve may also experience entrapment where it exists the abdomen deep to the inguinal ligament in a tunnel called the "lacuna musculorum", iliacus syndrome involves compression of the nerve by dint of myofascial restriction and/or scarring. A variety of etiologies cause this problem, including iatrogenic injury during surgery, trauma to the pelvis and hip, tension or abnormal enlargement of the iliopsoas muscle following tear, hematoma, or mass, distension of the iliopsoas bursa, and pseudoaneurysm of the iliac vessels.[7]

Vessels

- **Superficial circumflex iliac artery:** Arises from the femoral artery and courses along the inguinal ligament. Supplies the skin and subcutaneous tissue over the inferior portion of the anterolateral abdominal wall.

- **Deep circumflex iliac artery:** Arises from the external iliac artery, runs parallel to the inguinal ligament along the deep part of the anterior abdominal wall. Supplies the iliacus muscle and the inferior portion of the anterolateral abdominal wall.

Clinical Relevance: Entrapment of abdominal wall nerves after surgery or trauma likely injures vessels as well. Acupuncture, massage, and laser therapy can restore circulatory health and thereby facilitate recovery.

Indications and Potential Point Combinations

- **Gynecologic and menstrual disorders:** GB 28, ST 30, SP 6, SP 10, BL 23, LI 4.

- **Reproductive system or pelvic problems:** Pain, leukorrhea, endometritis, epididymitis, orchitis, pain in groin or thigh, hernia pain: GB 28, GB 26, ST 29, ST 30, CV 2, SP 6.

- **Lower abdominal pain:** GB 28, GB 25, BL 23, BL 26, palpate for trigger point involvement and treat accordingly.

- **Pain that radiates in a belt-like pattern from the lumbar region to the front of the body:** GB 28, GB 26, CV 2, BL 25.

- **Sense of heaviness deep in pelvis with cold buttocks:** GB 28, GB 26, GB 28, LR 13, CV 4, GB 41, TH 5.

- **Pain or nerve injury after autologous bone harvesting:**[1] GB 28, GB 27, GB 26, GB 29, BL 21-BL 23. For neuropathic pain after bone harvesting from the iliac crest, consider mechanism of pain (i.e., entrapment neuropathy by suture ligature strangulation or injury from intraoperative electrocautery, dissection, stretch, laceration, crush, or secondary trauma from high-speed bone saws). If neuropathic pain seems likely, the injury could involve one or more nerves because several lie in close proximity to the site of iliac crest harvesting. Potentially affected nerves include: the lateral

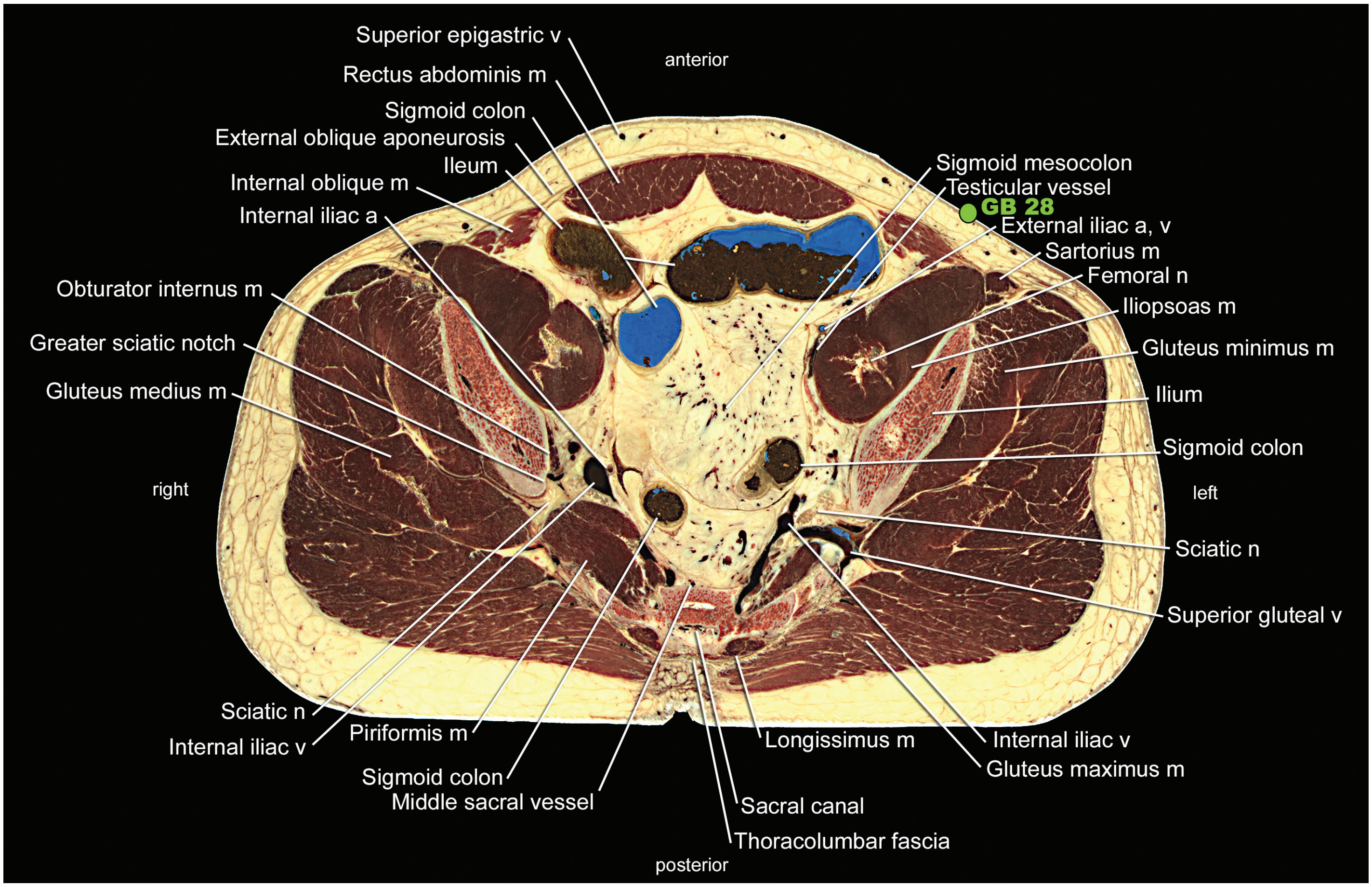

Superior epigastric v
anterior
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
Internal iliac a
Obturator internus m
Greater sciatic notch
Gluteus medius m
right
Sigmoid mesocolon
Testicular vessel
GB 28
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
Sigmoid colon
left
Sciatic n
Superior gluteal v
Sciatic n
Internal iliac v
Piriformis m
Sigmoid colon
Middle sacral vessel
Longissimus m
Internal iliac v
Gluteus maximus m
Sacral canal
Thoracolumbar fascia
posterior

Figure 11-80. GB 28, the "Linking Path" point, adjoins the abdomen and pelvic limb. This cross-section reinforces this descriptive title, illustrating the presence of abdominal wall musculature deep to GB 28 as well as the iliopsoas and sartorius, a predominantly pelvic limb structure.

cutaneous branch of the subcostal nerve, the lateral cutaneous branch of the iliohypogastric nerve, the lateral femoral cutaneous nerve, and the cluneal nerves.

- **Inguinal neuralgia involving the iliohypogastric nerve:**[2] GB 27, GB 28, SP 13, ST 29, KI 11, CV 2.
- **Paraspinal lumbar pain and/or cranial midline proximal thigh pain:** GB 27, GB 28, ST 31, KI 16.
- **Failed back syndrome from iliopsoas myofascial dysfunction:**[3] GB 27, GB 28, other trigger points as found that participate in the pain problem and functional restrictions.

References

1. Chou D, Storm PB, and Campbell JN. Vulnerability of the subcostal nerve to injury during bone graft harvesting from the iliac crest. *(J Neurosurg Spine 1)* 2004;1:87-89.
2. Viswanathan A, Kim DH, Reid N, et al. Surgical management of the pelvic plexus and lower abdominal nerves. *Neurosurgery*. 2009;65:A44-A51.
3. Ingber RS. Iliopsoas myofascial dysfunction: a treatable cause of "failed" low back syndrome. *Arch Phys Med Rehabil*. 1989;70:382-386.
4. Hollis MH. Nerve entrapment syndromes of the lower extremity. *Medscape Reference.* November 10, 2010. Accessed at http://emedicine.medscape.com/article/1234809-overview on 09-19-12.
5. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *American Surgeon*. 2010;76(3):253-262.
6. Beltran LS, Bencardino J, Ghazikhanian V, et al. Entrapment neuropathies III: lower limb. *Seminars in Musculoskeletal Radiology*. 2010;14(5):501-511.
7. Beltran LS, Bencardino J, Ghazikhanian V, et al. Entrapment neuropathies III: lower limb. *Seminars in Musculoskeletal Radiology*. 2010;14(5):501-511.

GB 29

Ju Liao "Squatting Bone-Hole"

On the lateral hip, midway between the anterior superior iliac spine (ASIS) and the most prominent part of the greater trochanter. Locate with the patient in lateral recumbency with the hip slightly flexed.

Note: The Chinese term "Ju Liao" for GB 29 is the same name given to ST 3. Both refer to large palpable depressions.

Fascia

- **Fascia lata:** The strong and deep fascia of the lower limb envelops the muscles it contains like an elastic stocking. By preventing the muscles of the limb from bulging during contraction, blood returns from the limb to the heart more efficiently.
- **Iliotibial band:** The iliotibial band (ITB) constitutes a thickening of the fascia lata on the lateral aspect of the limb, originating from fibers of the gluteus maximus, gluteus medius, and tensor fasciae latae muscles. It functions in part as a tendon for these structures. The ITB attaches proximal to the knee joint into the lateral femoral condyle as well as distal to the knee into the infracondylar tubercle of the tibia. Where it attaches below the knee, it inserts onto the tibial and fibula. There, it trifurcates into three separate bands. One attaches to the lateral aspect of the patella, one to Gerdy's tubercle, and one to the fibular head and biceps femoris tendon and aponeurosis. View the extensive size of the iliotibial band in Figure 11-82. Considering its femoral and tibial mechanical connections, atypical or abnormal hip and lower limb movements could strain the ITB.

Clinical Relevance: At the knee, the ITB functions primarily as a lateral stabilizing ligament to the lateral hip and knee.[1] The ITB performs a complex series of functions that aid in knee stabilization through both flexion and extension. Iliotibial band syndrome (ITBS) is considered the second leading cause of pain in runners. It has become the most common source of lateral knee pain.[3] Female runners who develop this syndrome exhibit limb kinematics suggestive of increased stress placed on the iliotibial band. While making adjustments in posture and limb motions during exercise would aid ITBS, acupuncture, massage, and laser therapy applied to the hip, ITB, and knee insertions supports recovery as well.

Muscles

- **Tensor fasciae latae muscle:** Acts on the thigh to abduct, medially rotate, and flex it. Helps keep the knee extended and steadies the pelvis on the femur. Mainly serves to control movement of the hip by assisting the gluteus medius and minimus muscles in stabilizing the pelvis onto the femur bones.

The most posterolateral fibers, in the vicinity of GB 29, also assist in stabilizing the knee.

- **Gluteus medius muscle:** Abducts the thigh and medially rotates it. Maintains the pelvis in a level position when the individual raises the contralateral leg.
- **Gluteus minimus muscle:** Abducts the thigh and medially rotates it. Maintains the pelvis in a level position when the individual raises the contralateral leg.

Clinical Relevance: Myofascial trigger points in the tensor fasciae latae at or near GB 29 lead to a condition known as "pseudotrochanteric bursitis" which produces pain in the hip that radiates down the anterolateral thigh, occasionally reaching the knee. Differential diagnoses include true trochanteric bursitis, L4 neuropathy caused by lumbar spondylosis, iliotibial tract friction syndrome, sacroiliac arthritis, or a peripheral nerve entrapment known as meralgia paresthetica.

Dubbed the "lumbago muscle", trigger points in the gluteus

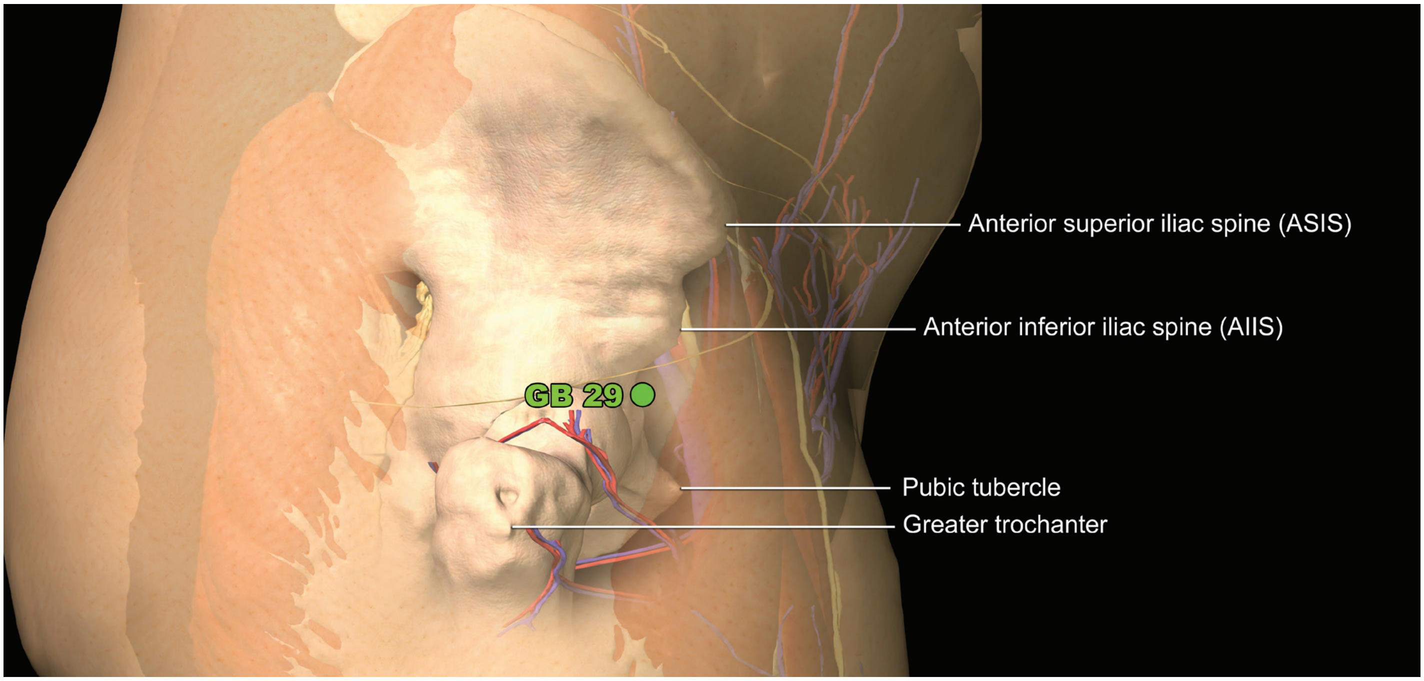

Anterior superior iliac spine (ASIS)
Anterior inferior iliac spine (AIIS)
GB 29
Pubic tubercle
Greater trochanter

Figure 11-81. GB 29, the "Squatting Bone-Hole", forms a clearly-defined cleft in the lateral aspect of the hip when the individual adopts a crouching position. With the gluteus medius and minimus removed in this image, this "scoop" appears more prominently.

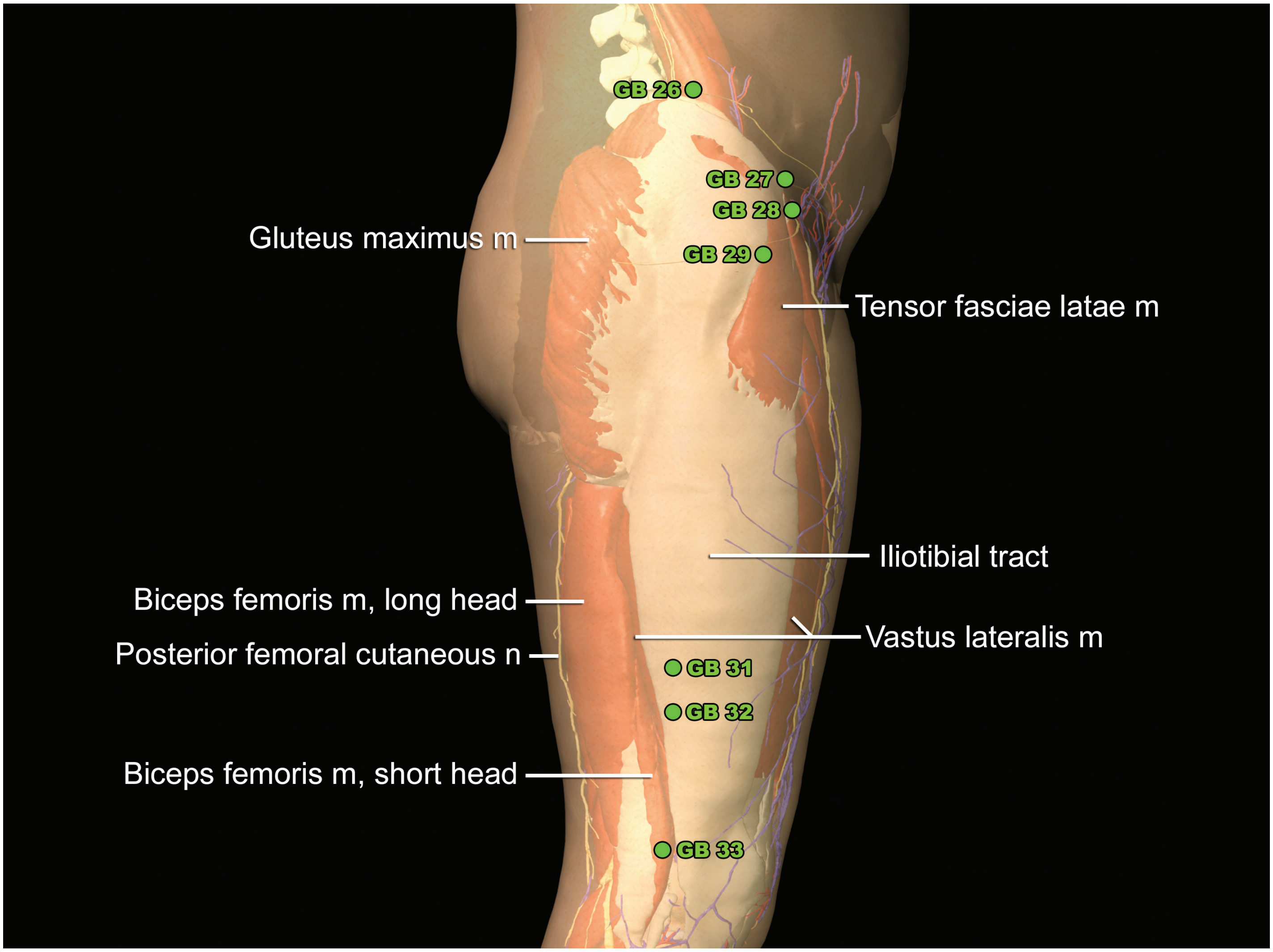


Figure 11-82. The iliotibial tract, or band, extends from the ilium to the tibia and fibula. This image depicts the relationship that several GB points share with this fascial band. This snapshot of the proximal GB channel on the limb highlights the close relationship the GB channel maintains with fascia and stabilizing yet often pain-producing connective tissue.

medius muscle refer pain to the low back.

Trigger points in the gluteus minimus muscle cause pain to radiate toward the buttock and down the leg along the GB and BL channels. This composite of pain resembles sciatic neuropathy and has earned this muscle the reputation of causing "pseudo-sciatica".

The hip abductor muscles (gluteus medius and minimus, as well as the tensor fasciae latae muscles) stabilize the pelvis during gait; they also abduct and rotate the hip joint.[4] Their close association with the ITB and mechanics of the hip joint make them vulnerable to strain and overuse. Note their size and bulk in Figure 11-84. Their appearance suggests a likelihood to harbor multiple myofascial trigger points.

Nerves

- **Superior gluteal nerve (L4, L5, S1):** Innervates the gluteus medius, gluteus minimus, and tensor fasciae latae muscles.
- **Lateral femoral cutaneous nerve (L2-L3):** Supplies the skin on the lateral thigh. (See Figures 11-79 and 11-76).

Clinical Relevance: The superior gluteal nerve exits the pelvis by way of the greater sciatic foramen, cranial to the piriformis muscle. It courses between the gluteus medius and minimus muscles.[5] It travels with the superior gluteal vessels to supply the gluteus medius, gluteus minimus, and tensor fasciae latae muscles along with the hip joint itself. Total hip arthroplasty along with other types of pelvic surgeries risk damaging the superior gluteal nerve. Up to 8% of patients undergoing total hip replacement incur injury to the superior and inferior gluteal nerves.[6] Problems resulting from this damage can severely affect patients' use of the limb and comfort; the injury can last a year or longer following hip replacement surgery. When damage to the nerve does occur, neuromodulation with laser therapy, acupuncture, and massage should follow soon thereafter. Due to the risk of infection with a recent joint implant, however, laser therapy may be preferable in this instance, in order to avoid introducing bacteria at the implant site. Following the acute postoperative period, however, local acupuncture can follow. Non-local acupuncture and carefully performed medical massage should not be a problem in the acute period, as long as good hygiene practices are maintained (hand washing, sterile needles, etc.).

The lateral femoral cutaneous nerve emerges from the lumbar

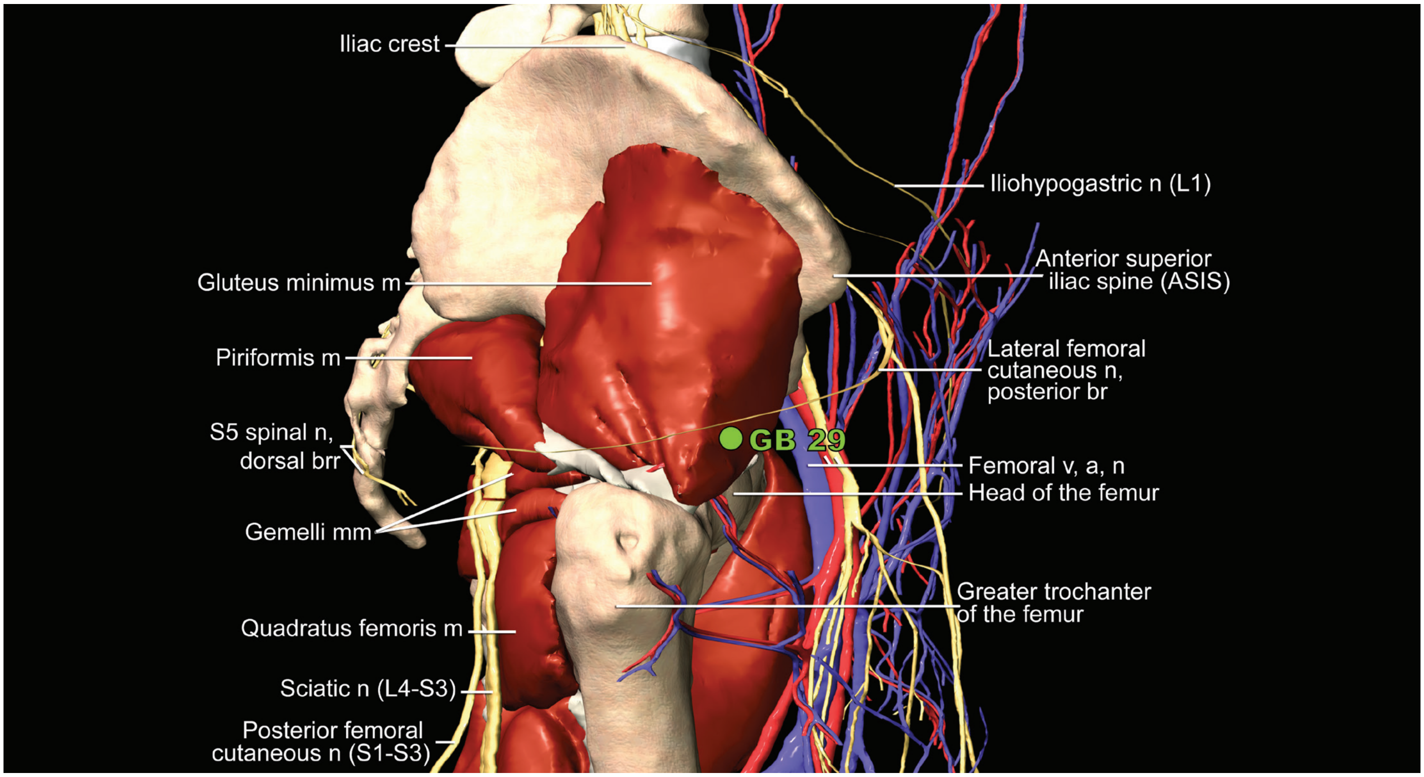


Figure 11-83. Trigger points in the gluteus minimus muscle radiate severe pain to the buttock and down the pelvic limb. Tenderness to palpation occurs at GB 30 and BL 54 as well as the lineup of points from GB 31 to GB 39 as well as BL 59. Because the intensity of discomfort mimics sciatica but does not involve the sciatic nerve, pain from gluteus minimus trigger points has been called "pseudo-sciatica". This image illustrates the depth of the gluteus minimus muscle. Locating it and its trigger points requires concerted focus on the local anatomy and deeper palpation than most other sites.

plexus at the lateral border of the psoas muscle, crosses the iliacus in an oblique fashion, and travels toward the ASIS. On its way to the thigh, it migrates deep to the inguinal ligament and across the sartorius muscle, whereupon it divides into anterior and posterior branches. Communications exist between the anterior branch of the lateral femoral cutaneous nerve and the anterior cutaneous branches of the femoral nerve itself. Communicating branches may also join from the lateral femoral to the infrapatellar branch of the saphenous nerve. When this occurs, the two create what is known as the "peripatellar plexus". This anatomical adjoining justifies inclusion of ST points as well as SP points for cranial knee pain. It also suggests considering GB 27 and GB 28 as proximal points to neuromodulate contribution from the lateral femoral cutaneous nerve to knee dysfunction.

Lateral femoral cutaneous neuropathy is also known as "meralgia paresthetica", or painful thigh. Causes include avulsion fracture of the ASIS, tumor in the pelvic cavity or retroperitoneal space, traction on the nerve due to prolonged hip and trunk hyperextension, leg length discrepancy, iatrogenic procedures, prolonged standing, weight gain, and external compression by heavy belts or tight clothing. Patients experience the burning pain and paresthesias associated with neuropathy. Pressure applied to GB 27, GB 28, and/or the ASIS may worsen the problems. Hip flexion alleviates the discomfort by providing more room for the nerve. Corrective actions include education on proper body mechanics, therapeutic exercise, elimination of heavy belts and avoidance of tight clothing, weight loss, and neuromodulation that allows the iliopsoas to relax and removes myofascial restriction compressing the nerve.

The posterior branch of the lateral femoral cutaneous nerve enters the fascia lata and divides into filaments that course laterad and caudad along the thigh. Figure 11-79 illustrates the caudal course that the posterior, or caudal, branch of the lateral femoral cutaneous nerve takes. At GB 28, this branch turns toward the hip and GB 29. These caudal branch fibers supply sensation to the skin from the greater trochanter to mid-thigh, following the GB line.

Vessels

- **Superior gluteal artery:** Deep branch runs between the gluteus medius and gluteus minimus muscles to supply these muscles and the tensor fasciae latae muscle.
- **Superior gluteal vein:** Accompanies the superior gluteal artery, draining blood from the gluteal region. A tributary of the internal iliac vein.

Clinical Relevance: The superior gluteal vessels, like the superior gluteal nerve, may undergo damage during total hip arthroplasty as well as other pelvic orthopedic and soft tissue surgeries. As with neurotrauma, laser therapy will aid in regenerating tissue and restoring function to damaged tissues.

The superior gluteal artery contributes indirectly to femoral head circulation by participating in a "periacetabular vascular ring".[7] Vessels forming this ring include the gluteal vessels proximally and circumflex femoral vessels distally. A supra-acetabular branch of the superior gluteal artery frequently forms an anastomosis with the ascending branch of the lateral femoral circumflex artery. It may also connect to the proximal deep branch of the inferior gluteal artery on the dorsal acetabulum. Thus, even when one artery loses function if injured during

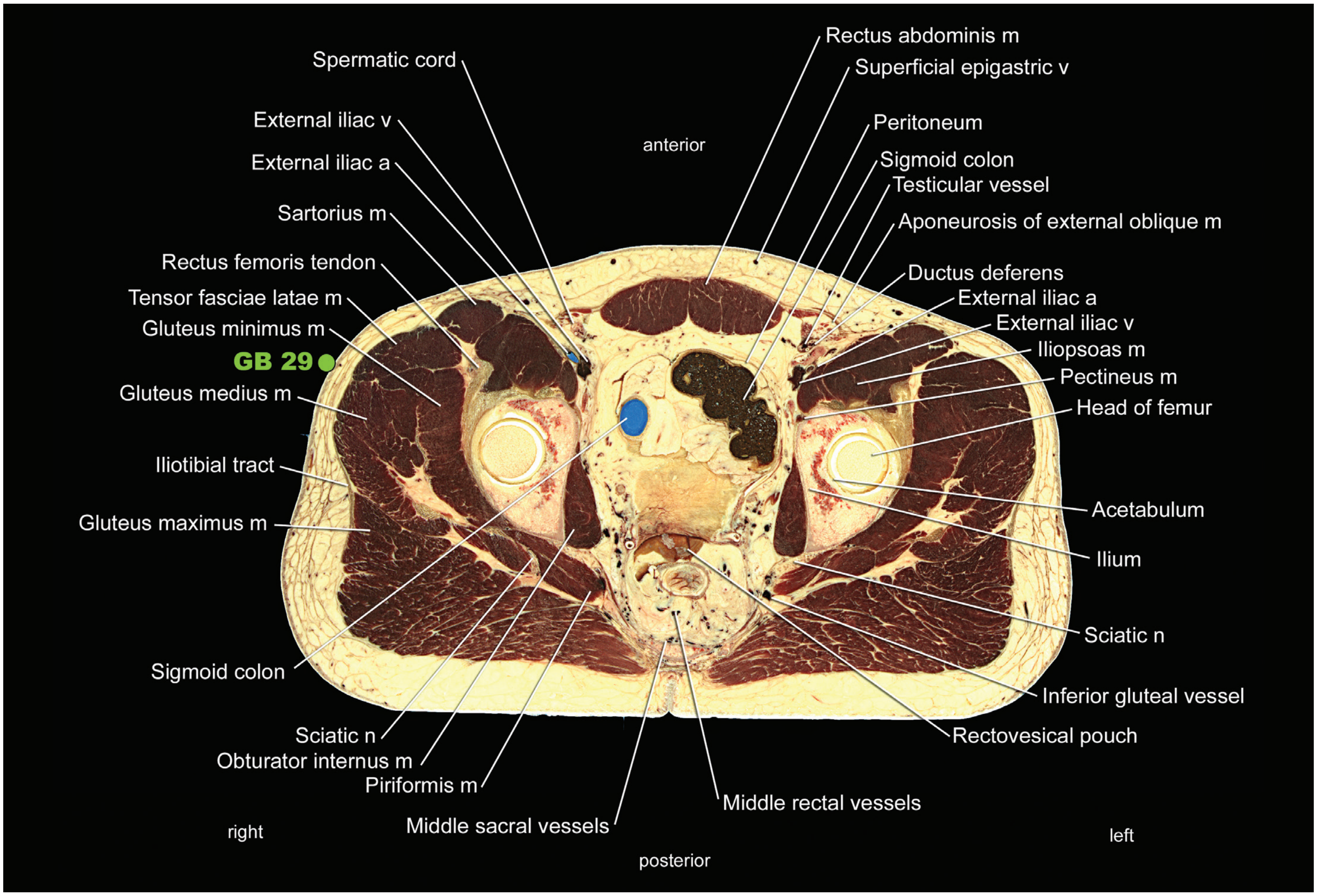

Spermatic cord
External iliac v
External iliac a
Sartorius m
Rectus femoris tendon
Tensor fasciae latae m
Gluteus minimus m
GB 29
Gluteus medius m
Iliotibial tract
Gluteus maximus m
Sigmoid colon
Sciatic n
Obturator internus m
Piriformis m
Middle sacral vessels
right
anterior
posterior
Rectus abdominis m
Superficial epigastric v
Peritoneum
Sigmoid colon
Testicular vessel
Aponeurosis of external oblique m
Ductus deferens
External iliac a
External iliac v
Iliopsoas m
Pectineus m
Head of femur
Acetabulum
Ilium
Sciatic n
Inferior gluteal vessel
Rectovesical pouch
Middle rectal vessels
left

Figure 11-84. GB 29 lives in a veritable hotbed of myofascial trigger points. As shown in this cross-section, the gluteus minimus, gluteus medius, and tensor fasciae latae Muscles all exist within reach of an acupuncture needle (chosen with appropriate length for the trigger point targeted) and laser therapy.

surgery or trauma, others may aid in providing circulation to the joint, fostered and encouraged with laser therapy, acupuncture, and massage.

Indications and Potential Point Combinations

- **Pain in the low back, pelvis, or hip:** GB 29, GB 30, BL 54, BL 40, GB 34, BL 62, BL 23, and trigger points involved in the generation and maintenance of the pain problem.
- **Problems with hip mobility or leg strength:** GB 29, GB 30, BL 54, BL 40, other pertinent trigger points.
- **Iliotibial band syndrome:** GB 29, GB 30. Palpate for trigger points in the hip abductors and along the iliotibial band and its attachment sites. Include massage or soft tissue manipulative therapy. Osteopathic manipulative treatment for iliotibial band friction syndrome has been shown to improve with counterstrain technique.[8] Conservative measures should be investigated and given an opportunity to work before any surgical treatment attempted.

Evidence-Based Applications

- Needling GB 30, GB 34, and BL 62 for **piriformis injury syndrome** outperformed needling at GB 30, GB 29, BL 36, and GB 34 in a reportedly randomized controlled trial.[2]

References

1. Whiteside LA and Roy ME. Anatomy, function, and surgical access of the iliiotibial band in total knee arthroplasty. *J Bone Joint Surg Am.* 2009;91:101-106.
2. Yang JX and Zhu XY. (Chinese). Observation on therapeutic effect of three needling method on piriformis injury syndrome. *Zhongguo Zhen Jiu.* 2008;28(3):205-206.
3. Ferber R, Noehren B, Hamill J, et al. Competitive female runners with a history of iliotibial band syndrome demonstrate atypical hip and knee kinematics. *J Orthop Sports Phys Ther.* 2010;40(2):52-58.
4. Flack NAMS, Nicholson HD, and Woodley SJ. A review of the anatomy of the hip abductor muscles, gluteus medius, gluteus minimus, and tensor fascia lata. *Clin Anat.* 2012;25:697-708.
5. Apaydin N, Kendir S, Loukas M, et al. Surgical anatomy of the superior gluteal nerve and landmarks for its localization during minimally invasive approaches to the hip. *Clin Anat.* 2012; Feb 28. Doi: 10.1002/ca.22057. [Epub ahead of print.]
6. Apaydin N, Kendir S, Loukas M, et al. Surgical anatomy of the superior gluteal nerve and landmarks for its localization during minimally invasive approaches to the hip. *Clin Anat.* 2012; Feb 28. Doi: 10.1002/ca.22057. [Epub ahead of print.]
7. Kalhor M, Horowitz K, Gharehdaghi J, et al. Anatomic variations in femoral head circulation. *Hip Int.* 2012;22(03):307-312.
8. Pedowitz RN. Use of osteopathic manipulative treatment for iliotibial band friction syndrome. *J Am Osteopath Assoc.* 2006;105(12):563-657.

GB 30

Huan Tiao "Jumping Round"

One-third the distance from the most prominent part of the greater trochanter to the sacral (sacrococcygeal) hiatus, at GV 2. Locate with the patient in lateral recumbency and with the hip slightly flexed. Review Figure 11-86 for the relationship of GB 30 to GV 2 and the greater trochanter.

Muscles

- **Gluteus maximus muscle:** Assists the thigh in lateral rotation and extends it when the thigh is flexed. Steadies the thigh and assists in standing after rising from a sitting position.
- **Short hip lateral rotator muscles: (piriformis, superior gemellus, obturator internus, inferior gemellus, and quadratus femoris):** All of the aforementioned muscles laterally rotate the thigh and steady the femoral head within the acetabulum. All except the quadratus femoris abduct the flexed thigh.

Clinical Relevance: Gait disturbances, trauma, hematoma, and trigger point pathology may precipitate piriformis syndrome by causing muscle spasm, contracture, scarring, and/or inflammation. While acupuncture at GB 30 can impact trigger points in the gluteus maximus muscle, its stronger clinical impact relates to its impact on the piriformis muscle and other short lateral rotators of the hip – the gemelli, quadratus femoris, and obturator internus muscles.

Specifically, pain emanating from myofascial dysfunction in this region arises both from the referred pain from trigger points as well as nerve entrapment from the shortened muscles shown in Figure 11-86.

Nerves

- **Inferior clunial nerves (S2, S3):** Supply the skin of the gluteal region as far as the greater trochanter.
- **Inferior gluteal nerve (L5-S2):** Innervates the gluteus maximus muscle.
- **Sciatic nerve (L4-S3):** Supplies all posterior thigh, leg and foot muscles, as well as the skin of the foot and most of the leg.
- **Nerve to obturator internus (L5, S1):** Supplies the superior gemellus and obturator internus muscles.
- **Nerve to quadratus femoris (L5, S1):** Supplies the quadratus femoris and inferior gemellus muscles.
- **Branches of ventral rami of S1 and S2:** Supply the piriformis muscle.

Clinical Relevance: The piriformis in particular can act as a "double devil" in its generation of pain, both because of trigger points at GB 30 and BL 30 as well as its tendency to place pressure on the sciatic nerve when the muscle enters a state of chronic contraction. Piriformis entrapment syndromes can compress nerves traveling through the greater sciatic foramen, including the superior gluteal nerve and blood vessels, the sciatic nerve, the pudendal nerve and associated vessels, the inferior gluteal nerve, the posterior femoral cutaneous nerve, and the nerves to the gemelli, obturator internus, and quadratus femoris muscles. Ongoing compression of nerves and vessels exiting the greater sciatic foramen would thus compromise sensation, motor function, and blood flow to and from the gluteal muscles, perineum, and posterior thigh and calf. Neuropathy of the aforementioned nerves would lead to pain in the buttock, inguinal region, posterior thigh, and lower limb. Sexual dysfunction may accompany the somatic complaints. Female patients may experience dyspareunia and males may complain of impotence. Constipation may worsen trigger point pain from the piriformis muscle, when hard feces press against the muscle causing a perception of rectal pain.

Entrapment neuropathy goes either un-recognized or under-recognized in both human and veterinary medicine. This cause of pain and functional impairment produces either acute or chronic injury to peripheral nerves. Symptoms and signs may overlap with other neurogenic problems, posing further challenges to accurate diagnosis. Compression, entrapment, and stretching injure nerves most commonly where space becomes constrained anatomically or functionally (e.g., secondary to myofascial restriction).

Sciatic entrapment neuropathy more commonly damages the fibular division. The fibular component of the sciatic nerve, in contrast to its tibial partner, occupies a more superficial position with less supportive connective tissue to protect it from compression. In addition, while the positions of both are fixed at the sciatic foramen, the fibular portion is also tethered at the fibular head. Thus, the fibular nerve has less opportunity for mobility. Sciatic neuropathy mimics distal common fibular neuropathy in that both may manifest as foot drop secondary to loss of nerve supply to the anterior (cranial) tibialis muscle.

The most common cause of sciatic neuropathy occurs when the surgeon either overstretches or directly traumatizes the nerve during total hip arthroplasty. Piriformis muscle syndrome, described above, entraps the sciatic as well.

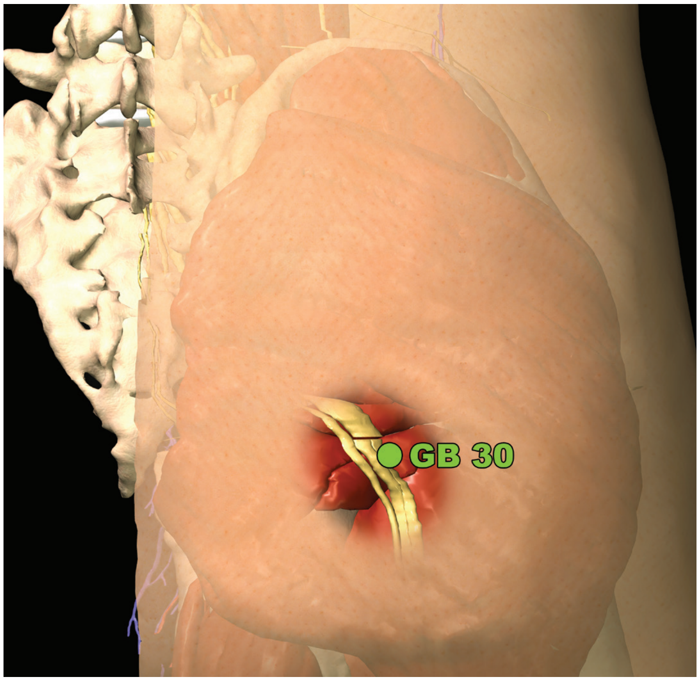
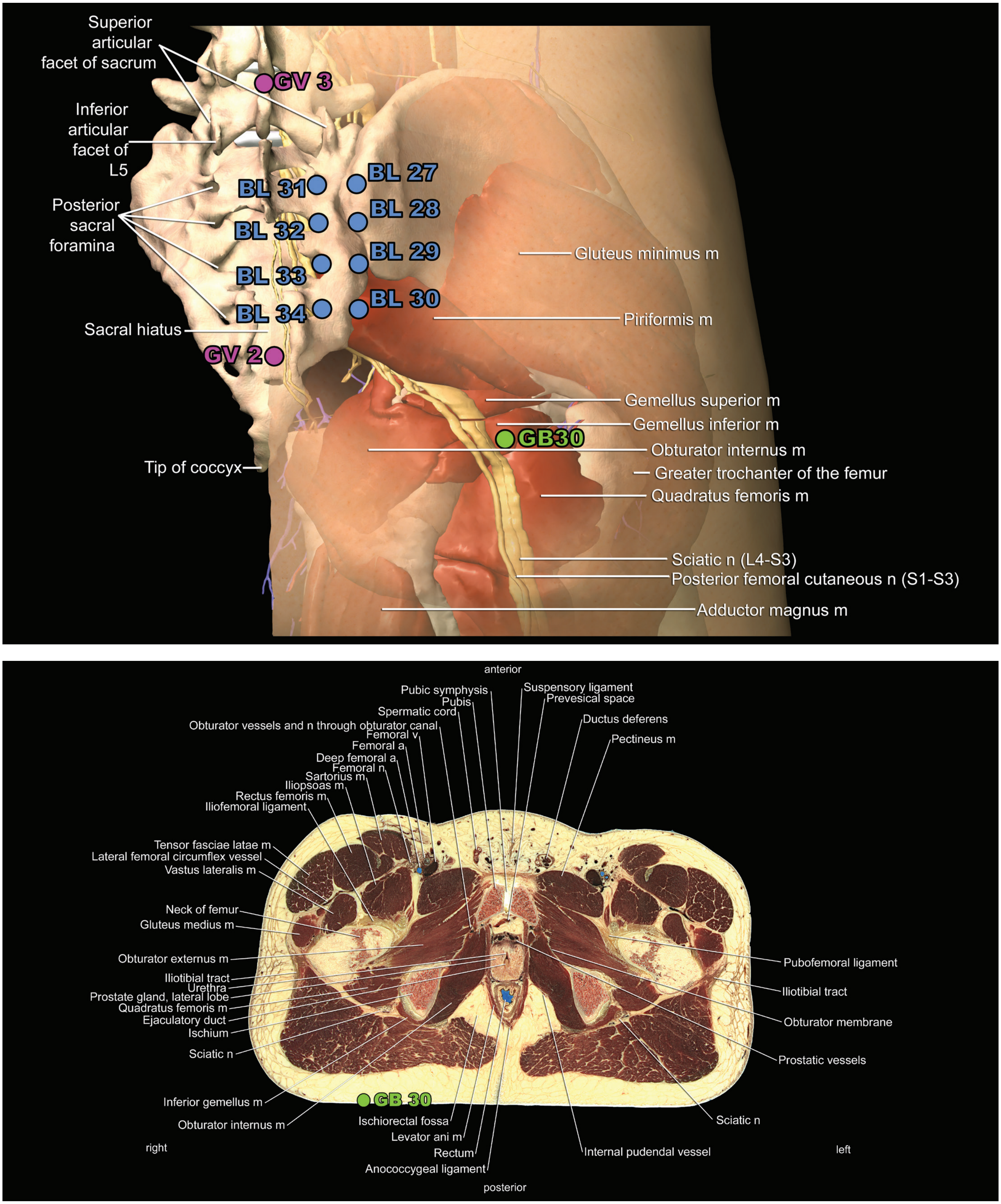


Figure 11-85. The gluteus maximus muscle spreads across nearly the entire buttock. This window through the skin and muscle exposes the nearby sciatic nerve at GB 30. The point's name, "Jumping Round", speaks to both the action of the gluteus maximus muscle, active when jumping and its rounded appearance.


Superior articular facet of sacrum
GV 3
Inferior articular facet of L5
BL 27
BL 31
BL 28
Posterior sacral foramina
BL 32
BL 29
Gluteus minimus m
BL 33
BL 30
BL 34
Piriformis m
Sacral hiatus
GV 2
Gemellus superior m
Gemellus inferior m
GB30
Obturator internus m
Tip of coccyx
Greater trochanter of the femur
Quadratus femoris m
Sciatic n (L4-S3)
Posterior femoral cutaneous n (S1-S3)
Adductor magnus m
anterior
Pubic symphysis
Suspensory ligament
Pubis
Prevesical space
Spermatic cord
Ductus deferens
Obturator vessels and n through obturator canal
Femoral v
Pectineus m
Femoral a
Deep femoral a
Femoral n
Sartorius m
Iliopsoas m
Rectus femoris m
Iliofemoral ligament
Tensor fasciae latae m
Lateral femoral circumflex vessel
Vastus lateralis m
Neck of femur
Gluteus medius m
Obturator externus m
Pubofemoral ligament
Iliotibial tract
Urethra
Iliotibial tract
Prostate gland, lateral lobe
Quadratus femoris m
Obturator membrane
Ejaculatory duct
Ischium
Sciatic n
Prostatic vessels
Inferior gemellus m
GB 30
Obturator internus m
Ischiorectal fossa
Sciatic n
Levator ani m
right
Rectum
Internal pudendal vessel
left
Anococcygeal ligament
posterior

Figures 11-86 and 11-87. Depending on point placement and needling angle, one may target any of the short lateral rotators depicted in these image, including the piriformis, gemellus superior, gemellus inferior, obturator internus, and quadratus femoris.

The piriformis muscle divides the greater sciatic foramen into the suprapiriformis and infrapiriformis foramina. The superior gluteal nerve exits the former while the inferior gluteal and sciatic nerves exit the latter.[7] Inferior gluteal entrapment neuropathy can arise as a complication of a dorsal, or posterior, approach to hip arthroplasty. Normally, the nerve exits the pelvis next to the sciatic nerve. Diagnosis of inferior gluteal entrapment neuropathy by MRI can be difficult due to the small size of the nerve. Astute myofascial palpation may localize the problem more quickly and less costly.

Vessels

- **Inferior gluteal artery:** Participates in the cruciate anastomosis of the thigh and anastomoses with the superior gluteal artery. Supplies the gluteus maximus, quadratus femoris, and the obturator internus muscles, as well as the proximal portions of the hamstring muscles. A major source of blood for the sciatic nerve.
- **Inferior gluteal vein:** Accompanies the inferior gluteal artery through the greater sciatic foramen, inferior to the piriformis muscle. Communicates with the femoral vein.

Clinical Relevance: Gluteal pain that radiates to the caudal thigh and calf makes many clinicians think first of lumbar disk disease or sciatica from piriformis syndrome and related myofascial dysfunction. However, patients with varicose veins may develop gluteal varicosities that compress the sciatic nerve.[8] Other reported sources of neurovascular compression syndromes in the vicinity of GB 30 include post-operative aneurysm of the gluteal artery and aberrant arterial loops. Although surgery or medication may be necessary for some severe patients, physical medicine measures should be considered whether or not more invasive or pharmacologic treatments are instituted. Laser therapy may ease the pain and inflammation and acupuncture may alleviate myofascial restriction and neuropathic pain.

In that the inferior gluteal artery provides the sciatic nerve with its primary blood supply, myofascial compression of the artery may deprive the nerve of adequate nourishment and oxygen, predisposing it to incur a neuropathic state. Treatment of the soft tissues with acupuncture and related techniques may be indicated.

Indications and Potential Point Combinations

- **Pain in the low back, pelvis, or hip:** GB 30, GB 39, BL 54, BL 40, GB 34, BL 62, BL 23, and trigger points involved in the generation and maintenance of the pain problem.
- **Problems with hip mobility or leg strength:** GB 30, GB 29, BL 54, BL 40, other pertinent trigger points.
- **Piriformis syndrome:** Consider GB 30, GB 31, GB 34, GB 39, BL 40, BL 60, ST 36;[9] add relevant trigger points, massage, laser therapy.
- **Sciatic nerve injury:**[10] GB 30, GB 34, BL 40, KI 3, other points along the sciatic nerve course. Target affected branches and muscles impacted. Include laser therapy for nerve regeneration and massage to remove myofascial compression.
- **Calcifying tendonitis of the gluteus medius:** GB 30, BL 23, BL 25, BL 28, and BL 30.[11]

Evidence-Based Applications

- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) improved the orthopedic management of **chronic low back pain**.[1]
- Needling GB 30, GB 34, and BL 62 for **piriformis injury syndrome** outperformed needling at GB 30, GB 29, BL 36, and GB 34 in a reportedly randomized controlled trial.[2]
- Electroacupuncture at GB 30 and GB 34 significantly suppressed experimentally induced hyperalgesia, markedly inhibiting experimentally provoked cytokine increases; combining electroacupuncture with celecoxib resulted in a synergistic **analgesic** effect.[3]
- Daily electroacupuncture at GB 30 significantly alleviated experimentally induced hyperalgesia from **bone cancer pain** in rats, at least in part by suppressing dynorphin expression.[4]
- Electroacupuncture at GB 30 ever day for 30 minutes alleviated experimentally induced **bone cancer pain** at least in part by suppressing interleukin-1-beta expression.[5]
- Electroacupuncture at GB 30 and GB 34 appears to suppress spinal glial activation and behavioral hypersensitivity in experimentally induced **inflammatory pain states**.[6]

References

1. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain*. 2002;99:579-587.
2. Yang JX and Zhu XY. (Chinese). Observation on therapeutic effect of three needling method on piriformis injury syndrome. *Zhongguo Zhen Jiu*. 2008;28(3):205-206.
3. Mi WL, Mao-Ying QL, Liu Q, et al. Synergistic anti-hyperalgesia of electroacupuncture and low dose of celecoxib in monoarthritic rats: involvement of cyclooxygenase activity in the spinal cord. *Brain Res Bull*. 2008;77(2-3):98-104.
4. Zhang RX, Li A, Liu B, et al. Electroacupuncture attenuates bone-cancer-induced hyperalgesia and inhibits spinal preprodynorphin expression in a rat model. *Eur J Pain*. 2008;12(7):870-878.
5. Zhang RX, Li A, Liu B, et al. Electroacupuncture attenuates bone cancer pain and inhibits spinal interleukin-1 beta expression in a rat model. *Anesth Analg*. 2007;105(5):1482-1488.
6. Sun S, Cao H, Han M, et al. Evidence for suppression of electroacupuncture on spinal glial activation and behavioral hypersensitivity in a rat model of monoarthritis. *Brain Res Bull*. 2008;75(1):83-93.
7. Petchprapa CN, Rosenberg ZS, Sconfienza LM, et al. MR imaging of entrapment neuropathies of the lwer extremity. Part 1. The pelvis and hip. *RadioGraphics*. 2010;30:983-1000.
8. Bendszus M, Rieckmann P, Perez J, et al. Painful vascular compression syndrome of the sciatic nerve caused by gluteal varicosities. *Neurology*. 2003;61:985-987.
9. Zou Z. Fifty-two cases of the piriformis syndrome treated by centro-square needling. *J Tradit Chin Med*. 2009;29(1):11-12.
10. Hoang NS, Sar C, Valmier J, et al. Electro-acupuncture on functional peripheral nerve regeneration in mice: behavioural study. *BMC Complementary and Alternative Medicine*. 2012;12:141.
11. Lin W, Liu C-Y, Tang C-L, et al. Acupuncture and small needle scalpel therapy in the treatment of calcifying tendonitis of the gluteus medius: a case report. *Acupunct Med*. 2012;20(2):142-143.

GB 31

Feng Shi "Wind Market"

On the lateral thigh, directly below the greater trochanter, 7 cun proximal to the transverse popliteal crease. With the patient standing with arms hanging freely and the hands close to the thighs, one finds the point where the tip of the middle finger touches the lateral thigh. Since the distance between the greater trochanter and the popliteal crease measures 19 cun, GB 31 lies at the tender spot approximately 1 cun proximal to the junction of the middle and lower thirds of this line.

Fascia

- **Fascia lata:** The strong and deep fascia of the lower limb envelops the muscles it contains like an elastic stocking. By preventing the muscles of the limb from bulging during contraction, blood returns from the limb to the heart more efficiently.
- **Iliotibial band:** The iliotibial band (ITB) constitutes a thickening of the fascia lata on the lateral aspect of the limb, originating from fibers of the gluteus maximus, gluteus medius, and tensor fasciae latae muscles. It functions in part as a tendon for these structures. The ITB attaches proximal to the knee joint into the lateral femoral condyle as well as distal to the knee into the infracondylar tubercle of the tibia. Where it attaches below the knee, it inserts onto the tibial and fibula. There, it trifurcates into three separate bands. One attaches to the lateral aspect of the patella, one to Gerdy's tubercle, and one to the fibular head and biceps femoris tendon and aponeurosis. View the extensive size of the iliotibial band in Figure 11-88. Considering its femoral and tibial mechanical connections, atypical or abnormal hip and lower limb movements could strain the ITB.

Clinical Relevance: At the knee, the ITB functions primarily as a lateral stabilizing ligament to the lateral hip and knee. The ITB performs a complex series of functions that aid in knee stabilization through both flexion and extension. Iliotibial band syndrome (ITBS) is considered the second leading cause of pain in runners. It has become the most common source of lateral

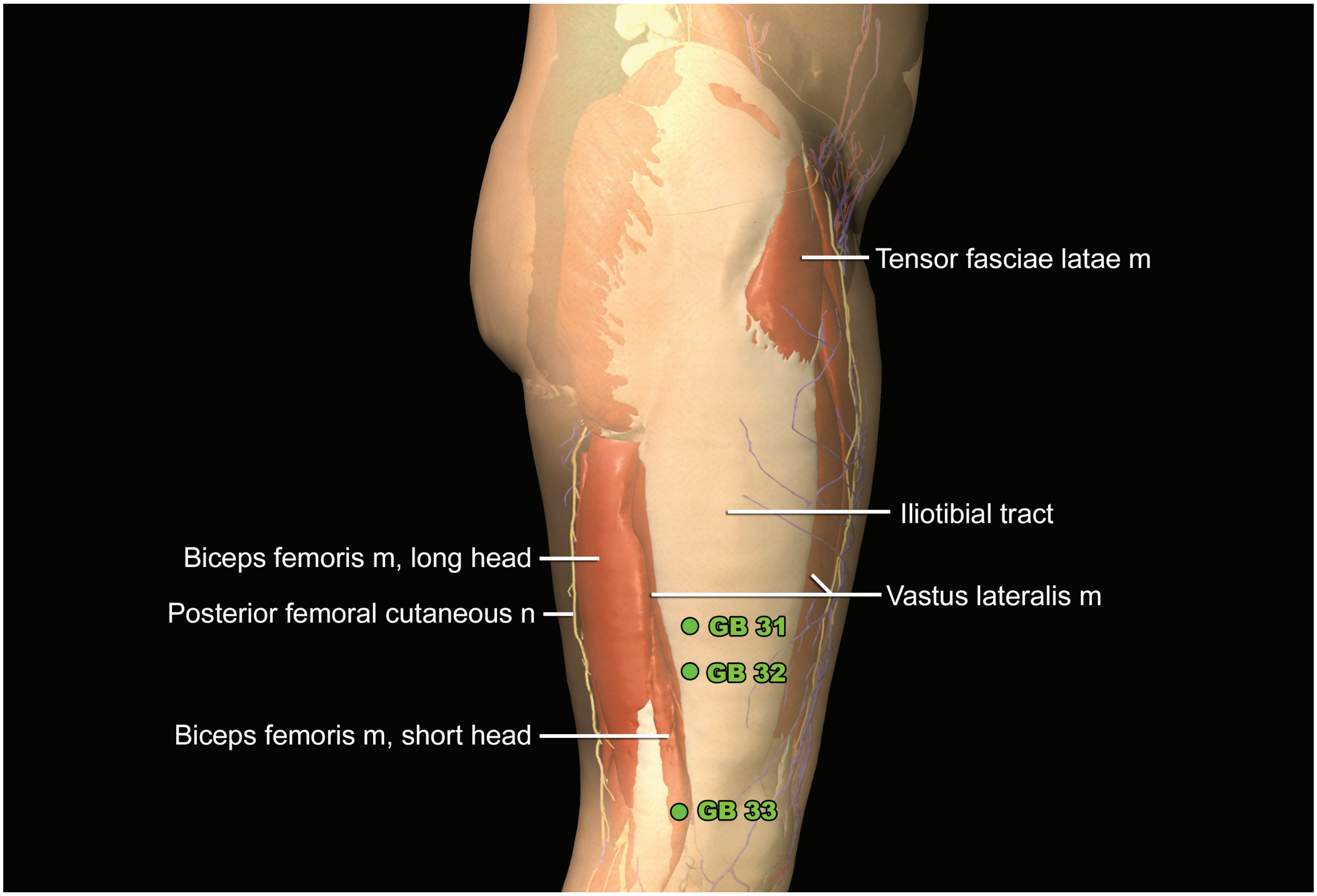

Tensor fasciae latae m
Iliotibial tract
Biceps femoris m, long head
Vastus lateralis m
Posterior femoral cutaneous n
GB 31
GB 32
Biceps femoris m, short head
GB 33

Figure 11-88. The GB line follows the caudal, or posterior, aspect of the iliotibial tract to the knee. Its intermediary position "between the two sinews" of the hamstrings and "quads" allows it to impact both extensors and flexors of the hip. Referred pain emanating from trigger points in the vastus lateralis muscle adheres closely to the trajectory outlined by the GB channel, extending from the hip to GB 34. The impact of GB 31 on tension, pain, and restricted mobility of the pelvic limb accounts for the point's name of "Wind Market". Wind and cold from the external environment further restricts movement by tightening (or shortening) the fascial band of the iliotibial tract and the veritable stocking formed by the fascia lata. "Wind Market" implies a concentration of this metaphorical wind at GB 31. It identifies a locus of pain and tension that manifests as a product of climatic factors affecting the thigh. Internal wind disorders in Chinese medicine indicate, in contrast, dysfunction caused by neurologic impairment. Paresis and paralysis of the lower limb due to peripheral or central nervous system lesions impair movement and induce contractures; GB 31 may assist in the recovery of lower limb function by attending to myofascial restrictions in this region.

knee pain.[3] Female runners who develop this syndrome exhibit limb kinematics suggestive of increased stress placed on the iliotibial band. While making adjustments in posture and limb motions during exercise would aid ITBS, acupuncture, massage, and laser therapy applied to the hip, ITB, and knee insertions supports recovery as well.

Muscles

- **Vastus lateralis muscle:** Extends the knee.
- **Vastus intermedius muscle:** Extends the knee.
- **Biceps femoris muscle:** Flexes the leg and, when the knee flexes, rotates the leg in a lateral direction. Extends the thigh at the hip when walking begins, keeping the trunk erect. Controls flexion at the hip during standing and forward bending. The short head of the bicep femoris, in particular, flexes the knee to allow the toes to clear the ground during ambulation.

Clinical Relevance: Pain in the hamstrings may cause patients to overload the quadriceps. Shortened hamstrings disrupt the biomechanical balance of walking and standing, promoting the spread and recurrence of trigger points in other muscles as weight is redistributed to compensate for unloading the painful muscle.

Travell and Simons call the quadriceps femoris group the "four-faced trouble maker". Individually, the rectus femoris is called "the two-jointed puzzler"; the vastus medialis is "the buckling knee muscle", the vastus intermedius is "the frustrator", and the vastus lateralis is "the stuck patella muscle" and exhibits the largest bulk of the four.

Five trigger point locations in the vastus lateralis have the potential to issue pain patterns along the entire thigh to the knee along the GB pathway. Superficial trigger points refer pain locally whereas deeper pathology produces deep pain that "explodes" in proximal and caudal directions. Pain typically worsens when lying on that side at night, interrupting sleep. The sense of having a "stuck patella" erupts from trigger points in the GB 32/GB 33 portion of the GB trajectory. These sites send pain toward the knee that may seem to enter into and through the knee. In fact, trigger points in and around GB 31 through GB 33 may refer pain as far proximad as GB 29 (almost to GB 26) and as far distad as GB 34. Travell and Simons refer to this cluster of myofascial consolidation as a "hornet's nest" of trigger points. About one-third of children with myofascial pain harbor trigger points in the vastus lateralis muscle.

In particular, trigger points in the vastus lateralis that abut the fascia lata can issue a pain sensation described as akin to a "bolt of lightning". Muscles affected by needling GB 31 depend on the depth of needle insertion, as Figure 11-90 displays.

Dubbed the "frustrator" muscle, the vastus intermedius develops difficult-to-find trigger points, hidden beneath the rectus femoris muscle. Pain from these trigger points extends over the front of the thigh and focus at mid-thigh.

Trigger points in the gluteus minimus muscle ("pseudo-sciatica" muscle) cause the patient to perceive pain in the buttock at GB 30 and the entire GB trajectory from the greater trochanter to GB 39 and on to the lateral malleolus.

Tensor fasciae latae muscle trigger points from GB 28 refer along the GB channel toward GB 31, GB 32, and almost reach GB 33.

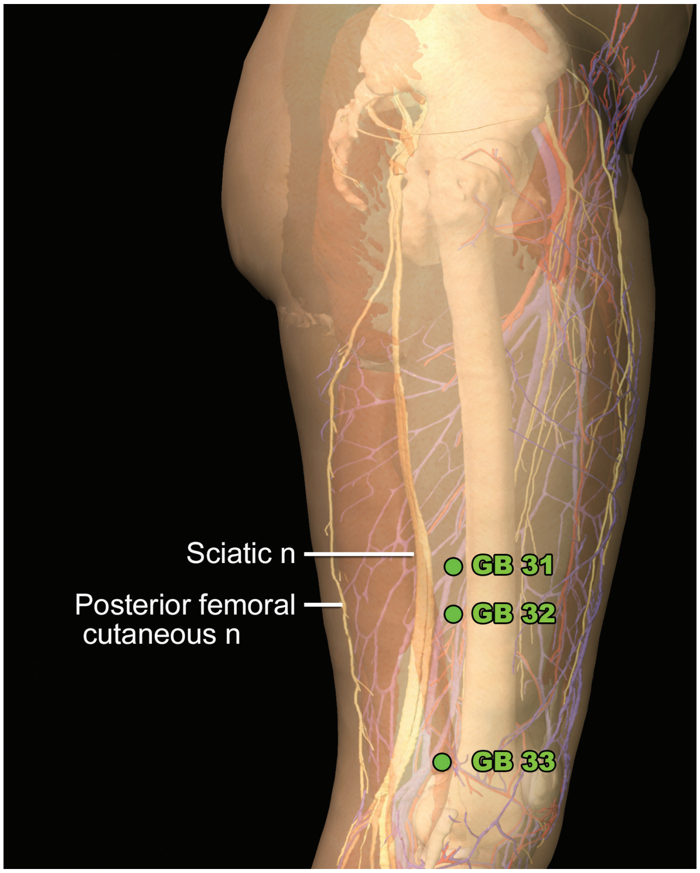


Figure 11-89. The "Internal Wind" alluded to in the name "Wind Market" for GB 31 metaphorically represents neurologic dysfunction in Chinese medicine. This image depicts two of the nerves potentially responsible for that dysfunction, including 1) the posterior femoral cutaneous nerve, supplying sensation to the buttock, perineum, posterior thigh, popliteal fossa, and proximal leg, and 2) the sciatic nerve, supplying motor function to the hamstrings and articular branches to the hip and knee joints. The posterior femoral cutaneous nerve supplies more skin than does any other cutaneous nerve. Although it does not lie directly in sight of the GB channel, this nerve is vulnerable to tension caused by restriction in the fascia affiliated with the GB line. That is, the posterior femoral cutaneous nerve lies deep to the fascia lata (the "deep fascia") and sends its sprigs to the skin. Excessive tension in the fascial stocking hinted at here could disrupt sensation due to nerve compression. The sciatic nerve provides motor supply to the hamstrings and the leg as well as sensation to most of the leg and all of the foot. The lateral femoral cutaneous nerve, while not visible in this image, supplies sensation to the lateral aspect of the thigh along the GB trajectory.

Trigger points in the biceps femoris, as with other hamstring muscles, can cause the patient to limp; the pain of placing a load on these muscles may also inhibit muscle function and reduce hip stability. Trigger points in the vicinity of GB 31 could arise in either the short or long head of the biceps femoris muscle; pain refers strongly to the popliteal fossa and may extend down the entire caudolateral thigh.

Nerves

- **Lateral femoral cutaneous nerve (L2, L3):** Innervates the skin the anterior thigh and the lateral aspect, from the greater trochanter to the knee.
- **Femoral nerve (L2-L4):** Innervates the muscles of the anterior

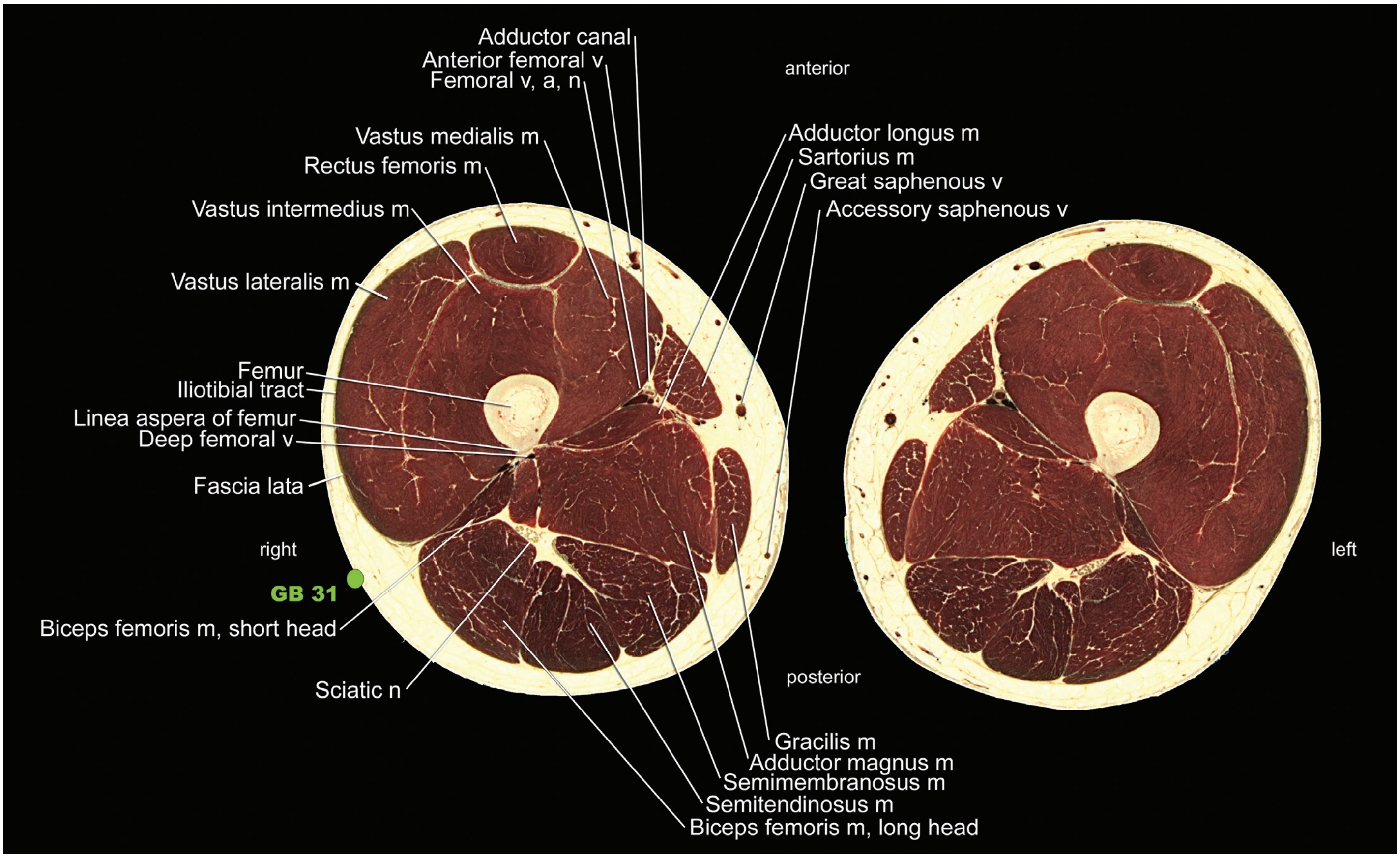

Adductor canal
Anterior femoral v
Femoral v, a, n
anterior
Vastus medialis m
Rectus femoris m
Vastus intermedius m
Vastus lateralis m
Adductor longus m
Sartorius m
Great saphenous v
Accessory saphenous v
Femur
Iliotibial tract
Linea aspera of femur
Deep femoral v
Fascia lata
right
left
GB 31
Biceps femoris m, short head
Sciatic n
posterior
Gracilis m
Adductor magnus m
Semimembranosus m
Semitendinosus m
Biceps femoris m, long head

Figure 11-90. The robust muscles and formidable fascia within reach of GB 31 highlight why early Chinese acupuncturists named this point the "Wind Market". Cold and wind constrict the tissue; acupuncture frees fascia and treats triggers incited by wind, cold, and neurologic compromise.

thigh, hip, and knee, as well as the skin on the anteromedial thigh.

- **Sciatic nerve (L4-S3):** The sciatic nerve supplies the biceps femoris as well as the other hamstring muscles, the semitendinosus and semimembranosus muscles. It divides into the tibial and common fibular (common peroneal) nerves to supply the flexor muscles and extensor/abductor muscles of the leg, respectively. Supplies sensation to the leg below the knee and all of the foot, except for the medial calf and ankle (see LR line) that receives sensory supply by the saphenous branch of the femoral nerve. The sciatic nerve sends a small branch to the hip joint, as well as an articular branch to the knee joint. It fully supplies the ankle joint.

Clinical Relevance: Entrapment mononeuropathy of the lateral femoral cutaneous nerve has been implicated in meralgia paresthetica, a clinical syndrome involving burning pain and/or dysesthesia in the anterolateral thigh. Contributing factors to meralgia paresthetica include 1) Repetitive or continuous contraction or pathological shortening of the iliopsoas and sartorius muscles, 2) Pelvic tilt and limb length discrepancy that place heightened tension on the inguinal ligament, and 3) Anatomic variations that make the lateral femoral cutaneous nerve more vulnerable to compression.[4]

Input from Group III- and Group IV-mediated afferent feedback through the femoral nerve influences the voluntary termination of exercise. This suggests that somatic afferent stimulation in the quadriceps muscle group may reduce peripheral fatigue and improve muscular adaptation to exercise.[5]

Vessels

- **Lateral circumflex femoral artery, descending branch:** Descends to the knee to join the genicular anastomosis. May arise from either the deep artery of the thigh or the femoral artery.
- **Lateral circumflex femoral vein:** Often terminates in the femoral vein, but may drain into the deep femoral vein.
- **Inferior gluteal artery:** Supplies the sciatic nerve.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Pain in hip, thigh, or knee:** GB 31; analyze which components of the myofascial structures of the lower body are participating in causing this pain. Investigate both hamstring and quadriceps muscle groups.
- **Restricted hip mobility or hip instability:** GB 31, GB 29, GB 30, and targeted trigger points.
- **Weakness in the pelvic limbs:** GB 31, trigger points responsible for inhibiting motor function, neuroanatomically applicable points to address sciatic or femoral nerve dysfunction.
- **Generalized pruritus:** GB 31, LI 11.

Evidence-Based Applications

- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[1]
- Warm needle acupuncture at GB 31 (a.k.a. moxibustion combined with needling) provided better **analgesia** compared to dry needling or moxibustion without needling in formalin-induced pain in rats.[2]
- In elderly patients following **total hip arthroplasty,** those who received transcutaneous electrical nerve stimulation (TENS) applied to ipsilateral GB 31 and bilateral LI 4, ST 36, and PC 6 required less fentanyl and reported less pain post-operatively for two days.[6]

References

1. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed*. 2000;28(1):25-33.
2. Kim H, Shim I, Yi SH, et al. Warm needle acupuncture at Pungsi (GB31) has an enhanced analgesic effect on formalin-induced pain in rats. *Brain Res Bull*. 2009;78 (4-5):164-169.
3. Ferber R, Noehren B, Hamill J, et al. Competitive female runners with a history of iliotibial band syndrome demonstrate atypical hip and knee kinematics. *J Orthop Sports Phys Ther*. 2010;40(2):52-58.
4. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res*. 2010;2(6):274-276.
5. Rossman MJ, Venturelli M, McDaniel J, et al. Muscle mass and peripheral fatigue: a potential role for afferent feedback? *Acta Physiol*. 2012; Jul 4. doi: 10.1111/j.1748-1716.2012.02471.x.
6. Lan F, Ma Y-H, Xue J-X, et al. Transcutaneous electrical nerve stimulation on acupoints reduces fentanyl requirement for postoperative pain relief after total hip arthroplasty in elderly patients. *Minerva Anestesiol*. 2012;78:887-895.

GB 32

Zhong Du "Middle Ditch", "Central Channel", "Central River"

On the lateral thigh between the vastus lateralis and biceps femoris muscles, 5 cun proximal to the transverse popliteal crease. 2 cun distal to GB 31. Find at a tender point just proximal to the junction of the upper three-fourths and lower one-fourth along the line defined by the prominence of the greater trochanter and the lateral limit of the popliteal crease.

Fascia

- **Fascia lata:** The strong and deep fascia of the lower limb envelops the muscles it contains like an elastic stocking. By preventing the muscles of the limb from bulging during contraction, blood returns from the limb to the heart more efficiently.
- **Iliotibial band:** The iliotibial band (ITB) constitutes a thickening of the fascia lata on the lateral aspect of the limb, originating from fibers of the gluteus maximus, gluteus medius, and tensor fasciae latae muscles. It functions in part as a tendon for these structures. The ITB attaches proximal to the knee joint into the lateral femoral condyle as well as distal to the knee into the infracondylar tubercle of the tibia. Where it attaches below the knee, it inserts onto the tibial and fibula. There, it trifurcates into three separate bands. One attaches to the lateral aspect of the patella, one to Gerdy's tubercle, and one to the fibular head and biceps femoris tendon and aponeurosis. View the extensive size of the iliotibial band in Figure 11-88. Considering its femoral and tibial mechanical connections, atypical or abnormal hip and lower limb movements could strain the ITB.

Clinical Relevance: At the knee, the ITB functions primarily as a lateral stabilizing ligament to the lateral hip and knee. The ITB performs a complex series of functions that aid in knee stabilization through both flexion and extension. Iliotibial band syndrome (ITBS) is considered the second leading cause of pain in runners. It has become the most common source of lateral knee pain. Female runners who develop this syndrome exhibit limb kinematics suggestive of increased stress placed on the iliotibial band. While making adjustments in posture and limb motions during exercise would aid ITBS, acupuncture, massage, and laser therapy applied to the hip, ITB, and knee insertions supports recovery as well.

Muscles

- **Vastus lateralis muscle:** Extends the knee.
- **Vastus intermedius muscle:** Extends the knee.
- **Biceps femoris muscle:** Flexes the leg and, when the knee flexes, rotates the leg in a lateral direction. Extends the thigh at the hip when walking begins, keeping the trunk erect. Controls flexion at the hip during standing and forward bending. The short head of the bicep femoris, in particular, flexes the knee to allow the toes to clear the ground during ambulation.

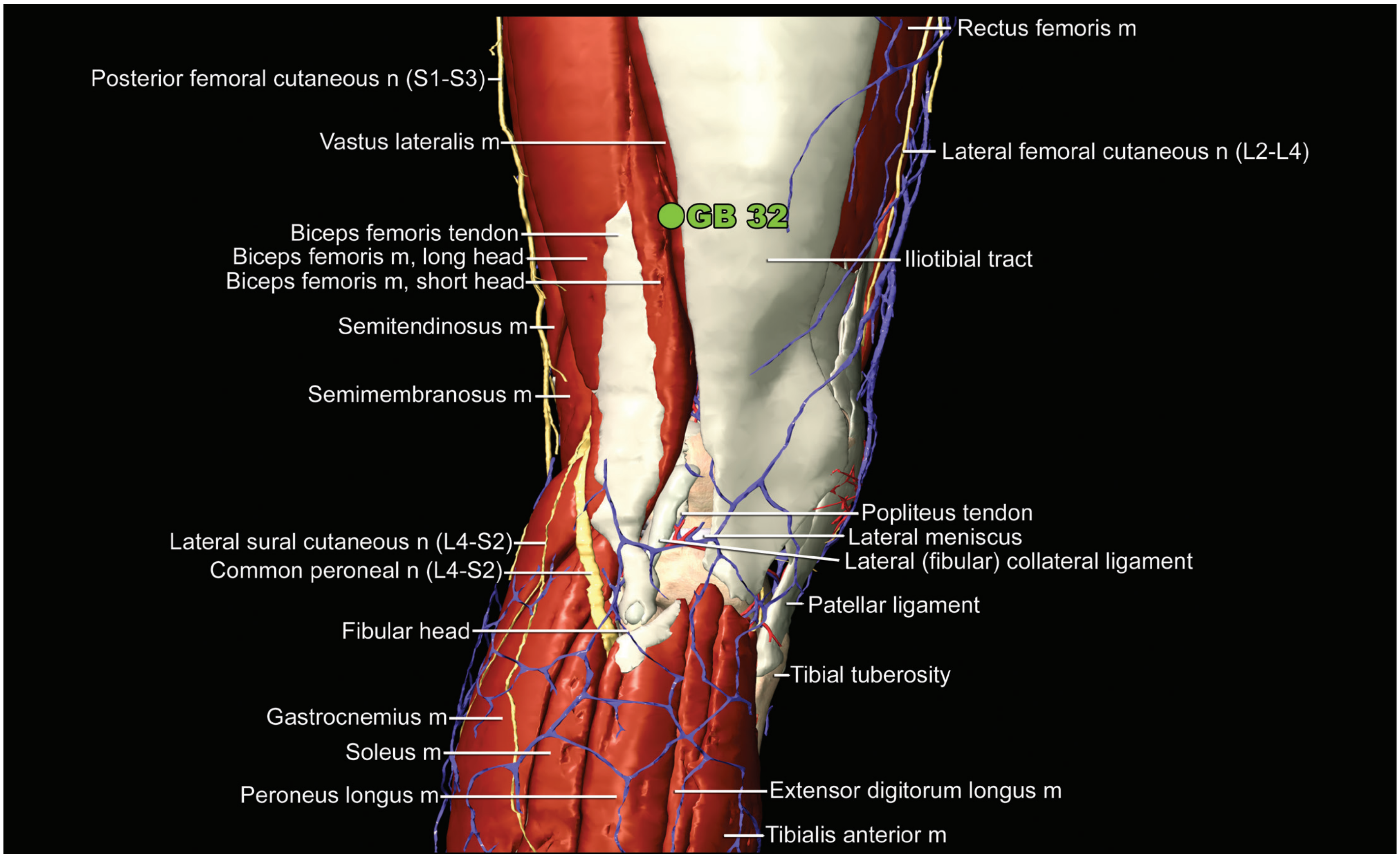

Posterior femoral cutaneous n (S1-S3)
Vastus lateralis m
Biceps femoris tendon
Biceps femoris m, long head
Biceps femoris m, short head
Semitendinosus m
Semimembranosus m
Lateral sural cutaneous n (L4-S2)
Common peroneal n (L4-S2)
Fibular head
Gastrocnemius m
Soleus m
Peroneus longus m
Rectus femoris m
Lateral femoral cutaneous n (L2-L4)
GB 32
Iliotibial tract
Popliteus tendon
Lateral meniscus
Lateral (fibular) collateral ligament
Patellar ligament
Tibial tuberosity
Extensor digitorum longus m
Tibialis anterior m

Figure 11-91. GB 32, the "Middle Ditch", "Central Channel", or "Central River" exists in a deep groove between the flexor and extensor compartments of the thigh, demarcated by the lateral femoral intermuscular septum and the caudal border of the iliotibial tract. Figure 11-93 exposes the lateral intermuscular septum well.

Clinical Relevance: Pain in the hamstrings may cause patients to overload the quadriceps. Shortened hamstrings disrupt the biomechanical balance of walking and standing, promoting the spread and recurrence of trigger points in other muscles as weight is redistributed to compensate for unloading the painful muscle.

Travell and Simons call the quadriceps femoris group the "four-faced trouble maker". Individually, the rectus femoris is called "the two-jointed puzzler"; the vastus medialis is "the buckling knee muscle", the vastus intermedius is "the frustrator", and the vastus lateralis is "the stuck patella muscle" and exhibits the largest bulk of the four.

Five trigger point locations in the vastus lateralis have the potential to issue pain patterns along the entire thigh to the knee along the GB pathway. Superficial trigger points refer pain locally whereas deeper pathology produces deep pain that "explodes" in proximal and caudal directions. Pain typically worsens when lying on that side at night, interrupting sleep. The sense of having a "stuck patella" erupts from trigger points in the GB 32/GB 33 portion of the GB trajectory. These sites send pain toward the knee that may seem to enter into and through the knee. In fact, trigger points in and around GB 31 through GB 33 may refer pain as far proximad as GB 29 (almost to GB 26) and as far distad as GB 34. Travell and Simons refer to this cluster of myofascial consolidation as a "hornet's nest" of trigger points. About one-third of children with myofascial pain harbor trigger points in the vastus lateralis muscle.

In particular, trigger points in the vastus lateralis that abut the fascia lata can issue a pain sensation described as akin to a "bolt of lightning". Muscles affected by needling GB 32 depend on the depth of needle insertion, as Figure 11-93 shows.

Dubbed the "frustrator" muscle, the vastus intermedius develops difficult-to-find trigger points, hidden beneath the rectus femoris muscle. Pain from these trigger points extends over the front of the thigh and focus at mid-thigh.

Trigger points in the gluteus minimus muscle ("pseudo-sciatica" muscle) cause the patient to perceive pain in the buttock at GB 30 and the entire GB trajectory from the greater trochanter to GB 39 and on to the lateral malleolus.

Tensor fasciae latae muscle trigger points from GB 28 refer along the GB channel toward GB 31, GB 32, and almost reach GB 33.

Trigger points in the biceps femoris, as with other hamstring muscles, can cause the patient to limp; the pain of placing a load on these muscles may also inhibit muscle function and reduce hip stability. Trigger points in the vicinity of GB 32 could arise in either the short or long head of the biceps femoris muscle as revealed by Figure 11-93; pain from these sites refers strongly to the popliteal fossa and may extend down the entire caudolateral thigh.

Nerves

- **Lateral femoral cutaneous nerve (L2, L3):** Innervates the skin the anterior and lateral parts of the thigh.
- **Femoral nerve (L2-L4):** Innervates the muscles of the anterior thigh, hip, and knee, as well as the skin on the anteromedial thigh.
- **Sciatic nerve (L4-S3):** The sciatic nerve supplies the biceps femoris as well as the other hamstring muscles, the semitendinosus and semimembranosus muscles. It divides into the tibial and common fibular (common peroneal) nerves to supply the flexor muscles and extensor/abductor muscles of the leg, respectively. Supplies sensation to the leg below the knee and all of the foot, except for the medial calf and ankle (see LR line) that receives sensory supply by the saphenous branch of the femoral nerve. The sciatic nerve sends a small branch to the hip joint, as well as an articular branch to the knee joint. It fully supplies the ankle joint.

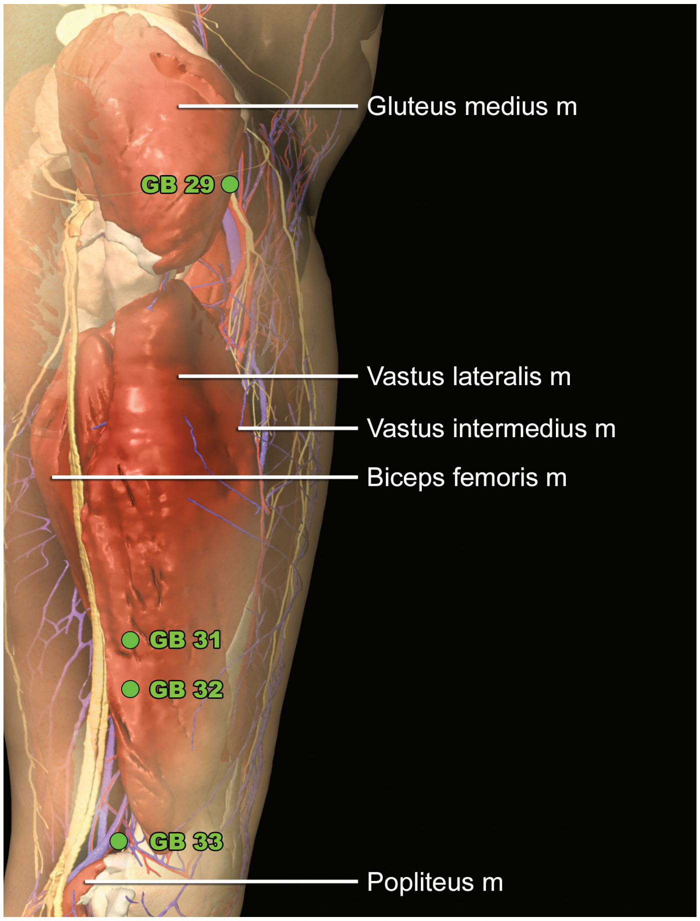


Figure 11-92. This image explores the relationship between the deep muscles of the hip and thigh to GB 29, GB 31, GB 32, and GB 33. Each location designates a region rich with trigger points.

Clinical Relevance: Entrapment mononeuropathy of the lateral femoral cutaneous nerve has been implicated in meralgia paresthetica, a clinical syndrome involving burning pain and/or dysesthesia in the anterolateral thigh. Contributing factors to meralgia paresthetica include 1) Repetitive or continuous contraction or pathological shortening of the iliopsoas and sartorius muscles, 2) Pelvic tilt and limb length discrepancy that place heightened tension on the inguinal ligament, and 3) Anatomic variations that make the lateral femoral cutaneous nerve more vulnerable to compression.

Input from Group III- and Group IV-mediated afferent feedback through the femoral nerve influences the voluntary termination of exercise. This suggests that somatic afferent stimulation in the quadriceps muscle group may reduce peripheral fatigue and improve muscular adaptation to exercise.

The posterior femoral cutaneous nerve supplies more skin than does any other cutaneous nerve. Although it does not lie directly

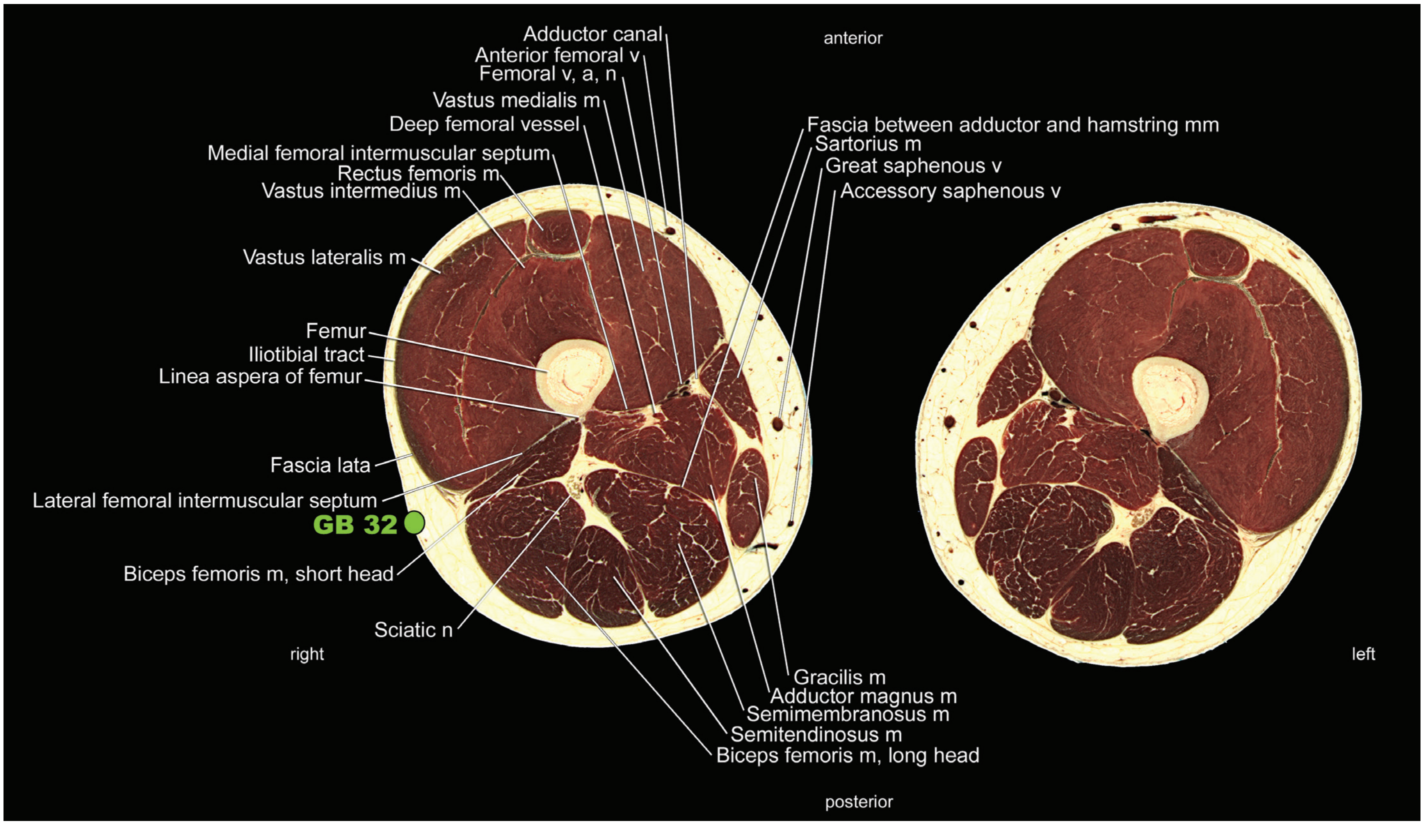

Adductor canal
Anterior femoral v
Femoral v, a, n
Vastus medialis m
Deep femoral vessel
Medial femoral intermuscular septum
Rectus femoris m
Vastus intermedius m
Vastus lateralis m
Femur
Iliotibial tract
Linea aspera of femur
Fascia lata
Lateral femoral intermuscular septum
GB 32
Biceps femoris m, short head
Sciatic n
right
anterior
Fascia between adductor and hamstring mm
Sartorius m
Great saphenous v
Accessory saphenous v
left
Gracilis m
Adductor magnus m
Semimembranosus m
Semitendinosus m
Biceps femoris m, long head
posterior

Figure 11-93. GB 32 provides access to the short and long heads of the biceps femoris muscle along with the vastus lateralis and vastus intermedius, depending on angle and depth of needle insertion. As a cautionary note, examine the relationship of the sciatic nerve to GB 32, i.e., it lies well within reach of a deeply placed needle.

in sight of the GB channel, this nerve is vulnerable to tension caused by restriction in the fascia affiliated with the GB line. That is, the posterior femoral cutaneous nerve lies deep to the fascia lata (the "deep fascia") and sends its sprigs to the skin. Excessive tension in the fascial stocking hinted at here could disrupt sensation due to nerve compression. The sciatic nerve provides motor supply to the hamstrings and the leg as well as sensation to most of the leg and all of the foot. The lateral femoral cutaneous nerve, while not visible in this image, supplies sensation to the lateral aspect of the thigh along the GB trajectory.

Vessels

- **Lateral circumflex femoral artery, descending branch:** Descends to the knee to join the genicular anastomosis. May arise from either the deep artery of the thigh or the femoral artery.
- **Lateral circumflex femoral vein:** Often terminates in the femoral vein, but may drain into the deep femoral vein.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Pain in hip, thigh, or knee:** GB 32 or GB 31; analyze which components of the myofascial structures of the lower body are participating in causing this pain. Investigate both hamstring and quadriceps muscle groups. Pain in the hamstrings may cause patients to overload the quadriceps. Shortened hamstrings disrupt the biomechanical balance of walking and standing, promoting the spread and reappearance of trigger points in other muscles as weight is redistributed to compensate for unloading the painful muscle. Trigger points in the vastus lateralis muscle, a member of the quadriceps femoris pack, erupt at GB 31, GB 32, and GB 33, and pain refers to GB 34 and/or the popliteal fossa region, at BL 38, BL 39, and BL 40.
- **Restricted hip mobility or hip instability:** GB 32, GB 31, GB 29, GB 30, and targeted trigger points.
- **Weakness in the pelvic limbs:** GB 32, trigger points responsible for inhibiting motor function, neuroanatomically applicable points to address sciatic or femoral nerve dysfunction.

References

1. Ferber R, Noehren B, Hamill J, et al. Competitive female runners with a history of iliotibial band syndrome demonstrate atypical hip and knee kinematics. *J Orthop Sports Phys Ther*. 2010;40(2):52-58.
2. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res*. 2010;2(6):274-276.
3. Rossman MJ, Venturelli M, McDaniel J, et al. Muscle mass and peripheral fatigue: a potential role for afferent feedback? *Acta Physiol*. 2012; Jul 4. doi: 10.1111/j.1748-1716.2012.02471.x.

GB 33

Xi Yang Guan "Knee Yang Joint"

On the lateral aspect of the knee, proximal to the joint line, in a depression between the biceps femoris muscle and the iliotibial tract, approximately 3 cun proximal to GB 34. Can be found by palpating along the groove between the femur and the biceps femoris and locating the site where the finger enters a depression just proximal to the lateral epicondyle of the femur.

Fascia

- **Fascia lata:** The strong and deep fascia of the lower limb envelops the muscles it contains like an elastic stocking. By preventing the muscles of the limb from bulging during contraction, blood returns from the limb to the heart more efficiently.
- **Iliotibial band:** The iliotibial band (ITB) constitutes a thickening of the fascia lata on the lateral aspect of the limb, originating from fibers of the gluteus maximus, gluteus medius, and tensor fasciae latae muscles. It functions in part as a tendon for these structures. The ITB attaches proximal to the knee joint into the lateral femoral condyle as well as distal to the knee into the infracondylar tubercle of the tibia. Where it attaches below the knee, it inserts onto the tibial and fibula. There, it trifurcates into three separate bands. One attaches to the lateral aspect of the patella, one to Gerdy's tubercle, and one to the fibular head and biceps femoris tendon and aponeurosis. View the extensive size of the iliotibial band in Figure 11-88. Considering its femoral and tibial mechanical connections, atypical or abnormal hip and lower limb movements could strain the ITB.

Clinical Relevance: At the knee, the ITB functions primarily as a lateral stabilizing ligament to the lateral hip and knee. The ITB performs a complex series of functions that aid in knee stabilization through both flexion and extension. Iliotibial band syndrome (ITBS) is considered the second leading cause of pain in runners. It has become the most common source of lateral knee pain.[2] Female runners who develop this syndrome exhibit limb kinematics suggestive of increased stress placed on the iliotibial band. While making adjustments in posture and limb motions during exercise would aid ITBS, acupuncture, massage, and laser therapy applied to the hip, ITB, and knee insertions supports recovery as well.

Muscles

- **Biceps femoris muscle and tendon:** Flexes the leg and, when the knee flexes, rotates the leg in a lateral direction. Extends the thigh at the hip when walking begins, keeping the trunk erect. Controls flexion at the hip during standing and forward bending. The short head of the bicep femoris, in particular, flexes the knee to allow the toes to clear the ground during ambulation.

Clinical Relevance: Pain in the hamstrings may cause patients to overload the quadriceps. Shortened hamstrings disrupt the biomechanical balance of walking and standing, promoting the spread and recurrence of trigger points in other muscles as weight is redistributed to compensate for unloading the painful muscle. Trigger points in the biceps femoris, as with other hamstring muscles, can cause the patient to limp; the pain of placing a load on these muscles may also inhibit muscle function and reduce hip stability. Trigger points in the vicinity of GB 33 could arise in either the short or long head of the biceps femoris muscle; pain refers strongly to the popliteal fossa and may extend down the entire caudolateral thigh.

Trigger points in the gluteus minimus muscle ("pseudo-sciatica" muscle) cause the patient to perceive pain in the buttock at GB 30 and the entire GB trajectory from the greater trochanter to GB 39 and on to the lateral malleolus.

Tensor fasciae latae muscle trigger points from GB 28 refer along the GB channel toward GB 31, GB 32, and almost reach GB 33.

Nerves

- **Lateral femoral cutaneous nerve (L2, L3):** Innervates the skin the anterior and lateral parts of the thigh.
- **Sciatic nerve (L4-S3):** The sciatic nerve supplies the biceps femoris as well as the other hamstring muscles, the semitendinosus and semimembranosus muscles. It divides into the tibial and common fibular (common peroneal) nerves to supply the flexor muscles and extensor/abductor muscles of the leg, respectively. Supplies sensation to the leg below the knee and all of the foot, except for the medial calf and ankle (see LR line) that receives sensory supply by the saphenous branch of the femoral nerve. The sciatic nerve sends a small branch to the hip joint, as well as an articular branch to the knee joint. It fully supplies the ankle joint.

Clinical Relevance: Entrapment mononeuropathy of the lateral femoral cutaneous nerve has been implicated in meralgia paresthetica, a clinical syndrome involving burning pain and/

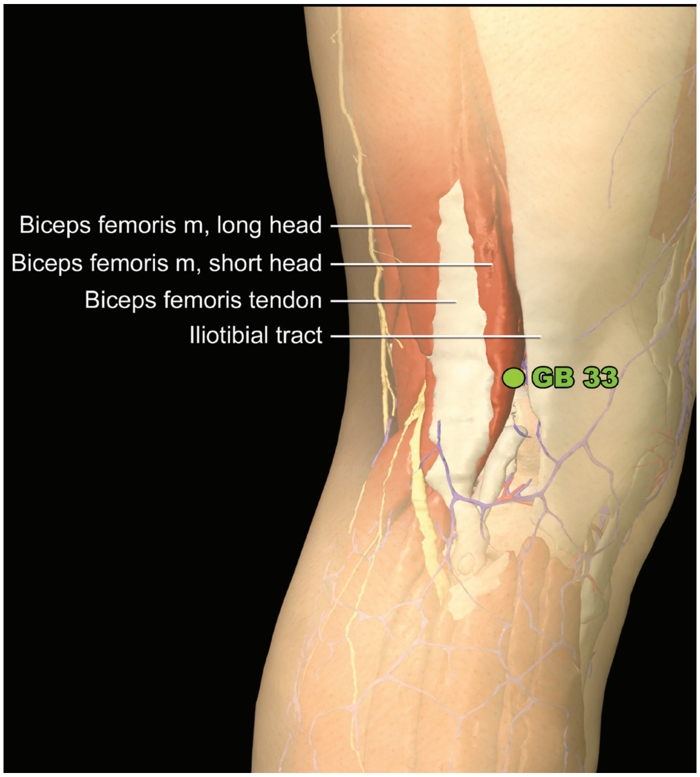


Figure 11-94. Attachment trigger points at GB 33 in either the short and long head of the biceps femoris muscle refer pain to the popliteal fossa and caudal thigh. This image shows a lateral perspective of the right knee.

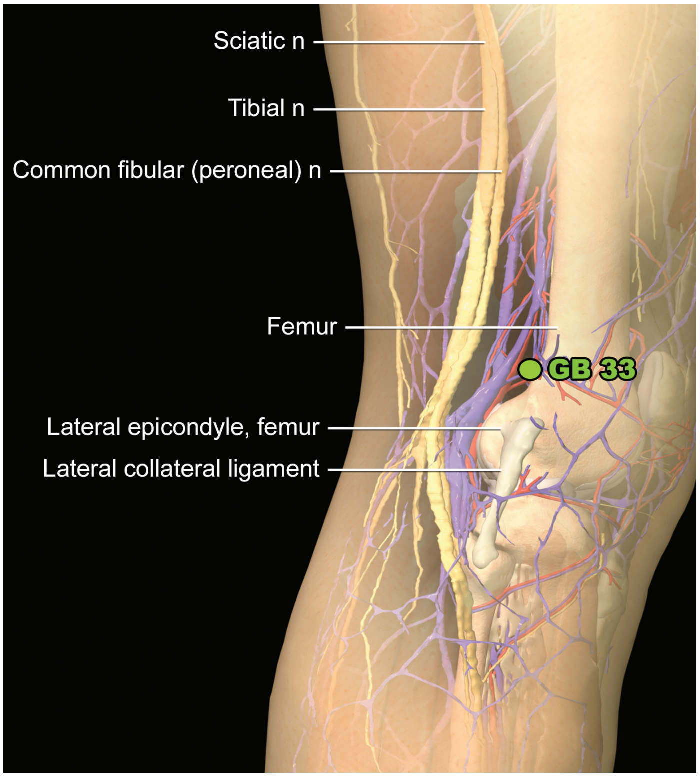

Sciatic n
Tibial n
Common fibular (peroneal) n
Femur
GB 33
Lateral epicondyle, femur
Lateral collateral ligament

Figure 11-95. “Knee Yang Joint”, the descriptive name for GB 33, lives proximal to the knee joint. In Chinese medicine, “superior” locations are Yang relative to “inferior”, which are Yin; similarly, “lateral” is Yang compared to “medial, which is Yin. Thus, a point located proximal and lateral to the joint itself qualifies as the “Knee Yang Joint” point. This image depicts the right knee, lateral aspect.

or dysesthesia in the anterolateral thigh. Contributing factors to meralgia paresthetica include 1) Repetitive or continuous contraction or pathological shortening of the iliopsoas and sartorius muscles, 2) Pelvic tilt and limb length discrepancy that place heightened tension on the inguinal ligament, and 3) Anatomic variations that make the lateral femoral cutaneous nerve more vulnerable to compression.[3]

Input from Group III- and Group IV-mediated afferent feedback through the femoral nerve influences the voluntary termination of exercise. This suggests that somatic afferent stimulation in the quadriceps muscle group may reduce peripheral fatigue and improve muscular adaptation to exercise.[4]

The posterior femoral cutaneous nerve supplies more skin than does any other cutaneous nerve. Although it does not lie directly in sight of the GB channel, this nerve is vulnerable to tension caused by restriction in the fascia affiliated with the GB line. That is, the posterior femoral cutaneous nerve lies deep to the fascia lata (the “deep fascia”) and sends its sprigs to the skin. Excessive tension in the fascial stocking hinted at here could disrupt sensation due to nerve compression. The sciatic nerve provides motor supply to the hamstrings and the leg as well as sensation to most of the leg and all of the foot. The lateral femoral cutaneous nerve, while not visible in this image, supplies sensation to the lateral aspect of the thigh along the GB trajectory.

Vessels

- **Lateral circumflex femoral artery, descending branch:** Descends to the knee to join the genicular anastomosis. May arise from either the deep artery of the thigh or the femoral artery.
- **Lateral circumflex femoral vein:** Often terminates in the femoral vein, but may drain into the deep femoral vein.

Clinical Relevance: Muscular compression and/or myofascial restriction in the anterolateral thigh may impede blood supply and drainage, facilitating the development and maintenance of myofascial trigger points in the region.

Indications and Potential Point Combinations

- **Knee pain:** Determine source and location of knee pain. For lateral knee pain affiliated with the lateral collateral ligament, the insertion of the biceps femoris muscle or iliotibial tract onto the tibia, or the lateral meniscus, GB 33 may be appropriate, along with GB 32 and ST 44. Pain in the popliteal fossa referred from trigger points in the biceps femoris may warrant stimulation of GB 33, BL 40, and other pertinent myofascial problems.
- **Knee osteoarthritis:** GB 33, GB 34, ST 34, SP 10, ST 35, ST, 36, CV 12, CV 4, ST 26, and SP 15.[5]
- **TMJ dysfunction:** GB 33, GB 2, GB 7, GB 8, GB 20, GB 21.

Evidence-Based Applications

- Supramaximal percutaneous electrical stimulation applied to the peroneal nerve through a surface electrode near GB 33 transiently disturbed stabilization of the postural stance; voluntary teeth clenching restored this stabilization. This study demonstrated the relationship between **1) activation of the motor portion of the trigeminal nerve as it contracts masseter muscle and 2) rapid postural adaptation to anterior-posterior perturbation of the upright position.**[1] These findings reinforce growing evidence linking lower limb function with reflexes affecting the trigeminal nerve. Further, it supports the contention that patients should rest after acupuncture and not engage in strenuous or athletic activity immediately after treatment in order to allow the body to adapt to the proprioceptive changes caused by some types of somatic afferent stimulation.
- Acupuncture applied to GB 33 affects **oxygen saturation** in the tissue to a depth of 2-4 cm.[6]

References

1. Fujino S et al. Influence of voluntary teeth clenching on the stabilization of postural stance disturbed by electrical stimulation of unilateral lower limb. *Gait Posture*. 2009, doi: 10.1016/j.gait.post.2009.09.010.
2. Ferber R, Noehren B, Hamill J, et al. Competitive female runners with a history of iliotibial band syndrome demonstrate atypical hip and knee kinematics. *J Orthop Sports Phys Ther*. 2010;40(2):52-58.
3. Ahmed A. Meralgia Paresthetica and femoral acetabular impingement: a possible association. *J Clin Med Res*. 2010;2(6):274-276.
4. Rossman MJ, Venturelli M, McDaniel J, et al. Muscle mass and peripheral fatigue: a potential role for afferent feedback? *Acta Physiol*. 2012; Jul 4. doi: 10.1111/j.1748-1716.2012.02471.x.
5. Meng C-R, Fan L, Fu W-B, et al. Clinical research on abdominal acupuncture plus conventional acupuncture for knee osteoarthritis. *J Tradit Chin Med*. 2009;29(4):249-252.
6. Litscher G, Ofner M, He W, et al. Acupressure at the meridian acupoint Xiyangguan (GB 33) influences near-infrared spectroscopic parameters (regional oxygen saturation) in deeper tissue of the knee in healthy volunteers. Evidence-Based Complementary and Alternative Medicine. 2013;Article ID 370341.

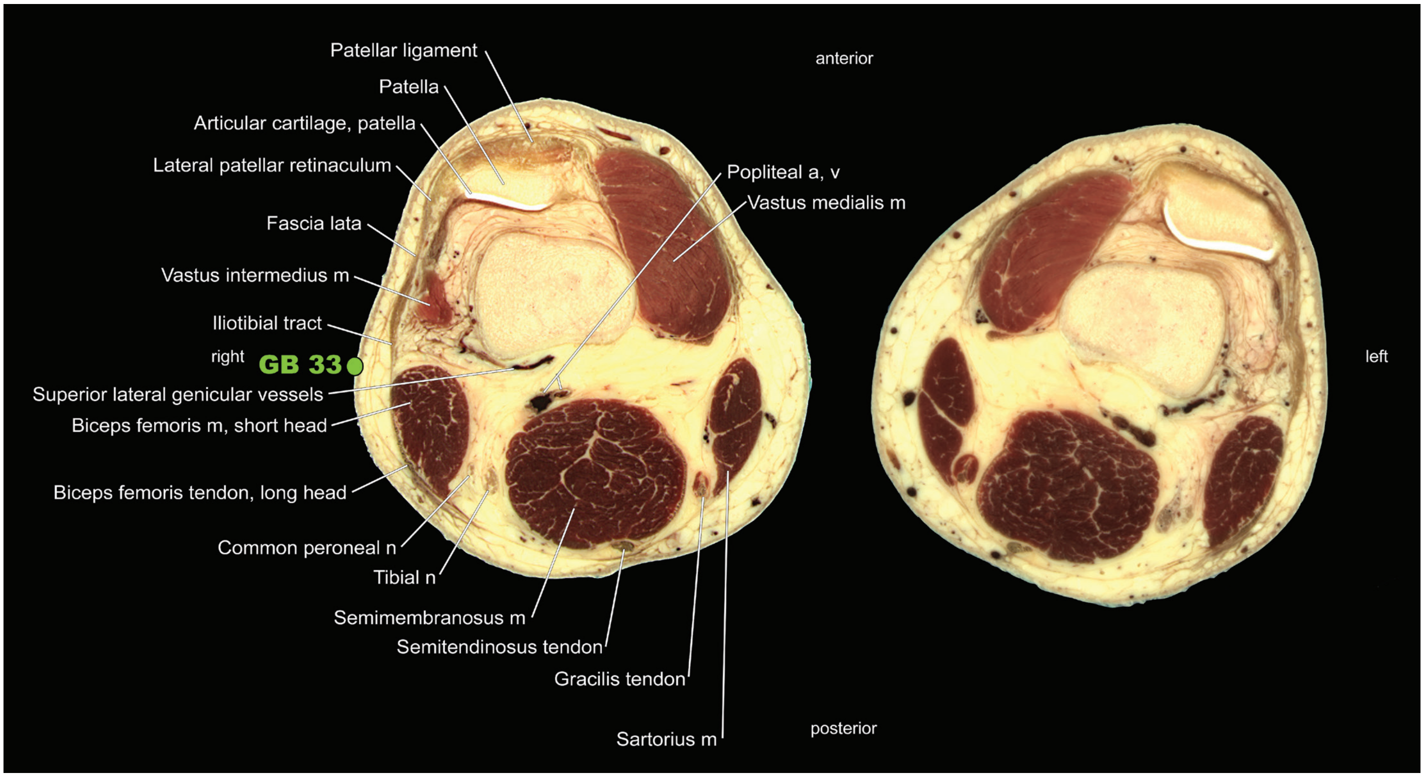

Patellar ligament
Patella
Articular cartilage, patella
Lateral patellar retinaculum
Fascia lata
Vastus intermedius m
Iliotibial tract
right
GB 33
Superior lateral genicular vessels
Biceps femoris m, short head
Biceps femoris tendon, long head
Common peroneal n
Tibial n
Semimembranosus m
Semitendinosus tendon
Gracilis tendon
Sartorius m
anterior
Popliteal a, v
Vastus medialis m
left
posterior

Figure 11-96. Only a remnant of the vastus intermedius appears in this cross section; as such, the biceps femoris muscle supplies most of the myofascial "meat" available for trigger point deactivation at GB 33.

GB 34

Yang Ling Quan "Yang Mound Spring"

In a depression approximately 1 cun cranial and distal to the head of the fibula.

Note: Excessively deep, vigorous, and/or otherwise incorrect needling practices could injure the peroneal (fibular) nerve at GB 34.[25,26]

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Extensor digitorum longus muscle:** Extends the lateral four digits; dorsiflexes the ankle. In conjunction with the extensor hallucis longus muscle, the extensor digitorum longus muscle functions to help control, or slow down, the descent of the forefoot to the floor right after heel-strike. This averts "foot-slap". Prevents excessive postural sway backward.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve and lead to significant problems with food drop and paresthesias. Trigger points in the peroneal (fibularis) muscles may cause "weak ankles".

Trigger points in the extensor digitorum longus muscle refer pain down the GB line to the foot and toes. Taut bands in the extensor digitorum longus may compress the deep peroneal nerve against the fibula and induce foot-drop. Treatment options include deactivation of the trigger points and taut bands responsible for the neuropraxia by means of acupuncture, laser therapy, and/or soft tissue manual therapy. These should be tried, ideally, before pursuing surgery.

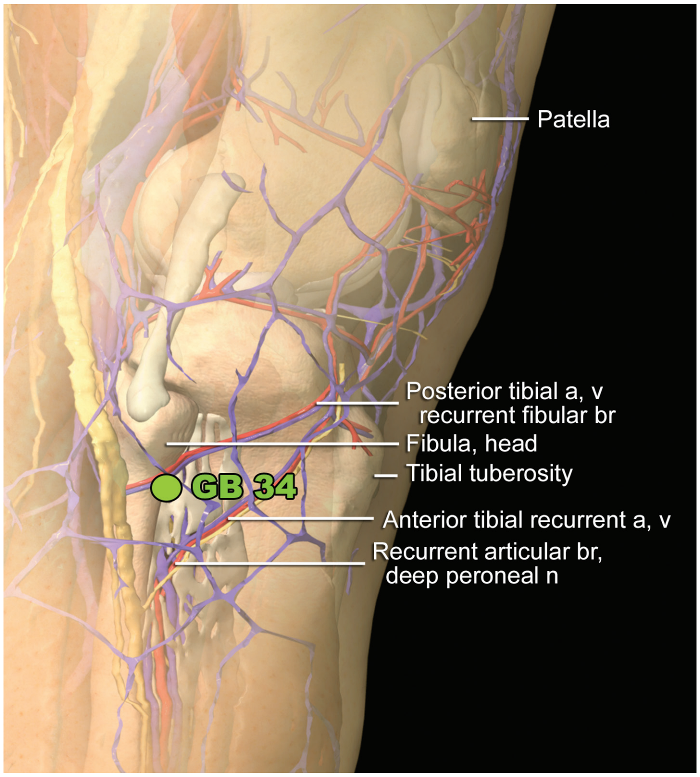


Figure 11-97. The "Yang Mound" at GB 34 refers to the fibular head, a prominence on the outer, or Yang, aspect of the knee. "Spring" speaks to the neurovascular structures participating in the genicular anastomoses. The Yin, or medial knee counterpart for "Yang Mound Spring" (GB 34) is SP 9, called "Yin Mound Spring".

Nerves

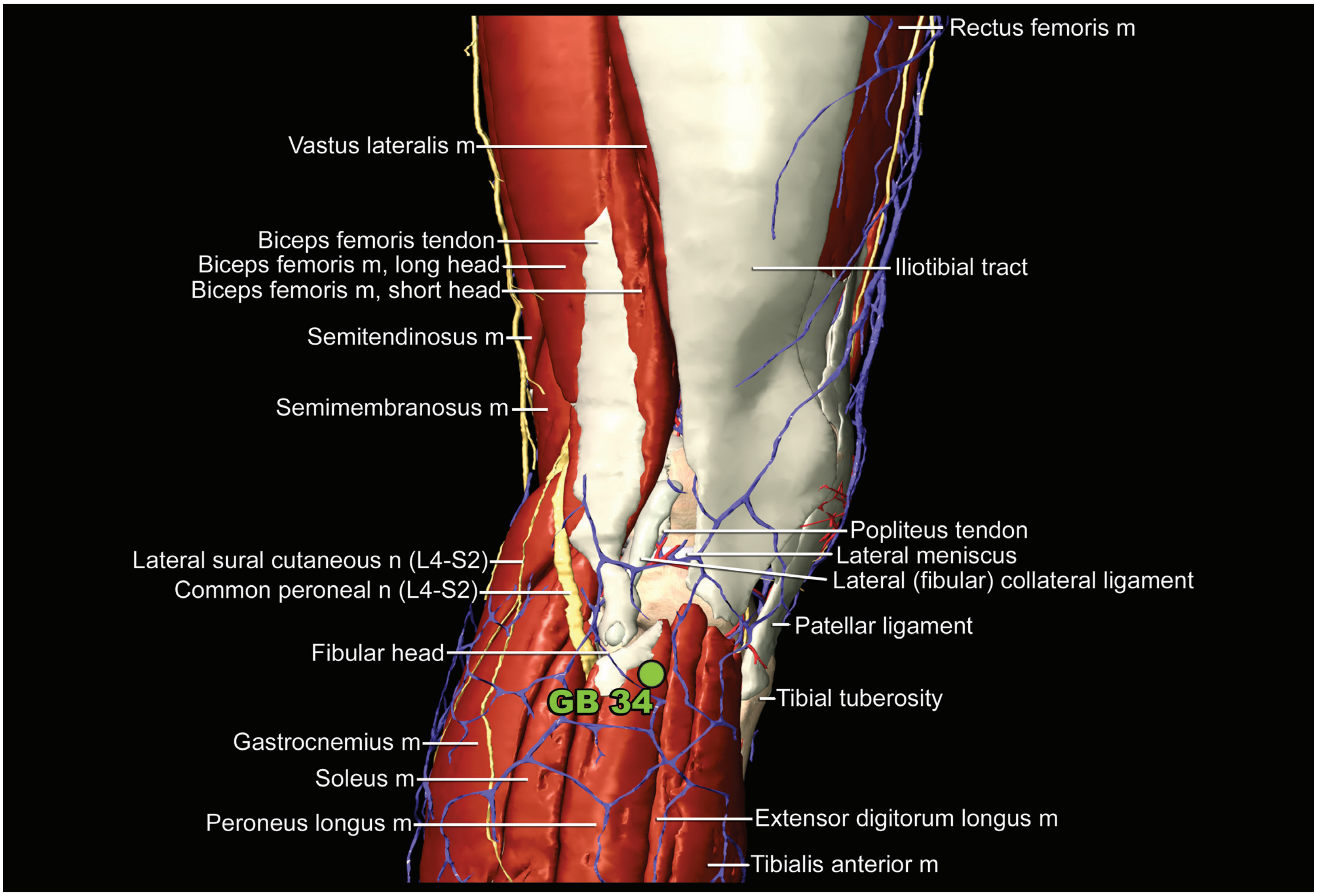
- **Recurrent articular nerve from common peroneal (fibular) nerve:** Supplies the knee joint.
- **Lateral sural cutaneous nerve (L5):** A branch of the common peroneal (fibular) nerve that innervates the skin on the lateral part of the caudal crus.
- **Superficial peroneal (fibular) nerve ((L4)L5-S2):** Innervates the peroneus (fibularis) longus and brevis muscles. Supplies the dorsal skin on the distal third of the crus and most of the dorsum of the foot.
- **Deep peroneal (fibular) nerve ((L4)L5-S1):** Supplies motor function to the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the 1st and 2nd digits and metatarsi. Emits articular branches to the joints it crosses.
- **Common peroneal (fibular) nerve:** Winds around the neck of the fibula after passing over the caudal aspect of the head. Travels deep to the peroneus (fibularis) longus where it then divides into its superficial and deep branches. Innervates the skin on the lateral aspect of the caudal crus via the lateral sural cutaneous nerve. Supplies the knee joint with an articular branch.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus of entrapment involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where its two heads attach onto the fibula. Because the lateral sural cutaneous nerve has branches off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this branch escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three nerves may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue may force the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[27]

Patients with common peroneal (fibular) nerve syndrome (i.e., neuropathic compression of the nerve trunk) report pain near GB 34 and along the GB channel. Pain worsens with exercise and pressure applied to the site of entrapment. Muscles affected by common peroneal (fibular) nerve syndrome demonstrate weakness of ankle dorsiflexion and inversion. Forcing the ankle into an inversion position accentuates discomfort. Chronic entrapment may cause foot drop.

Types of external compression that incite entrapment include osteophytes, surgery, tight plaster casts, ganglion or synovial cysts, crossed-leg sitting posture, constrictive clothing, and binding hosiery. Repetitive exercises that induce or worsen the problem include those involving repeated inversion and pronation. Examples include running, cycling, and the operation of certain machines. Lateral compartment syndrome afflicting



Rectus femoris m
Vastus lateralis m
Biceps femoris tendon
Biceps femoris m, long head
Biceps femoris m, short head
Iliotibial tract
Semitendinosus m
Semimembranosus m
Popliteus tendon
Lateral meniscus
Lateral sural cutaneous n (L4-S2)
Lateral (fibular) collateral ligament
Common peroneal n (L4-S2)
Patellar ligament
Fibular head
GB 34
Tibial tuberosity
Gastrocnemius m
Soleus m
Peroneus longus m
Extensor digitorum longus m
Tibialis anterior m

Figure 11-98. The reputation of GB 34 for treating the "sinews" or connective tissue, may derive from the many nearby intersecting structures, including the biceps femoris tendon, the lateral (fibular) collateral ligament, the lateral gastrocnemius tendon, fabellofibular ligament, mid third lateral capsular ligament, popliteofibular ligament, popliteus muscle and tendon, and the iliotibial band.[44] Note the way in which the common peroneal (fibular) nerve dives deep to the peroneus (fibularis) longus in this lateral view of the right knee as it enters the peroneal (fibular) tunnel discussed earlier.

the superficial peroneal (fibular) nerve may spill over into injuring the trunk as well.

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle.

At about the junction of the distal and middle third of the fibula, near GB 35, GB 36, and GB 37 territory, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by the crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 37 and GB 38, this nerve emerges through the crural fascia and divides into two cutaneous branches. Fascial restriction may compress the branches as they cross the cranial ankle. If this occurs, sensation may be impaired to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve. (See LR 2 and LR 3.)

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation that follows the GB channel onto the dorsum of the foot, extending to the sensory territory of the dorsal superficial branch and thus incorporating parts of the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer.

Nonsurgical approaches to releasing the nerve and fascial restriction should be considered and initiated prior to surgery in order to assess their ability to reduce pain and nerve injury without surgery.[28]

Vessels

- **Inferior lateral genicular artery:** One of several arteries contributing to the anastomosis around the knee, known as the genicular anastomosis. These vessels provide collateral circulation to the knee if the popliteal vessels are occluded.
- **Anterior tibial recurrent artery (ATRA):** A branch of the anterior tibial artery that arises after the artery emerges from the interosseous space; helps provide circulation to the knee. Connects the anterior tibial artery to the genicular anastomosis and supplies structures in this region, including the lateral tibial condyle.[29] That ATRA anastomoses with the inferior lateral genicular artery (a branch of the popliteal artery) with branches surrounding the

lateral intercondylar tubercle and the femoro-tibial joint capsule.

Clinical Relevance: The ATRA branches off of the anterior tibial artery (ATA) in the vicinity of ST 36, near GB 34. (See Figure 11-97 to view the branching pattern.) Thus, improving circulation through acupuncture at ST 36 and GB 34 not only influences multiple levels of nerve function, but also improves hemodynamics of knee and surrounding structures. Arthroscopy of the joint, tibial fracture repair, and sub-meniscal arthrotomy may damage these delicate vessels, requiring support through neuro- and circulatory modulation by means of acupuncture and related techniques.

Indications and Potential Point Combinations

- **Generalized muscle or tendon pain:** GB 34, local trigger points.
- **Pelvic limb weakness associated with peroneal nerve injury:** GB 34, LR 2, LR 3, ST 36, trigger points or taut bands in the peroneus longus and/or extensor digitorum longus muscles.
- **Knee pain:** GB 34, ST 36, ST 34, SP 10, SP 9, BL 40, pertinent trigger points. Consider ST 35, Xiyan (eyes of the knee), and SP 6 in addition to the aforementioned points.[30]

Evidence-Based Applications

- Case series reported effectiveness in treating **shoulder pain, elbow pain, lateral thoracic pain, lumbar pain, and gastrocnemius spasm.**[1]
- Acupuncture at BL 23, BL 25, GB 30, BL 40, BL 60, and GB 34, plus BL 31, BL 32, and BL 54 (as needed) improved the orthopedic management of **chronic low back pain.**[2]
- **Reduces alpha-motoneuron excitability** when researchers needled GB 34 and SP 9 for 15 minutes of manual acupuncture.[3]
- Needling at GB 34 **reduced motor system excitability** when transcranial magnetic stimulation (TMS) parameters were measured at the abductor digiti minimi muscle 15 minutes before and after needling.[31]
- Transcutaneous electrical acupoint stimulation (TEAS) at GB 34, BL 57, ST 36, and SP 6 enhanced the rate of **muscle force recovery following fatigue of the quadriceps.**[32] Stimulation did not alter lactate removal or restitution of median power frequency of the vastus medialis.
- Acupuncture at GB 34, GB 37, GB 39, LI 4, LI 11, LI 13, LI 15, GB 20, PC 6, ST 36, SP 6, LU 7, and LR 3, among other sites may enhance **exercise performance and support post-exercise recovery.**[33]
- Electroacupuncture at ST 38 and GB 34 provided significantly more relief for patients with **tennis elbow** than did manual acupuncture.[4]
- Acupuncture at GB 34 provided more relief of **chronic tennis elbow pain** than BL 13.[5]
- Acupuncture at GB 34 **modulates the cortical activities of the somatomotor area** in humans.[6,34]
- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis**, using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[7]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point "cervical spine" provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[8]
- Acupuncture applied to GB 34, GB 20, TH 5, ST 8, LI 6, and ST 36 **reduced pain** and altered cerebral glucose metabolism in pain-related brain regions **in migraineurs** according to PET-CT findings.[35]
- Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve **reduction of sympathetic nervous system activity.**[36,37]
- Acupuncture at BL 23, BL 25, BL 26, BL 36, BL 40, BL 62, GB 31, and GB 34 for patients with **lumbar disc protrusion** resulted in significant pain reduction.[9]
- **Lowers blood pressure** and may help prevent cardiac muscle hypertrophy.[10]
- Needling GB 34, ST 36, SP 6, and BL 67 may help decrease the need for **labor induction** and cesarean section.[11]
- Prophylactic use of bilateral noninvasive acuplaster on BL 10, BL 11, and GB 34 significantly reduces **vomiting in children after strabismus correction.**[12]
- Acupuncture at GB 34, PC 6, and BL 11 has become more accepted in the clinical management of **postoperative vomiting after strabismus surgery** in children.[13]
- Acupressure to KI 1, GB 34, ST 36, and SP 6 helped relieve **fatigue in patients with end-stage renal disease.**[14]
- Acupuncture at ST 36 and GB 34 may exert their **hypotensive effects by decreasing renin secretion.**[15]
- Electroacupuncture at GB 34 elicited significantly higher activation of the hypothalamus and primary somatosensory-motor cortex than did sham treatment. It caused stronger deactivation over the rostral segment of the anterior cingulate cortex. Thus, electroacupuncture at real acupuncture points **modulated hypothalamus-limbic function** significantly more than did sham points.[16]
- Electroacupuncture at ST 36 + SP 6 was compared to GB 34 + BL 57, in order to study differences in brain activation from acupuncture points located in the same spinal segments. Both overlapping and distinct cerebral response patterns from stimulation of the two pairs were observed. Both pairs of points (ST 36/SP 6 and GB 34/BL 57) activated the primary and secondary somatosensory areas, insula, ventral thalamus, parietal Brodmann Area 40, temporal lobe, putamen, and cerebellum; both deactivated the amygdala. However, ST 36/SP 6 specifically activated the orbital frontal cortex and deactivated the hippocampus, while GB 34/BL 57 activated the dorsal thalamus and inhibited the primary motor area and premotor cortex. These cerebral response differences may help explain why ST 36/SP 6 is indicated more for visceral disorders and pain while GB 34/BL 57 are important points for **modulation of muscle and tendon function and motor output.**[17]
- Electroacupuncture at GB 34 and GB 39 modulates **sympathetic nervous system activity** in the brain, possibly accounting in part for the analgesic effects of these two points.[38]
- Acupressure at GB 34, ST 36, SP 9, and SP 6 caused significant increases in lower leg blood flow in patients with Stage II **peripheral arterial occlusive diseases.**[39]

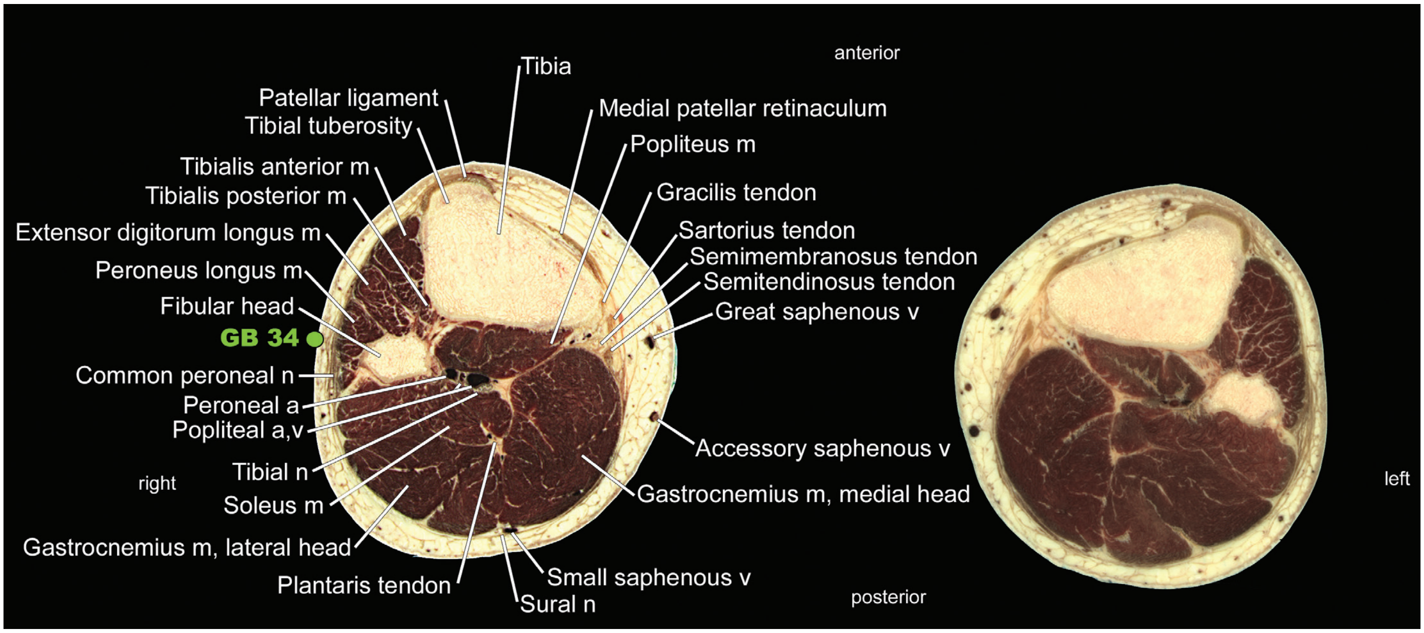


Figure 11-99. The proximity of the common peroneal nerve to GB 34 underscores the impact of this point on peroneal (fibular) nerve function and the tissues it supplies. Note, as well, the cramped quarters in this craniolateral compartment of the crus. These crowded conditions raise the risk of nerve entrapment.

- The "three needling method" for **piriformis injury syndrome** that involves GB 30, GB 34, and BL 62 outperformed the routine approach for this condition treated by GB 30, BL 36, and GB 34.[18]
- GB 34 and LR 3 delivered neuroprotective effects against neuronal death in a **Parkinson's disease** model.[19]
- Acupuncture at GB 34 increased activation of the putamen and primary motor cortex in patients with **Parkinson's disease.**[40]
- Acupuncture at GB 34 increased neural responses in brain areas injured by **Parkinson's disease.** These regions included the substantia nigra, caudate, thalamus, and putamen.[41]
- Electroacupuncture stimulation of GB 34 produced a significant decrease in **Sphincter of Oddi motility** and concomitant increase in cholecystokinin levels. These changes returned to baseline after discontinuation of the electrical stimulation.[20]
- Electroacupuncture stimulation of GB 34 and GB 30 significantly suppressed experimentally induced spinal **glial activation.**[21]
- It significantly suppressed experimentally induced hyperalgesia and markedly inhibited cytokines associated with **inflammation,** including PGE2, IL-1beta, IL-6, and TNF-alpha in the spinal cord.[22]
- Acupuncture provides substantial pain relief for patients with **chronic pain following spinal cord injury.** Medical acupuncturists stimulated GV 14 in all patients. In addition, Huatuojiaji points were selected at the level of the lesion. BL 10 was selected for lesions cranial to T1. Below L5, BL 40 was selected. Patients who did not respond satisfactorily to adding either BL 10 or BL 40 were then stimulated at both sites. Additional points depending on the pain location included Baxie or Bafeng points on an affected hand or foot, respectively. Points on the limbs were added according to the channel and surface affected. Thus, GB 34 was included when pain affected the lateral leg.[42]
- Stimulation of the fibular nerve with functional electrical stimulation (with mechanisms similar to electroacupuncture) **reduces foot drop and increases walking speed** in patients with spastic paraparesis.[43]
- Electroacupuncture at GB 34, GB 36, TH 8, and LI 4 **reduced postoperative narcotic analgesic requirements in patients following thoracotomy.**[23]
- Manual acupuncture at GB 34, GV 20, LI 4, CV 3, CV 4, CV 6, BL 23, SP 6, and auricular Shen Men produced a statistically significant reduction in symptoms of **primary dysmenorrhea** for one year.

References

1. Lu J. The clinical application of Yanglingquan (GB34) point. *Journal of Traditional Chinese Medicine.* 1993;13(3):179-181.
2. Molsberger AF, Mau J, Pawalec DB, and Winkler J. Does acupuncture improve the orthopedic management of chronic low back pain – a randomized, blinded, controlled trial with 3 months follow up. *Pain.* 2002;99:579-587.
3. Chan AKS, Vujnovich A, and Bradnam-Roberts L. The effect of acupuncture on alpha-motoneuron excitability. *Acupuncture & Electrotherapeutics Res., Int. J.* 2004;29:53-72.
4. Tsui P and Leung MCP. Comparison of the effectiveness between manual acupuncture and electro-acupuncture on patients with tennis elbow. *Acupuncture & Electrotherapeutics Res., Int. J.* 2002;27:107-117.
5. Molsberger A and Hille E. The analgesic effect of acupuncture in chronic tennis elbow pain. *British Journal of Rheumatology.* 1994;33:1162-1165.
6. Jeun S-S, Kim J-S, Kim B-S, Park S-D, Lim E-C, Choi G-S, and Choe B-Y. Acupuncture stimulation for motor cortex activities: a 3T fMRI study. *American Journal of Chinese Medicine.* 2005;33(4):573-578.
7. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology.* 1999;38:346-354.
8. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1-6.
9. Wang RR and Tronnier V. Effect of acupuncture on pain management in patients before and after lumbar disc protrusion surgery – a randomized control study. *Am J Chin Ed.* 2000;28(1):25-33.
10. Wu H-C, Liu J-G, Hsien C, Chang Y-H, Chang C-G, Hsieh C-L, Hsin-Chieh A, Ueng K-C, Kuo W-W, Lin JA, Liu J-Y, and Huang C-Y. The effects of acupuncture on cardiac muscle cells and blood pressure in spontaneous hypertensive rats. *Acupuncture & Electro-therapeutics Res., Int J.* 2004;29:83-95.
11. Duke K and Don M. Acupuncture use for pre-birth treatment. A literature review and audit-based research. *Complementary Therapies in Clinical Practice.* 2005;11:121-126.
12. Chu Y-C, Lin S-M, Hsieh Y-C, Peng G-C, Lin Y-H, Tsai S-K, and Lee T-Y. Effect of BL-10

(Tianzhu), BL-11 (Dazhu) and GB-34 (Yanglinquan) acuplaster for prevention of vomiting after strabismus surgery in children. *Acta Anaesthesiol Sin*. 1998;36:11-16.

13. Fujii Y. Clinical management of postoperative vomiting after strabismus surgery in children. *Curr Drug Saf*. 2010;5(2):132-148.

14. Tsay S-L. Acupressure and fatigue in patients with end-stage renal disease – a randomized controlled trial. *International Journal of Nursing Studies*. 2004;41:99-106.

15. Chiu YJ, Chi A, and Reid IA. Cardiovascular and endocrine effects of acupuncture in hypertensive patients. *Clin and Exper Hypertension*. 1997;19(7):1047-1063.

16. Wu M-T, Sheen J-M, Chuang K-H, Yang P, Chin S-L, Tsai C-Y, Chen C-J, Liao J-R, Lai P-H, Chu K-A, Pan H-B, and Yang C-F. Neuronal specificity of acupuncture response: a fMRI study with electroacupuncture. *NeuroImage*. 2002;16:1028-1037.

17. Zhang W-T, Jin Z, Luo F, Zhang L, Zeng Y-W, and Han J-S. Evidence from brain imaging with fMRI supporting functional specificity of acupoints in humans. *Neuroscience Letters*. 2004;354:50-53.

18. Yang JX and Zhu XY. (Chinese) Observation on therapeutic effect of three needling method on piriformis injury syndrome. *Zhongguo Zhen Jiu*. 2008;28(3):205-206.

19. Park H-J, Lim S, Joo W-S, Yin C-S, Lee H-S, Lee H-J, Seo J-C, Leem K, Son Y-S, Kim Y-J, Kim C-J, Kim Y-S, and Chung J-H. Acupuncture prevents 6-hydroxydopamine-induced neuronal death in the nigrostriatal dopaminergic system in the rat Parkinson's disease model. *Experimental Neurology*. 2003;180:92-97.

20. Lee S-K, Kim M-H, Kim H-J, et al. Electroacupuncture may relax the sphincter of Oddi in humans. *Gastrointestinal Endoscopy*. 2001;53(2):211-216.

21. Sun S, Cao H, Han M, et al. Evidence for suppression of electroacupuncture on spinal glial activation and behavioral hypersensitivity in a rat model of monoarthritis. *Brain Research Bulletin*. 2008;75:83-93.

22. Mi W-L, Mao-Ying Q-L, Liu Q, et al. Synergistic anti-hyperalgesia of electroacupuncture and low dose of celecoxib in monoarthritic rats: Involvement of the cyclooxygenase activity in the spinal cord. *Brain Research Bulletin*. 2008;77:98-104.

23. Wong RHL, Lee TW, Sihoe ADL, et al. Analgesic effect of electroacupuncture in postthoracotomy pain: a prospective randomized trial. *Ann Thorac Surg*. 2006;81:2031-2036.

24. Habek D, Habek JC, Bobic-Vukovic M, et al. Efficacy of acupuncture for the treatment of primary dysmenorrheal. *Gynakol Geburtshilfliche Rundsch*. 2003;43:250-253.

25. Sato M, Katsumoto H, Kawamura K, et al. Peroneal nerve palsy following acupuncture treatment. *Journal of Bone & Joint Surgery*. 2003;85A(5):916-918.

26. Lu Z and Chen Z. Electroacupuncture for treatment of 12 cases of infantile peroneal nerve injury. *J Tradit Chin Med*. 2000;20(2):130-131.

27. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med*. 2002;32(6):371-391.

28. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.

29. Hannouche D, Duparc F, and Beaufils P. The arterial vascularization of the lateral tibial condyle: anatomy and surgical applications. *Surg Radiol Anat*. 2006;28:38-45.

30. Purepong N, Jitvimonrat A, Sitthipornvorakul E, et al. External validity in randomized controlled trials of acupuncture for osteoarthritis knee pain. *Acupunct Med*. 2012;30(3):187-194.

31. Zunhammer M, Eichhammer P, Franz J, et al. Effects of acupuncture needle penetration on motor system excitability. *Clinical Neurophysiology*. 2012;42:225-230.

32. So RCH, Ng JKF, and Ng GYF. Effect of transcutaneous electrical acupoint stimulation on fatigue recovery of the quadriceps. *Eur J Appl Physiol*. 2007;100:693-700.

33. Urroz P, Colagiuri B, Smith CA, et al. Effect of acute acupuncture treatment on exercise performance and postexercise recovery: a systematic review. *J Alt Complement Med*. 2013;19(1):9-16.

34. Na B-J, Jahng G-H, Park S-U, et al. An fMRI study of neuronal specificity of an acupoint: Electroacupuncture stimulation of Yanglingquan (GB 34) and its sham point. *Neuroscience Letters*. 2009;464:1-5.

35. Yang J, Zeng F, Feng Y, et al. A PET-CT study on the specificity of acupoints through acupuncture treatment in migraine patients. *BMC Complementary and Alternative Medicine*. 2012;12:123.

36. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med*. 2012;18(2):130-136.

37. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol*. 2006;291(1):H318-H326.

38. Zhang JH, Li J, Cao XD, et al. Can electroacupuncture affect the sympathetic activity, estimated by skin temperature measurement? A functional MRI study on the effect of needling at GB 34 and GB 39 on patients with pain in the lower extremity. *Acupunct Electrother Res*. 2009;34(3-4):151-164.

39. Li X, Hirokawa M, Inoue Y, et al. Effects of acupressure on lower limb blood flow for the treatment of peripheral arterial occlusive diseases. *Surg Today*. 2007;37:103-108.

40. Chae Y, Lee H, Kim H, et al. Parsing brain activity associated with acupuncture treatment in Parkinson's diseases. *Movement Disorders*. 2009;24(12):1794-1802.

41. Yeo S, Lim S, Choe I-H, et al. Acupuncture stimulation on GB 34 activates neural responses associated with Parkinson's disease. CNS Neuroscience & Therapeutics. 2012;18:781-790.

42. Nayak S, Shiflett SC, Schoenberger NE, et al. Is acupuncture effective in treating chronic pain after spinal cord injury? *Arch Phys Med Rehabil*. 2001;82:1578-1586.

43. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation*. 2013;16(3):256-260.

44. Haims AH, Medvecky MJ, Pavlovich R, Jr., et al. MR imaging of the anatomy of and injuries to the lateral and posterolateral aspects of the knee. *AJR*. 2003;180:647-653.

GB 35

Yang Jiao "Yang Intersection"

On the lateral crus, caudal to the fibula, 7 cun proximal to the most prominent part of the lateral malleolus, level with GB 36, ST 39, and BL 58. Given that the distance between the lateral malleolus and the popliteal crease measures 16 cun, GB 35 lands 1 cun distal to the midpoint of this line.

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Peroneus (Fibularis) brevis muscle:** Everts the foot.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve and lead to significant problems with foot drop and paresthesias.

Trigger points in the peroneus brevis issue pain along the caudal border of the fibula to the lateral malleolus, then onto the dorsum of the foot toward GB 42.

Trigger points in the peroneal (fibularis) muscles may cause the feeling of having "weak ankles".

Nerves

- **Lateral sural cutaneous nerve (L5-S1):** A branch of the common peroneal nerve that innervates the skin on the lateral part of the posterior leg.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot, on their anterior surfaces.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus of entrapment involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where its two heads attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this entity escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three nerves may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue may force the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[1]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 lie, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

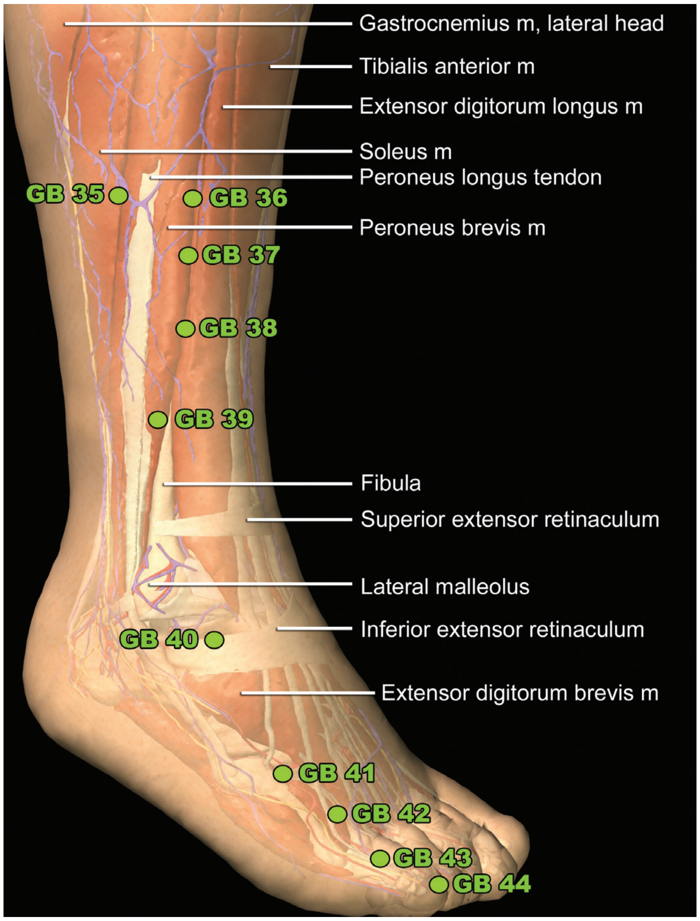
Compression of the superficial peroneal (fibular) nerve by the crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 37 and GB 38, this nerve emerges through the crural fascia and divides into two cutaneous branches. Fascial restriction may compress the branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve. (See LR 2 and LR 3.)

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation that follows the GB channel onto the dorsum of the foot, extending to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer.

Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[2]

Vessels

- **Peroneal (fibular) artery:** The largest and most important branch of the tibial artery. Provides muscular branches to the



Gastrocnemius m, lateral head
Tibialis anterior m
Extensor digitorum longus m
Soleus m
Peroneus longus tendon
GB 35
GB 36
Peroneus brevis m
GB 37
GB 38
GB 39
Fibula
Superior extensor retinaculum
Lateral malleolus
Inferior extensor retinaculum
GB 40
Extensor digitorum brevis m
GB 41
GB 42
GB 43
GB 44

Figure 11-100. The GB line follows the common peroneal nerve and primarily the superficial peroneal (fibular) nerve branch. Associated muscles include the peroneal (fibular) muscles and the extensor digitorum longus muscle. GB 35, in particular, associates with the peroneus brevis muscle while GB 36 through GB 39 reside in the groove between the peroneus longus and the extensor digitorum longus muscles.

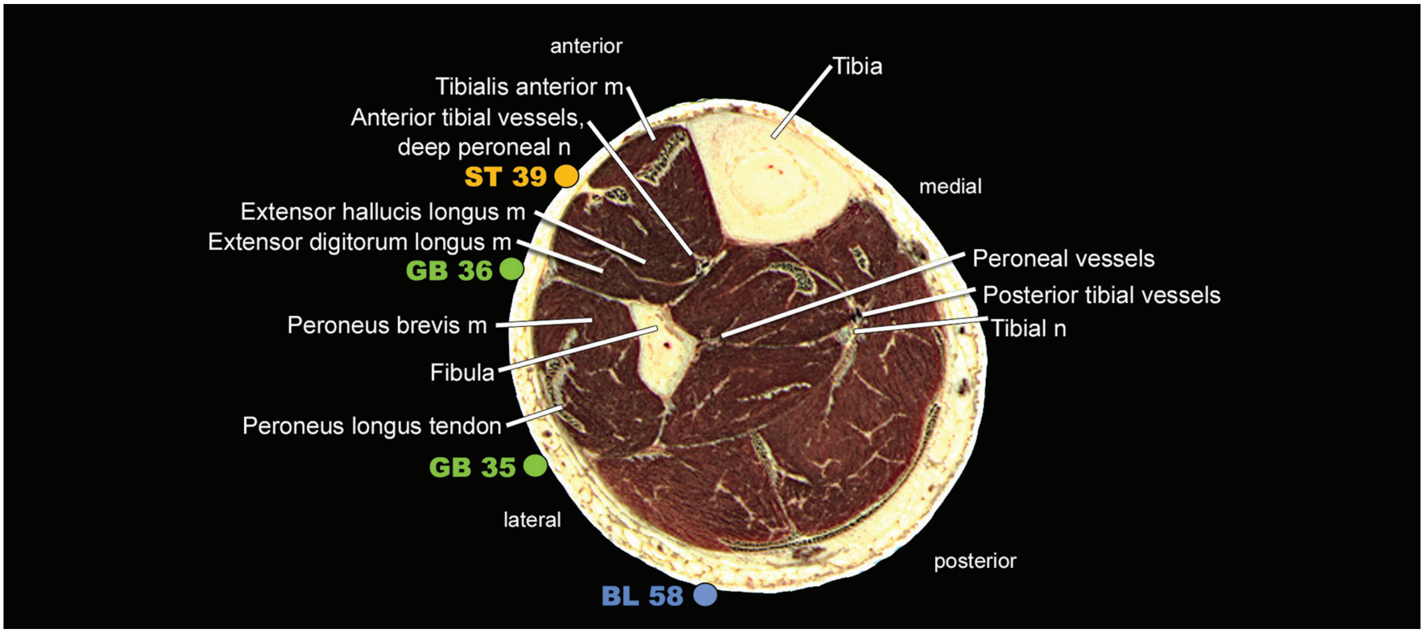

anterior
Tibialis anterior m
Anterior tibial vessels, deep peroneal n
ST 39
Extensor hallucis longus m
Extensor digitorum longus m
GB 36
Peroneus brevis m
Fibula
Peroneus longus tendon
GB 35
lateral
BL 58
Tibia
medial
Peroneal vessels
Posterior tibial vessels
Tibial n
posterior

Figure 11-101. The descriptive term for GB 35, "Yang Intersection", denotes the co-occurrence of four "Yang" or lateral points on the same horizontal plane: GB 35, GB 36, ST 39, and BL 58.

popliteus and other muscles occupying the posterior and lateral compartments of the leg. Supplies a nutrient artery to the fibula.

Clinical Relevance: Ankle injuries involving the tibiofibular syndesmosis raise the likelihood of producing prolonged ankle discomfort and disability.[3] In part, this is due to the possible disruption of the primary vascular supply to anterior ankle ligaments, i.e., the peroneal (fibular) artery at its perforating branch.

Indications and Potential Point Combinations

- **Feeling of weak ankles associated with peroneal trigger points:** GB 35, GB 34, GB 39, and LR 2.
- **Cramping pain on the lateral leg and/or peroneal nerve entrapment causing paresthesias and, possibly, foot drop:** GB 35, GB 38, GB 34, LR 3.

References

1. McCrory P, Bell S, and Bradshaw C. Nerve entrapments of the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
2. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
3. McKeon KE, Wright RW, Johnson JE, et al. Vascular anatomy of the tibiofibular syndesmosis. *J Bone Joint Surg Am.* 2012;94(10):931-938.

GB 36

Wai Qiu “Outer Hill”

On the lateral crus, cranial to the fibula (in contrast to GB 35, which was caudal to the fibula). 7 cun proximal to the most prominent part of the lateral malleolus, level with GB 35, ST 39, and BL 58. Given that the distance between the lateral malleolus and the popliteal crease measures 16 cun, GB 35 lands 1 cun distal to the midpoint of this line.

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Peroneus (Fibularis) brevis muscle**: Everts the foot.
- **Extensor digitorum longus muscle:** Extends the lateral four digits; dorsiflexes the ankle.
- **Extensor hallucis longus muscle:** Extends the great toe and dorsiflexes the ankle.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve, thereby causing significant problems with foot drop and paresthesias.

Trigger points in the peroneus brevis issue pain along the caudal border of the fibula to the lateral malleolus, then onto the dorsum of the foot toward GB 42.

Trigger points in the peroneal (fibularis) muscles may cause the feeling of having “weak ankles”.

Referred pain from extensor digitorum longus trigger points near GB 36 issue pain along the distal GB channel on the dorsum of the foot.

A trigger point in the extensor hallucis longus muscle can refer pain from GB 36 to the LR line on the foot.

Sustained myofascial dysfunction in the extensor digitorum and hallucis longus muscles can eventually deform the toes, leading to the “classic hammer toe” presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble “hammer heads”. Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

Nerves

- **Lateral sural cutaneous nerve (S1):** A branch of the common peroneal (fibular) nerve that innervates the skin on the lateral part of the caudal crus.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus (fibularis) longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot, on their cranial surfaces.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Sends articular branches to the joints it crosses.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus of entrapment involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where its two heads attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this entity escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three nerves may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue may force the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[3]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies

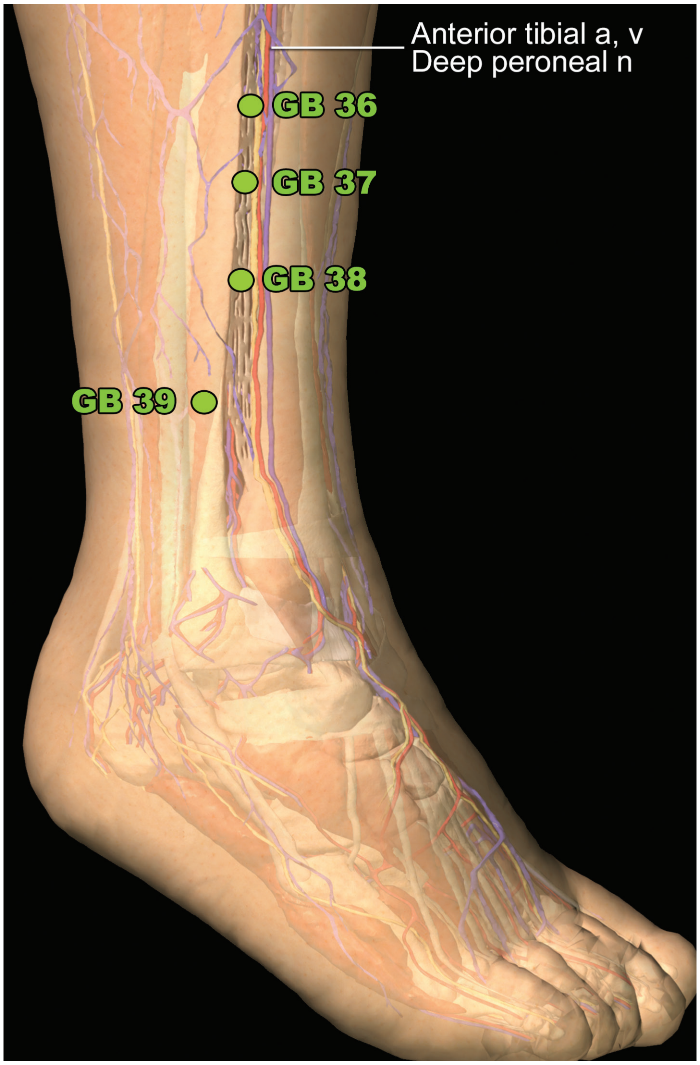


Figure 11-102. This perspective shows how GB 36, GB 37, and GB 38 Line up along the cranial border of the fibula, paralleling the anterior tibial vessels and deep peroneal (fibular) nerve to the ankle. On the dorsum of the foot, this neurovascular bundle then follows the LR line. In actuality, the GB line more closely follows the superficial peroneal (fibular) nerve, not shown.

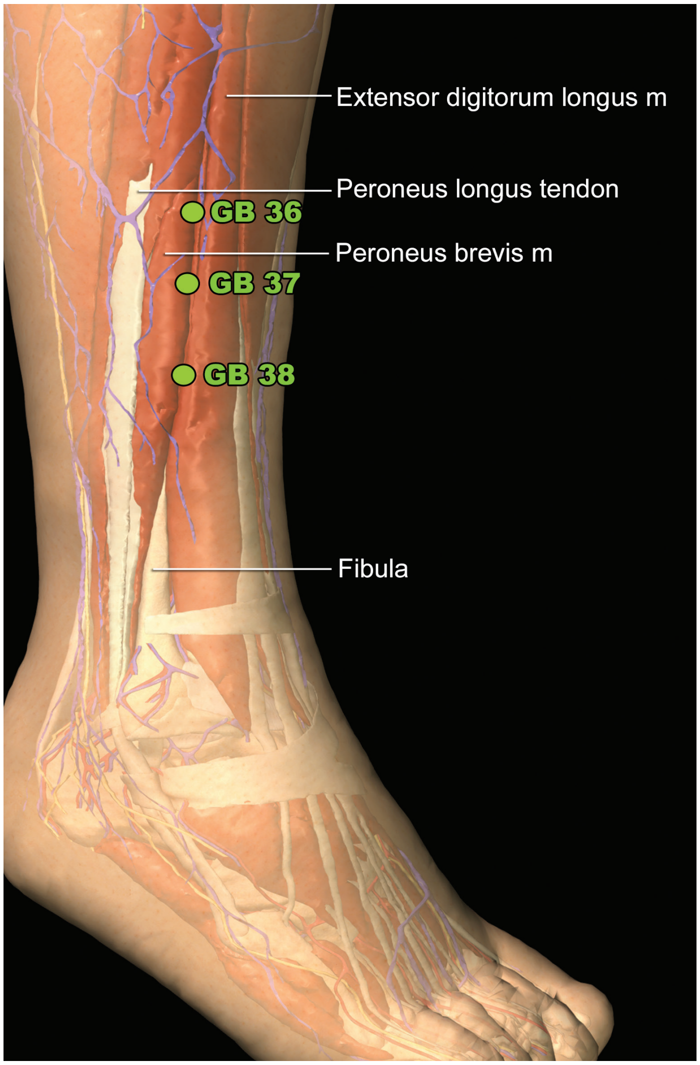


Figure 11-103. GB 36, GB 37, and GB 38 course along the myofascial cleavage plane between the extensor digitorum longus and peroneus (fibularis) brevis muscles. The title "Outer Hill" for GB 36 connotes the mound of muscle on the lateral leg located at the site. This section of the calf contains several points that metaphorically mention landscape, including "Yin Mound Spring" (SP 9), "Leaking Valley" (SP 7), "Yin Valley" (KI 10), "Mountain Support" (BL 57), "Yang Mound Spring" (GB 34), and "Outer Hill" (GB 36).

the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 lie, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by the crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 37 and GB 38, this nerve emerges through the crural fascia and divides into two cutaneous branches. Fascial restriction may compress the branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve. (See LR 2 and LR 3.)

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation that follows the GB channel onto the dorsum of the foot, extending to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[4]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem. Entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[5]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[6,7]

Vessels

- **Anterior tibial artery:** Supplies the anterior compartment of the leg.

Clinical Relevance: Arteries such as the anterior tibial artery are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[8] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

Indications and Potential Point Combinations

- **Leg pain or cramping, caused by trigger points in the extensor digitorum or hallucis longus muscles, sending pain referred to their respective tendons on the dorsum of the foot:** GB 36, palpably tender trigger points, LR 2, GB 41.
- **Post-thoracotomy pain:** GB 36, GB 34, LI 4, TH 8, local pain and trigger points.
- **Chest wall pain:** GB 36, GB 22, GB 23, pertinent intercostal and/or trigger points affiliated with the dysfunctional or painful region.

Evidence-Based Applications

- Acupuncture at GB 36, BL 40, GB 43, and spinal nerve points from L4-S1 improved signs and symptoms in patients with **prolapsed lumbar intervertebral disk,** possibly in part by improving their IL-6 and hemodynamic profiles.[1]
- Electroacupuncture at GB 36, GB 34, LI 4, and TH 8 significantly reduced the cumulative dose of patient-controlled morphine analgesia accessed by patients on the second postoperative day following **thoracotomy,** compared to patients in receiving sham electroacupuncture.[2]

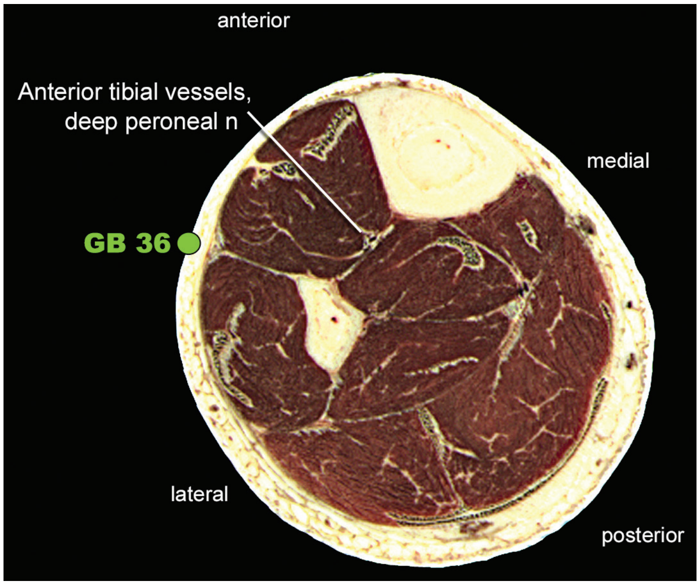


Figure 11-104. Viewing the anatomy deep to GB 36 in cross section exposes the actual distance between the anterior tibial vessels, the deep peroneal (fibular) nerve, and GB 36. As noted above, a closer neural companion to the GB channel than the deep peroneal (fibular) nerve is the superficial peroneal (fibular) nerve.

References

1. Zhuang Z and Jiang G. Thirty cases of the blood-stasis type prolapse of lumbar intervertebral disc treated by acupuncture at the xi (cleft) point plus herbal intervention injection. *J Tradit Chin Med.* 2008;28(3):178-182.
2. Wong RHL, Lee TW, Sihoe ADL, et al. Analgesic effect of electroacupuncture in postthoracotomy pain: a prospective randomized trial. *Ann Thorac Surg.* 2006;81:2031-2036.
3. McCrory P, Bell S, and Bradshaw C. Nerve entrapments f the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
4. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
5. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
6. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
7. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol.* 2006;291(1):H318-H326.
8. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2721-2724.

GB 37

Guang Ming "Bright Light"

On the lateral crus, along the cranial border of the fibula, 5 cun proximal to the most prominent part of the lateral malleolus. Located just proximal to the junction of the middle and lower thirds on a line that connects the tip of the lateral malleolus to the lateral limit of the popliteal crease.

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Peroneus (Fibularis) brevis muscle:** Everts the foot.
- **Extensor digitorum longus muscle:** Extends the lateral four digits; dorsiflexes the ankle.
- **Extensor hallucis longus muscle:** Extends the great toe and dorsiflexes the ankle.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve, thereby leading to significant problems with foot drop and paresthesias.

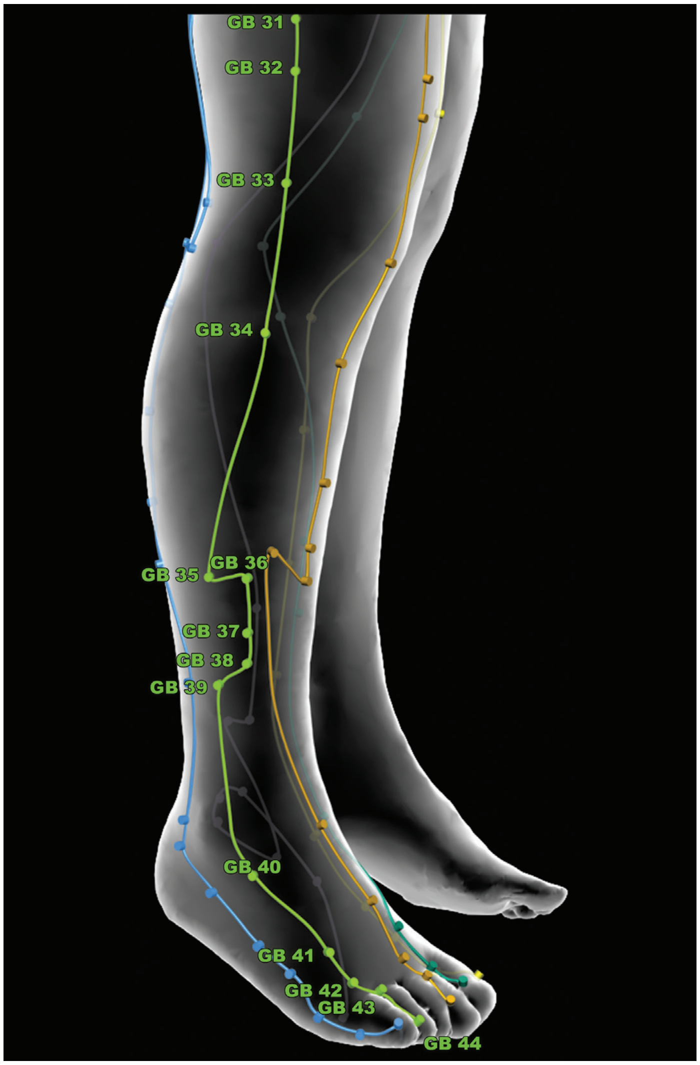


Figure 11-105. One finds GB 37, "Bright Light", either by counting 5 cun proximal to the prominence of the lateral malleolus or by locating it just proximal to the junction of the middle and lower third of the line connecting the tip of the lateral malleolus to the popliteal crease, on the cranial border of the fibula.

Trigger points in the peroneus brevis issue pain along the caudal fibula to the lateral malleolus, then onto the dorsum of the foot toward GB 42.

Trigger points in the peroneal (fibularis) muscles may cause the feeling of having "weak ankles".

Referred pain from extensor digitorum longus trigger points near GB 37 issue pain along the distal GB channel on the dorsum of the foot.

A trigger point in the extensor hallucis longus muscle can refer pain from GB 37 to the LR line on the foot.

Sustained myofascial dysfunction in the extensor digitorum and hallucis longus muscles can eventually deform the toes, leading to the "classic hammer toe" presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble "hammer heads". Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

Nerves

- **Lateral sural cutaneous nerve (S1):** A branch of the common peroneal (fibular) nerve that innervates the skin on the lateral part of the caudal crus.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus (fibularis) longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot, on their cranial surfaces.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Sends articular branches to the joints it crosses.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus of entrapment involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where its two heads attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this entity escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three nerves may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue may force the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[9]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 lie, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by the crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 37 and GB 38, this nerve emerges through the crural fascia and divides into two cutaneous branches. Fascial restriction may compress the branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve. (See LR 2 and LR 3.)

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation that follows the GB channel onto the dorsum of the foot, extending to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[10]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem. Entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[11]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[12,13]

Vessels

- **Anterior tibial artery:** Supplies the anterior compartment of the leg.

Clinical Relevance: Arteries such as the anterior tibial artery are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[14] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

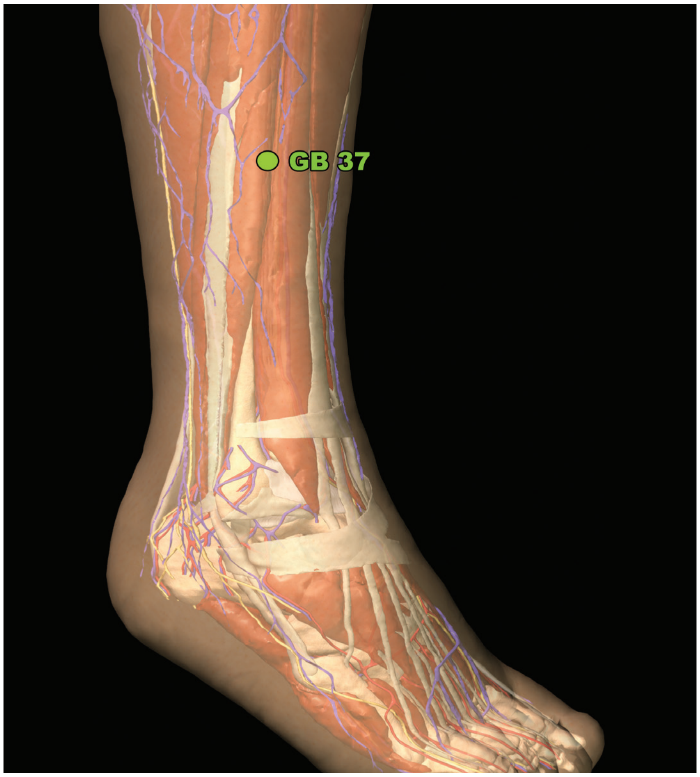


Figure 11-106. The descriptive name for GB 37, "Bright Light" connotes its indication for visual disturbances. This connection inspired researchers in brain imaging to investigate its effects on the brain and especially on centers that process visual information. However, whether GB 37 is unique in this regard is unclear and requires further research. It may be that several points on the lateral crus similarly influence visual processing and stimulate posterior cerebral artery blood flow.

Indications and Potential Point Combinations

- **Pain at the dorsum of the foot:** GB 37, other local trigger points referring pain to the toes.
- **Eye disorders, diminished vision, adjunctive treatment for glaucoma:** GB 37, LI 4, LR 3, BL 60.

Evidence-Based Applications

- Acupuncture stimulation of GB 37 failed to activate the visual cortex on functional magnetic resonance imaging, unlike BL 67, which has been demonstrated to do so, although GB 37 has **vision-related applications.** Strength and type of stimulation may be a factor in brain activation results.[1]
- Blood oxygen-level-dependent signal decreases in the occipital cortex of the brain, evoked by electroacupuncture, occurred in a similar fashion when both **"vision points"**, GB 37 and BL 60, were stimulated, as well as an adjacent non-acupuncture point.[2,3] Although the points themselves may lack specificity, the connection between them and their impact on brain function likely stems from their common neurologic supply; i.e., branches of the peroneal nerve.
- Acupuncture at GB 37 and LR 3 produced changes in blood oxygen saturation levels in certain brain regions, though not in the **visual cortex,** with either visual stimulation or needle stimulation, causing one to question whether the study design is crucial in picking up these changes.[4] Another experiment

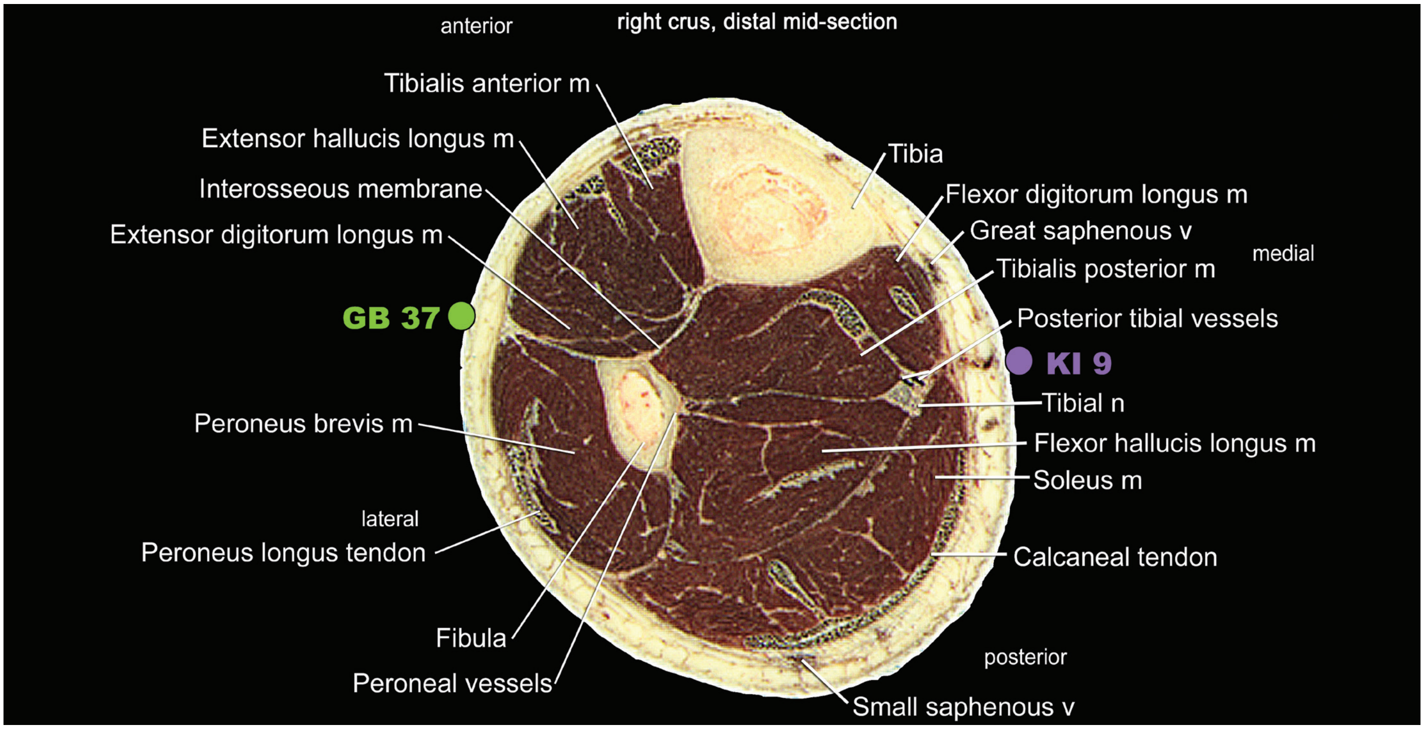


Figure 11-107. Like its GB point compatriots along the mid-crus, GB 37 is perfectly situated to address myofascial trigger points in either the extensor digitorum longus or the peroneus (fibularis) brevis muscle, depending on the angle and depth of needle insertion.

involving electroacupuncture at GB 37 compared to KI 8 showed that both points produced strong activation in the visual cortical regions BA 17/18/19 and that they were modulated in opposite directions during the resting state following acupuncture.[5] Given that GB 37 is supplied by the peroneal nerve primarily, and KI 8 by the tibial, the Complementarity of temporal modulation but similarity of spatial distribution parallels the impression that each point sits on opposite aspects of the leg, but originate from the same nerve, i.e., the sciatic.

- Acupuncture at GB 37, ST 40, and ST 43 did not affect the visual cortex, but did impact the insula sulcus lateralis and the parieto-temporal cortex, areas involved in **processing painful and/or somatosensory input.**[6]
- Acupuncture at GB 37 induced **complex brain activity in the visual cortex.**[15]
- Electroacupuncture at GB 37, LI 4, and LR 3 significantly **reduced intraocular pressure** in both eyes in isoflurane-anesthetized and normal dogs.[7,8]
- Laser stimulation of GB 37, LR 3, and BL 67 produced significant increases in blood flow velocity through the **posterior cerebral artery** and not the anterior cerebral artery, perhaps linking these points more specifically to the visual system in the brain.[16] In contrast LI 4, LI 6, and LI 20 significantly increased blood flow velocity in the anterior cerebral artery but not the posterior cerebral artery.
- Manual acupuncture at GB 37 may help reduce the pain of **panretinal photocoagulation.**[17]

References

1. Gareus IK, Lacour M, Schulte A-C, and Hennig J. Is there a BOLD response of the visual cortex on stimulation of the vision-related acupoint GB 37? *Journal of Magnetic Resonance Imaging.* 2002;15:227-232.
2. Kong J, Kaptchuk TJ, Webb JM, et al. Functional neuroanatomical investigation of vision-related acupuncture point specificity – a multisession fMRI study. *Human Brain Mapping.* 2009;30:38-46.
3. Kong J, Gollub RL, Webb JM, et al. Test-retest study of fMRI signal change evoked by electro-acupuncture stimulation. *Neuroimage.* 2007;34(3):1171-1181.
4. Hu KM, Wang CP, and Henning J. (Chinese) Observation on relation of acupuncture at Guangming (GB 37) and Taichong (LR 3) with central nervous reaction. *Zhongguo Zhen Jiu.* 2005;25(12):860-862.
5. Zhang Y, Liang J, Qin W, et al. Comparison of visual cortical activations induced by electroacupuncture at vision and nonvision-related acupoints. *Neurosci Lett.* 2009;458(1):6-10.
6. Hu KM, Wang CP, Xie HJ, et al. (Chinese) Observation on activating effectiveness of acupuncture at acupoints and non-acupoints on different brain regions. *Zhongguo Zhen Jiu.* 2006;26(3):205-207.
7. Kim M-S, Yoo J-H, Seo K-M, et al. Effects of electroacupuncture on intraocular pressure and hemodynamic parameters in isoflurane anesthetized dogs. *V Vet Med Sci.* 2007;69(11):1163-1165.
8. Kim M-S, Seo K-M, and Nam T-C. Effect of acupuncture on intraocular pressure in normal dogs. *J Vet Med Sci.* 2005;67(12):1281-1282.
9. McCrory P, Bell S, and Bradshaw C. Nerve entrapments f the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
10. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
11. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
12. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
13. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol.* 2006;291(1):H318-H326.
14. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2721-2724.
15. Liu J, Nan J, Xiong S, et al. Additional evidence for the sustained effect of acupuncture at the vision-related acupuncture point, GB 37. *Acupuncture in Medicine.* 2013;31(2):185-194.
16. Litscher G. Cerebral and peripheral effects of laserneedle® stimulation. *Neurological Research.* 2003; 25:722-728.
17. Chiu HH and Wu PC. Manual acupuncture for relieving pain associated with panretinal photocoagulation. *J Altern Complement Med.* 2011;17(10):915-921.

GB 38

Yang Fu "Yang Assistance"

On the lateral crus, along the cranial border of the fibula, 4 cun proximal to the most prominent part of the lateral malleolus. Located at the junction of the upper three-fourths and lower one-fourth of the line connecting the tip of the lateral malleolus to the lateral limit of the popliteal crease.

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Peroneus (Fibularis) brevis muscle:** Everts the foot.
- **Peroneus (Fibularis) tertius muscle:** The peroneus tertius differs from the peroneus longus and brevis muscles both anatomically and functionally. Whereas the peroneus longus and brevis course behind the lateral malleolus, the peroneus tertius tendon courses over the cranial aspect of the malleolus. Its tendon actually anchors onto three locations: the tubercle of the 5th metatarsal, the mediodorsal surface of the 5th metatarsal, and the base of the 4th metatarsal. These insertions spiral and tighten during passive inversion of the foot; they lengthen, straighten, and relax when the foot passively everts.
- **Extensor digitorum longus muscle:** Extends the lateral four digits; dorsiflexes the ankle.
- **Extensor hallucis longus muscle:** Extends the great toe and dorsiflexes the ankle.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve, thereby leading to significant problems with foot drop and paresthesias.

Trigger points in the peroneus brevis issue pain along the caudal fibula to the lateral malleolus, then onto the dorsum of the foot toward GB 42.

Trigger points in the peroneal (fibularis) muscles may cause the feeling of having "weak ankles".

Peroneus tertius trigger points at GB 38 and a bit more distal send pain to the dorsolateral ankle and foot, following the GB and ST lines to the toes. Another segment of pain from a dysfunctional peroneus tertius projects to the lateral calcaneal tendon and heel, from BL 60 to BL 62. The peroneus longus and brevis receive motor function from the superficial peroneal (fibular) nerve (L4, L5, S1) while the peroneus tertius is innervated by the deep peroneal (fibular) nerve (L5, S1). The peroneus tertius occupies the cranial compartment of the crus while the peroneus longus and brevis live on the lateral leg.

Referred pain from extensor digitorum longus trigger points near GB 38 issue pain along the distal GB channel on the dorsum of the foot.

A trigger point in the extensor hallucis longus muscle can refer pain from GB 38 to the LR line on the foot.

Sustained myofascial dysfunction in the extensor digitorum and hallucis longus muscles can eventually deform the toes, leading to the "classic hammer toe" presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble "hammer heads". Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

Nerves

- **Lateral sural cutaneous nerve (S1):** A branch of the common peroneal (fibular) nerve that innervates the skin on the lateral part of the caudal crus.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus (fibularis) longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot, on their cranial surfaces.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Sends articular branches to the joints it crosses.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus of entrapment involves the common peroneal (fibular) nerve

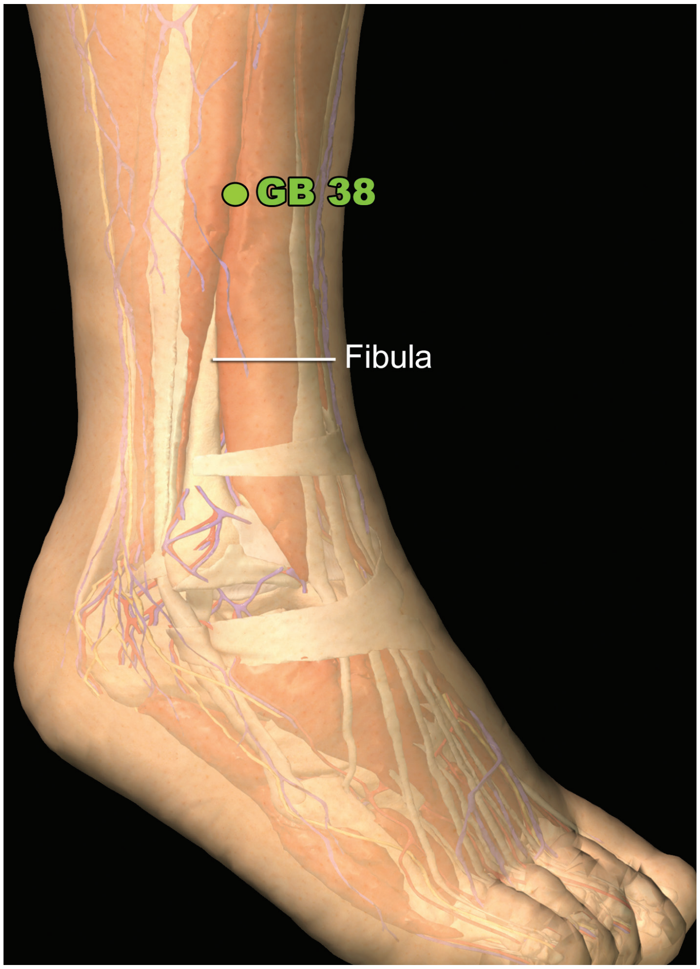


Figure 11-108. GB 38, "Yang Assistance" refers to the support provided by the fibula to the lower limb. The Chinese term "Fu" in "Yang Fu" connotes a pole attached to a cart to keep it from tipping.[7] Note how the fibula here pokes through the cleft between the peroneal (fibularis) and long digital extensor muscles.

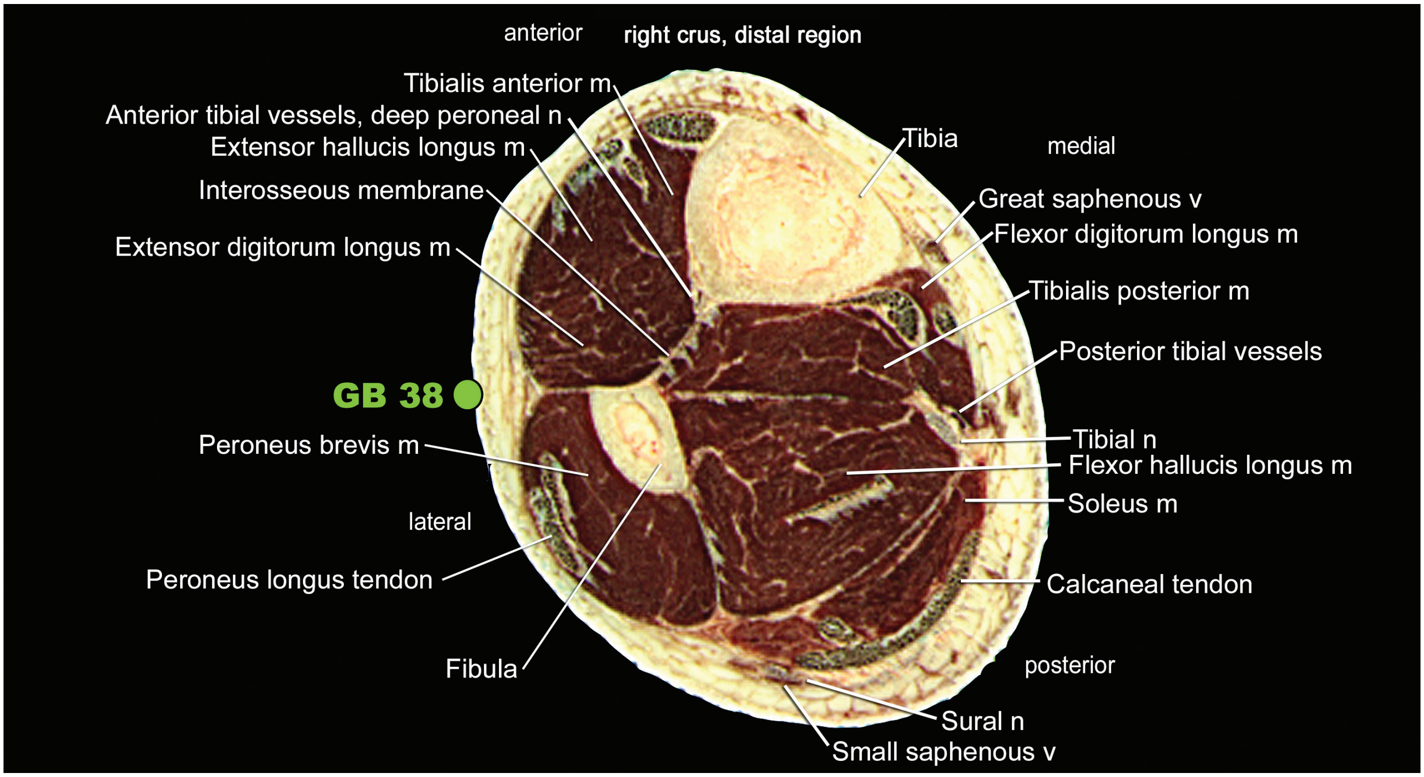


Figure 11-109. The fibula is becoming more superficial at GB 38. The peroneus tertius, discussed earlier, does not appear in this cross section, and is not present in all individuals. The three peroneal muscles are variable, with some individuals having a peroneus quartus and/or a peroneus (fibularis) digiti minimi muscle.

trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where its two heads attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this entity escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three nerves may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue may force the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[1]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 lie, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by the crural fascia causes “superficial peroneal (fibular) nerve syndrome”. Near GB 37 and GB 38, this nerve emerges through the crural fascia and divides into two cutaneous branches. Fascial restriction may compress the branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve. (See LR 2 and LR 3.)

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation that follows the GB channel onto the dorsum of the foot, extending to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[2]

Typically, nerve entrapment syndromes manifest as burning or “pins and needles” sensations, loss of coordination and proprioception in the limbs, system symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated with resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem. Entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[3]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[4,5]

Vessels

- **Anterior tibial artery:** Supplies the cranial compartment of the crus.

Clinical Relevance: Arteries such as the anterior tibial artery are vulnerable to damage during surgical procedures such as cutting of the tibia or retracting soft tissues away from the edge of the tibia.[6] Neuromodulation may assist with circulatory benefits and, in the case of laser therapy, angiogenesis and neovascularization.

Indications and Potential Point Combinations

- **Feeling of weakness in the ankles:** GB 38, other pertinent trigger points. Evaluate the peroneus longus, brevis, and tertius closely for myofascial tenderness and trigger points.
- **Foot drop:** GB 38, LR 2, ST 36, Bafeng (at the web spaces between the toes).

References

1. McCrory P, Bell S, and Bradshaw C. Nerve entrapments f the lower leg, ankle and foot in sport. *Sports Med*. 2002;32(6):371-391.
2. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice*. 2012;28(7):552-561.
3. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation*. 2013;16(3):256-260.
4. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med*. 2012;18(2):130-136.
5. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol*. 2006;291(1):H318-H326.
6. Noda M, Saegusa Y, Takahashi M, et al. A case of geniculate artery pseudoaneurysm after total knee arthroplasty: search for preventive measures by evaluation of arterial anatomy of cadaver knees. *Knee Surg Sports Traumatol Arthrosc*. 2013;21(12):2721-2724.
7. Ellis A, Wiseman N, and Boss N. Grasping the Wind. Brookline: Paradigm Publications, 1989. P. 284.

GB 39

Xuan Zhong "Suspended Bell" or, less commonly, Jue Gu "Severed Bone"

On the lateral crus, 3 cun proximal to the most prominent part of the lateral malleolus, in a depression between the caudal border of the fibula and the peroneus (fibularis) longus and brevis muscles/tendons. Some authors place GB 39 between the two tendons. Ask the patient to wiggle the ankle to differentiate the two tendons on the lateral aspect of the leg if targeting the latter location. Review the relationship of the peroneal (fibular) myotendinous structures and the fibula in Figure 11-110.

Muscles

- **Peroneus (Fibularis) longus muscle:** Everts the foot and, to a lesser degree, plantarflexes the ankle.
- **Peroneus (Fibularis) brevis muscle:** Everts the foot.

Clinical Relevance: Taut bands in the peroneus (fibularis) longus muscle can compress the superficial and deep branches of the peroneal (fibularis) nerve, leading to significant problems with foot drop and paresthesias.

Trigger points in the peroneus brevis issue pain along the caudal fibula to the lateral malleolus, then onto the dorsum of the foot toward GB 42.

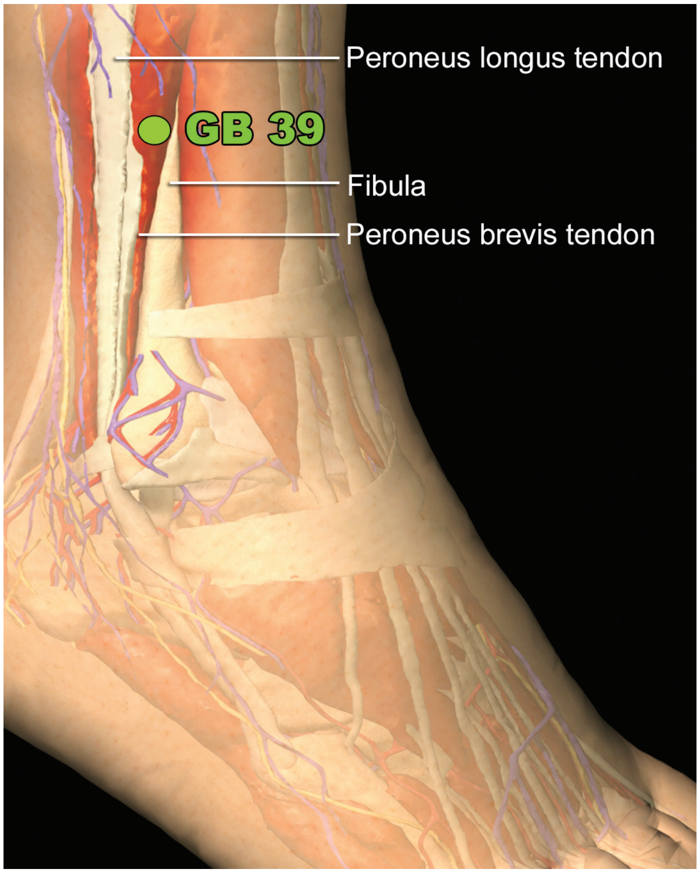


Figure 11-110. The descriptive title for GB 39, i.e., "Suspended Bell", has two connotations. Firstly, the lateral malleolus flares like a bell suspended from the fibula at GB 39. Secondly, children in parts of ancient China wore bells around their ankles.

Trigger points in the peroneal (fibularis) muscles may cause the feeling of having "weak ankles".

Nerves

- **Lateral sural cutaneous nerve (S1):** A branch of the common peroneal (fibular) nerve that innervates the skin on the lateral crus.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus (fibularis) longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot, on their dorsal surfaces.

Clinical Relevance: Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where they attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this nerve escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue forces the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[4]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 appear, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 39, this nerve emerges through the crural fascia and divides into two cutaneous branches, the medial dorsal and intermediate dorsal cutaneous nerves. The intermediate dorsal cutaneous nerve follows the GB channel to the toes while the medial dorsal cutaneous nerve accompanies the ST channel. The LR channel on the dorsum of the foot (from about LR 1-LR 3) receives sensation by the lateral branch of the deep peroneal (fibular) nerve but may include some fibers from the intermediate dorsal cutaneous nerve from superficial peroneal (fibular) origin.[5]

Fascial restriction can compress cutaneous branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus, the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve.

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation along the GB channel on the distal, lateral crus and dorsum of the foot that extends to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[6]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated by resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem.

Distal entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Compression at GB 39 affects the superficial peroneal (fibular) nerve where it branches into the medial and intermediate dorsal cutaneous nerves. Anatomically, the superficial peroneal (fibular) nerve exits from deep fascia here. A fascial edge may impinge on the nerve, as may muscle that has herniated through fascial defects.[7] The superficial peroneal (fibular) nerve courses along a short fibrous tunnel located between the anterior intermuscular septum and the fascia of the lateral compartment. Patients with nerve entrapment at this location may be considered to exhibit a local compartment syndrome.

Chronic ankle instability and sprain reinjures the nerve and predisposes individuals to develop a fibrotic, low compliant nature to this tunnel. Surgery may also cause problems, as it may shift the fascia following anterior compartment fasciotomy and place added stretch on the nerve. Iatrogenic injuries to the common peroneal (fibular) nerve and its branches stem from procedures that take a lateral or craniolateral approach to the knee, ankle, fibular, or soft tissue. A fracture of the fibular head may lacerate or compress one or more nerve branches and manifest as sensory and/or motor loss of varying degrees. Inflammation and edema after trauma may injure nerves as well.

Patients experiencing superficial peroneal (fibular) nerve entrapment at GB 39 complain of pain on the craniolateral calf and dorsum of the ankle and foot. Pain often lasts for years and recurs intermittently. About a third of patients report sensory changes along the distribution of the nerve, in the form of numbness or paresthesias. Activities such as running, squatting, jogging, or even walking worsen the problem. Focused palpation along the entire GB channel from GB 34 to GB 40 as well as the entire pelvic limb should provide insight into the source of myofascial dysfunction and the sites to needle or otherwise neuromodulate.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[8]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[9,10]

Vessels

- **Peroneal (fibular) artery:** The largest and most important branch of the tibial artery. Provides muscular branches to the popliteus and other muscles occupying the posterior and lateral compartments of the leg. Supplies a nutrient artery to the fibula.

Clinical Relevance: Ankle injuries involving the tibiofibular syndesmosis raise the likelihood of producing prolonged ankle discomfort and disability.[11] In part, this is due to the possible disruption of the primary vascular supply to cranial ankle ligaments, i.e., the peroneal (fibular) artery at its perforating branch.

Indications and Potential Point Combinations

- **Lateral ankle pain:** GB 39, GB 35, assess for additional trigger points.
- **"Weak ankles":** GB 39, other GB points on the crus, SP 6, GB 40, strengthening therapeutic exercise, laser therapy, massage.
- **Knee pain:** GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan

Evidence-Based Applications

- Uncontrolled study showed GB 39 effective for **treating costal chondritis.**[1]
- Acupuncture was shown to be an effective and safe adjunctive therapy for patients with **knee osteoarthritis,** using the following points: GB 34, GB 39, SP 6, SP 9, ST 35, ST 36, KI 3, and Xiyan.[2]
- Electroacupuncture at Neixiyan, Waixiyan, GB 39, and KI 3 alleviated symptoms of **knee osteoarthritis** better than did hyaluronic acid injection. Electroacupuncture also suppressed secretion of interleukin-1, interleukin-6, tumor necrosis factor-alpha, prostaglandin E-2 alpha, and matrix metalloproteinase 3 in synovial fluid of the knee.[12]
- Acupuncture at GB 39 for postoperative **orthopedic pain** and ashi (local painful) points provided comparable analgesia to medication (Bezoxazocine i.m.).[3]
- Deep needling of GB 34 and GB 39 modulated sympathetic activity in patients with **pelvic limb pain.**[13]
- Although GB 39 receives attention clinically as one of the Hui, or Influential points that specifically affects **marrow**, it is difficult to find any anatomic justification or evidential support for this contention.[14] Furthermore, Chinese clinicians of today as well past generations rarely use this point for marrow disorders, emphasizing its misnaming as an influential point for marrow.
- Electroacupuncture at SP 6 immediately alleviated **menstrual pain** while GB 39 does not. This may reflect the differing innervation of the two points (tibial versus peroneal (fibular) nerve) arising from different spinal cord segments.[15] However, others disputed these findings.[16]

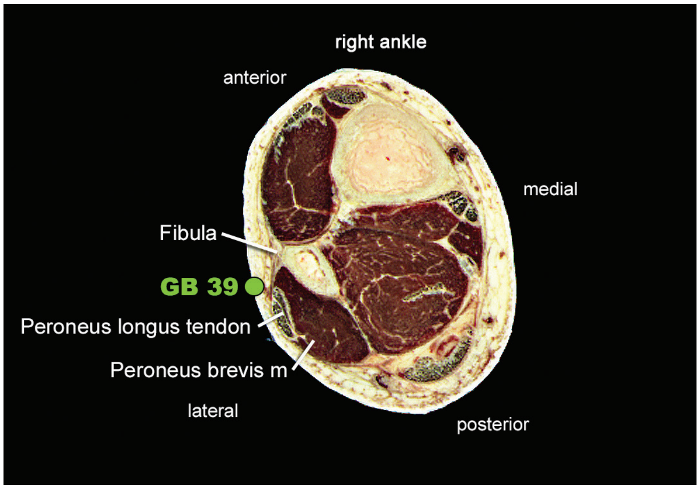


Figure 11-111. This cross section illustrates the close connections made by the fibula and the two peroneus tendons in the vicinity of GB 39. One can imagine the tight quarters that the superficial peroneal (fibular) nerve must navigate as its cutaneous branches make their way through dense and tense fascial structures to subcutaneous levels.

References

1. Li B. 106 cases of non-suppurative costal chondritis treated by acupuncture at Xuanzhong point. *Journal of Traditional Chinese Medicine.* 1998;18(3):195-196.
2. Berman BM, Singh BB, Lao L, Langenberg P, LI H, Hadhazy V, Bareta J and Hochberg M. A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology.* 1999;38:346-354.
3. Sun ZH and Feng CX. (Chinese) The clinical observation on acupuncture at Xuanzhong (GB 39) and Ashi points for treatment of orthopedic postoperative pain. *Zhongguo Zhen Jiu.* 2007;27(12):895-897.
4. McCrory P, Bell S, and Bradshaw C. Nerve entrapments f the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
5. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
6. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
7. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
8. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
9. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
10. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol.* 2006;291(1):H318-H326.
11. McKeon KE, Wright RW, Johnson JE, et al. Vascular anatomy of the tibiofibular syndesmosis. *J Bone Joint Surg Am.* 2012;94(10):931-938.
12. Wu MX, Li XH, Lin MN, et al. Clinical study on the treatment of knee osteoarthritis of Shen-Sui insufficiency syndrome type by electroacupuncture. *Chin J Integr Med.* 2010;16(4):291-297.
13. Zhang JH, Li J, Cao XD, et al. Can electroacupuncture affect the sympathetic activity, estimated by skin temperature measurement? A functional MRI study no the effect of needling at GB 34 and GB 39 on patients with pain in the lower extremity. *Acupunct Electrother Res.* 2009;34(3-4):151-164.
14. Guo T and Zhang QP. Different opinion about "marrow meeting point" of eight confluent acupoints. *Zhongguo Zhen Jiu.* 2010;30(4):322-324.
15. Ma YX, Ma LX, Liu XL, et al. A comparative study on the immediate effects of electroacupuncture at Sanyinjiao (SP 6), Xuanzhong (GB 39) and a non-meridian point, on menstrual pain and uterine arterial blood flow, in primary dysmenorrhea patients. *Pain Med.* 2010;11(10):1564-1575.
16. Liu CZ, Xie JP, Wang LP, et al. Immediate analgesia effect of single point acupuncture in primary dysmenorrhea: a randomized controlled trial. *Pain Med.* 2011;12(2):300-307.

GB 40

Qiu Xu "Mound of Ruins"

In a large depression anterior and inferior to the lateral malleolus, just lateral to the extensor digitorum longus tendon, at the entrance to the sinus tarsi. Locate at the intersection of lines drawn from the anterior and inferior borders of the lateral malleolus. Easier to locate with foot slightly supinated.

Connective Tissues

- **Interosseous talocalcaneal ligament in the sinus tarsi:** Supports the subtalar joint, which is where the talus rests on the calcaneus and forms an articulation. It is here that most of the inverting and everting movements of the ankle occur.
- **Inferior extensor retinaculum:** This Y-shaped strap of flat and thick connective tissue crosses the proximal aspect of the foot. The stem of this Y, located beneath GB 40, encloses the long extensor tendons in between its superficial and deep laminae.[1]

Clinical Relevance: While the medial root of the retinaculum attaches to the calcaneus just anterior to the location of talocalcaneal ligament attachment, the lateral root of the inferior extensor retinaculum attaches to the calcaneus in the vicinity of GB 40, at the external aspect of the tarsal sinus. Following foot trauma, a dysfunctional retinaculum may produce peroneal nerve entrapment.[2]

Chronic craniolateral ankle pain and snapping on ankle inversion may be due to trauma or the consequences of trauma, wherein tissue changes in the region around GB 40 produce various problems. These include proliferative synovitis, peroneal (fibularis) tendon instability, or abnormalities in the anteriorinferior tibiofibular ligament over the lateral talar dome.[6] Atraumatic conditions responsible for craniolateral ankle pain and snapping include osteochondral lesions, arthritis, presence of a peroneus (fibularis) tertius muscle, and loose bodies in the joint.

Bony Features

- **Sinus tarsi (Tarsal sinus, or talocalcaneal sulcus):** A canal, or hollow, created where the groove of the talus meets the interosseous groove of the calcaneus. It is here where the interosseous talocalcaneal ligament can be found. Although Figure 11-112 only indicates space in the tarsal sinus, it actually contains a number of structures such as fat, an arterial anastomosis, nerve endings, joint capsules, and five ligaments. These ligaments include the medial, intermediate, and lateral roots of the inferior extensor retinaculum, the cervical ligament, and the ligament of the tarsal canal, also known as the interosseous talocalcaneal ligament.[7]

Clinical Relevance: Ankle biomechanics involve more than simple flexion-extension motions. Its characteristics include subtalar joint mechanics that allow the foot to adapt to the surface of the ground.[8] The subtalar ligaments associated with the sinus tarsi provide ankle stability by means of the cervical and interosseous calcaneal interosseous ligament.

Surgeries designed to stabilize the ankle and reconstruct ligamentous support may fail due to inadequate correction of the complex pathomechanics of ankle instability.

Overly tightened ankle ligaments may impair proprioceptive reflexes. As such, physical medicine maneuvers may be indicated in order to improve soft tissue mechanics, proprioceptive support, and improve postural balance.

Sinus tarsi syndrome occurs between the calcaneus, talus, and talocalcaneonavicular and subtalar joints. Symptoms include lateral midfoot heel pain or pain in the lateral calcaneus and ankle. Pain worsens following exercise as well as when walking on an uneven surface. Repeated sprain of the lateral ankle as well as chronic hyperpronation of the foot predisposes individuals to developing sinus tarsi syndrome.[9] Usual recommended treatments include orthotics, physical therapy, and injections at GB 40; anti-inflammatory and analgesic drugs may be beneficial. However, acupuncture and laser therapy may lessen pain and improve function in ways that allopathic treatments do not.

Nerves

- **Sural nerve:** Most commonly arises from the union of the medial sural cutaneous branch of the tibial nerve (L4-S3) and the sural communicating branch of the common peroneal (fibular) nerve (L4-S2). Innervates the lateral aspect of the foot. Courses caudal to the lateral malleolus, accompanying the small saphenous vein. Provides lateral calcaneal branches and terminates as the dorsal lateral cutaneous nerve of the foot.
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot and all digits, except for the lateral side of the 5th pedal digit and the adjoining sides of the 1st and 2nd digits (which receives innervation from the deep peroneal nerve). Forms the dorsal digital nerves.

Clinical Relevance: Certain afferent nerve neuromodulation techniques stimulate the sural nerve in order to treat voiding dysfunction, making use of the overlapping spinal cord of

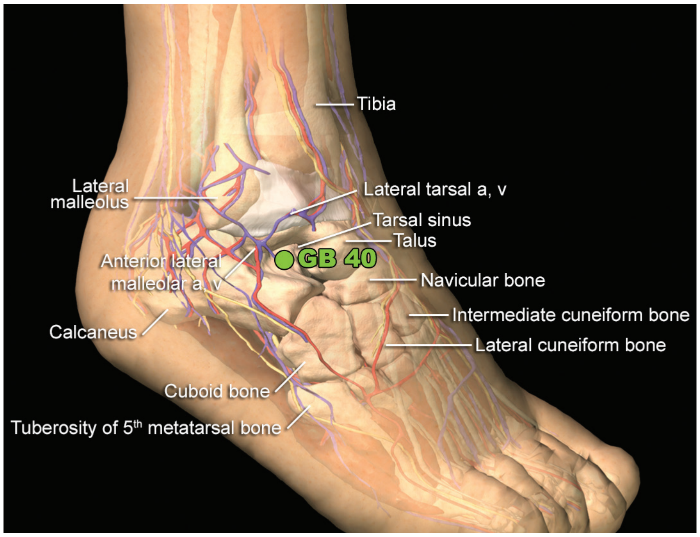


Figure 11-112. GB 40, "Mound of Ruins" connotes a pile of rubble at the bottom of a hill, strongly evocative of the tarsal bones lying below the ankle joint. The specific indication of GB 40 for sinus tarsi syndrome becomes clear based on the anatomy. One or more structures within the tarsal sinus and canal can cause pain and a feeling of instability in the ankle. Although not shown in this figure, the interosseous talocalcaneal ligament extends from the calcaneus to the talus and maintains apposition of the talus tali and the sulcus calcaneus. Injury to this and other connective tissue structures influencing the tarsal sinus may accompany ankle sprain.[24]

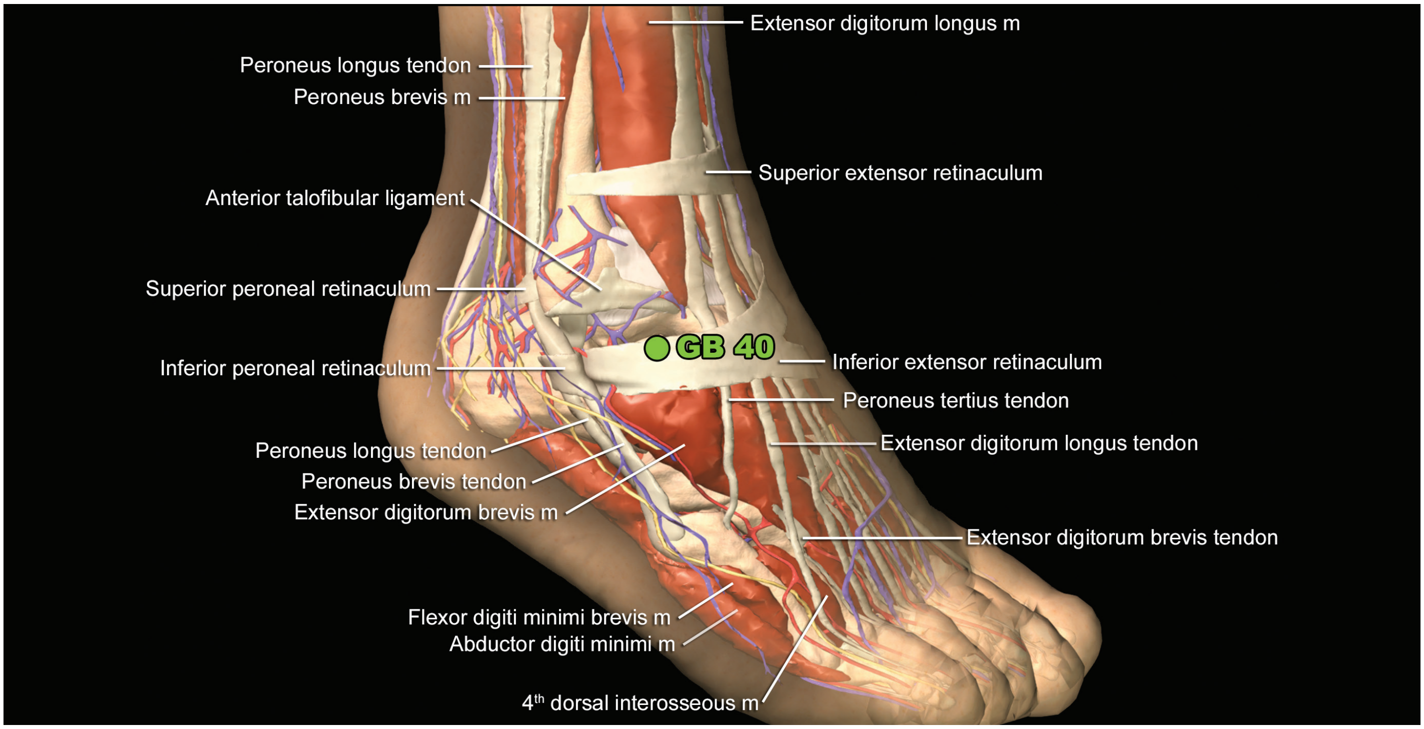

Extensor digitorum longus m
Peroneus longus tendon
Peroneus brevis m
Superior extensor retinaculum
Anterior talofibular ligament
Superior peroneal retinaculum
GB 40
Inferior extensor retinaculum
Inferior peroneal retinaculum
Peroneus tertius tendon
Extensor digitorum longus tendon
Peroneus longus tendon
Peroneus brevis tendon
Extensor digitorum brevis m
Extensor digitorum brevis tendon
Flexor digiti minimi brevis m
Abductor digiti minimi m
4th dorsal interosseous m

Figure 11-113. The inferior extensor retinaculum blankets the tarsal sinus at GB 40, producing potential problems for neural structures coursing deep to the fascial band.

segments supplying both the pelvic limb and pelvic viscera.[3]

The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression. Heel pain accompanied by tingling, burning, or loss of sensation suggest neuropathic injury by compression, traction, or other causes.[10]

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[11] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-121B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Lateral heel pain from lateral calcaneal neuritis (branches of the sural nerve) produces discomfort that radiates along the nerve, although the pain may be difficult to localize in some cases. This contrasts with calcaneal stress fracture that leads to pain over the entire calcaneus or peroneal (fibularis) tendon disorders that cause pain on the lateral calcaneus and peroneal tubercle.

Several sites of entrapment threaten the common peroneal (fibular) nerve and its branches. The first locus involves the common peroneal (fibular) nerve trunk. This occurs at the peroneal (fibular) tunnel – a soft tissue opening between the two heads of the peroneus (fibularis) longus muscle where they attach onto the fibula. Because the lateral sural cutaneous nerve has already branched off of the common peroneal (fibular) nerve by the time the trunk arrives at the tunnel, this nerve escapes entrapment. Note the anatomy of these nerves and muscles made apparent in Figure 11-98.

Inside the peroneal (fibularis) tunnel proximal to GB 34, the common peroneal (fibular) nerve divides into three nerves: the deep, superficial, and recurrent peroneal (fibular) nerves. All three may undergo traction and compression as they cross the fibular neck. Tension in the soft tissue forces the nerves against the fibular neck, manifesting as impaired sensation, movement, or pain.[12]

Distal to the peroneal (fibular) tunnel, the deep peroneal (fibular) branch follows the ST line while the GB channel accompanies the superficial peroneal (fibular) nerve branch, following the fibula and peroneus (fibularis) longus muscle to GB 39.

At about the junction of the distal and middle third of the fibula where GB 35, GB 36, and GB 37 fall, the superficial peroneal (fibular) nerve sends a branch to the peroneus (fibularis) brevis muscle. This branch may suffer compression as it makes its way to the brevis between the fibular and peroneus (fibularis) longus muscle.

Compression of the superficial peroneal (fibular) nerve by crural fascia causes “superficial peroneal (fibular) nerve syndrome”. Near GB 39, this nerve emerges through the crural fascia and divides into two cutaneous branches, the medial dorsal and intermediate dorsal cutaneous nerves. The intermediate dorsal cutaneous nerve follows the GB channel to GB 40 and the toes while the medial dorsal cutaneous nerve accompanies the ST channel. The LR channel on the dorsum of the foot (from about LR 1-LR 3) receives sensation by the lateral branch of the deep peroneal (fibular) nerve but may include some fibers from the intermediate dorsal cutaneous nerve from superficial peroneal (fibular) origin.[13]

Fascial restriction can compress cutaneous branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus and ankle (GB 40), the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory

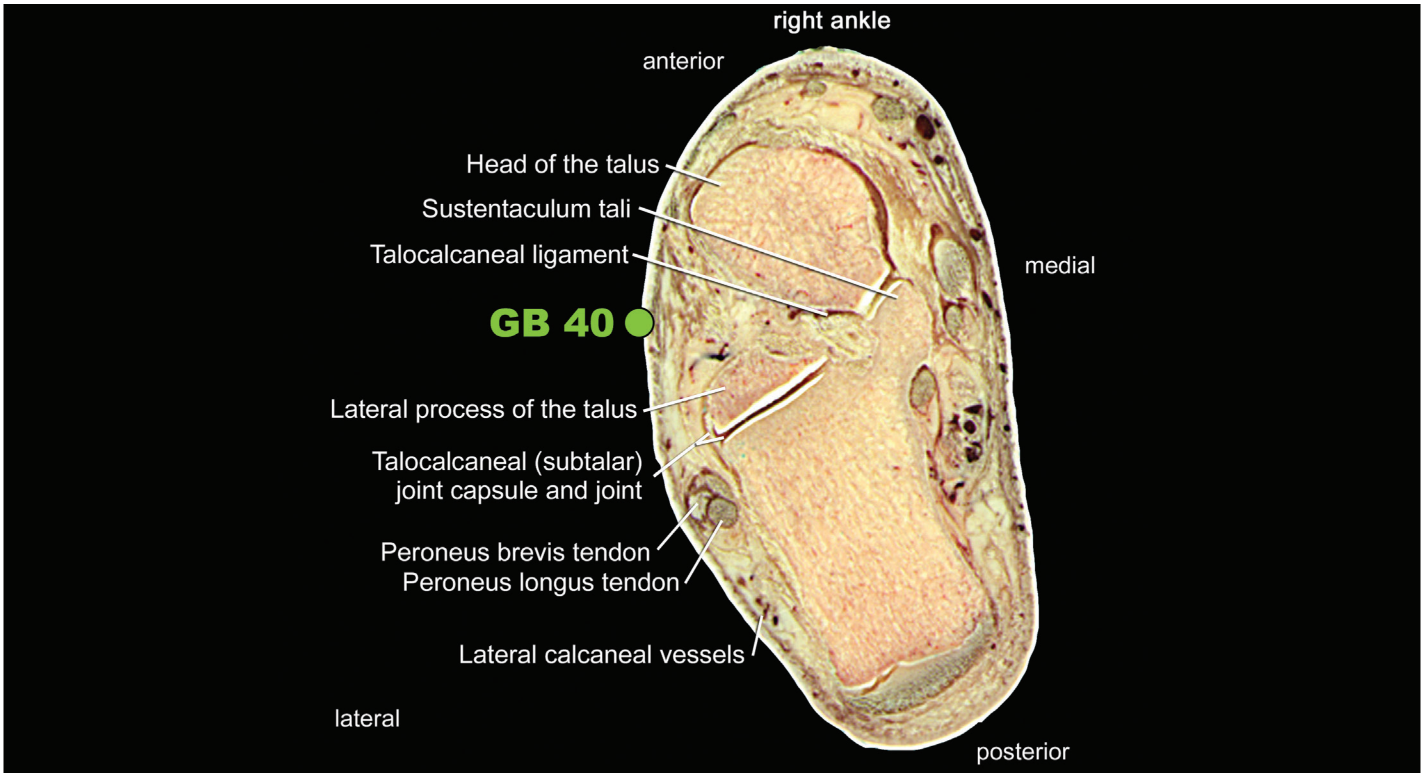


Figure 11-114. The interosseous talocalcaneal ligament, visible in this cross section, extends from the calcaneus to the talus, forming a transverse partition between the sulcus tali and the sulcus calcaneus. A functional link between the medial component of the inferior extensor retinaculum and the interosseous talocalcaneal ligament appears to exist, arguing for complex and extensive connective tissue continuity throughout the ankle joints.[25]

supply from the deep peroneal (fibular) nerve.

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation along the GB channel on the distal, lateral crus and dorsum of the foot that extends to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[14]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated by resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem.

Distal entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Compression at GB 39 affects the superficial peroneal (fibular) nerve where it branches into the medial and intermediate dorsal cutaneous nerves. Anatomically, the superficial peroneal (fibular) nerve exits from deep fascia here. A fascial edge may impinge on the nerve, as may muscle that has herniated through fascial defects.[15] The superficial peroneal (fibular) nerve courses along a short fibrous tunnel located between the anterior intermuscular septum and the fascia of the lateral compartment. Patients with nerve entrapment at this location may be considered to exhibit a local compartment syndrome. Chronic ankle instability and sprain reinjures the nerve and predisposes individuals to develop a fibrotic, low compliant nature to this tunnel. Surgery may also cause problems, as it may shift the fascia following anterior compartment fasciotomy and place added stretch on the nerve. Iatrogenic injuries to the common peroneal (fibular) nerve and its branches stem from procedures that take a lateral or craniolateral approach to the knee, ankle, fibular, or soft tissue.

Ankle injuries, whether traumatic or iatrogenic, have the capacity to cause damage either directly or by accentuating the pressure from the inferior extensor retinaculum onto the intermediate dorsal cutaneous branch of the superficial peroneal (fibular) nerve as well as the lateral branch of the deep peroneal (fibular) nerve.[16]

A fracture of the fibular head may lacerate or compress one or more nerve branches and manifest as sensory and/or motor loss of varying degrees. Inflammation and edema after trauma may injure nerves as well.

Patients experiencing superficial peroneal (fibular) nerve entrapment at GB 39 complain of pain on the craniolateral calf and dorsum of the ankle and foot. Pain often lasts for years and recurs intermittently. About a third of patients report sensory changes along the distribution of the nerve, in the form of numbness or paresthesias. Activities such as running, squatting, jogging, or even walking worsen the problem. Focused palpation along the entire GB channel from GB 34 to GB 40 as well as the entire pelvic limb should provide insight into the source of myofascial dysfunction and the sites to needle or otherwise neuromodulate.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[17]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[18,19]

Vessels

- **Lateral tarsal artery:** Branches off of the dorsalis pedis artery and anastomoses with branches of the arcuate, anterior lateral malleolar, and lateral plantar arteries. Also branches with the peroneal (fibular) artery.
- **Anterior lateral malleolar artery and vein:** Supply and drain the lateral ankle region.
- **Sinus tarsi artery:** Usually formed from anastomosing branches of the anterior tibial artery; i.e., the anterior lateral malleolar and proximal lateral tarsal artery.[20]
- **Veins of the sinus tarsi, with and without accompanying arteries:** Drain the tarsal sinus.

Clinical Relevance: Fractures of the proximal 5th metatarsal bone are some of the most common fractures that affect the foot; mechanisms involve falling from standing height or ankle twist with fixed forefoot.[21] Repetitive, cyclic loading can induce stress fractures of the 5th metatarsal. Inadequate circulation to this lateral portion of the foot contributes to incomplete or delayed fracture healing. Medical acupuncture, massage, and laser therapy support restoration of blood flow, resolution of pain, and bone healing.

The venous system of the sinus tarsi drains most of the blood from the talus as well as that from adjacent portions of the capsules surrounding the talocalcaneal and talocalcaneonavicular joints. Fibrotic changes affecting the walls of the veins and surrounding tissues may reduce venous outflow, increasing sinus pressure. Tissue swelling over the sinus at GB 40 may increase arterial inflow but also restrict venous outflow. Fibrosis may result from repeated ankle sprains and cause the aforementioned changes.

Indications and Potential Point Combinations

- **Tarsal sinus syndrome:** Lateral foot pain, perceived ankle instability, history of trauma involving inversion of the foot, typically found in patients in the 3rd or 4th decade of life, with worsened discomfort when pressure is applied over the lateral orifice of the tarsal sinus at GB 40: GB 40, GB 39, ST 39, BL 64, local trigger points as necessary.

Evidence-Based Applications

- A study evaluating the effects on cortical activation during stimulation of left LR 3 and left GB 40 revealed that, compared to the non-rotating stimulation method, rotating stimulation caused an **increase in activation in bilateral secondary somatosensory cortical areas, frontal areas, the right thalamus and the left side of the cerebellum.** Stimulation of sham points did not strengthen the effects of acupuncture on brain activation.[4]
- Acupuncture at GB 40 enhanced causal connectivity between the superior temporal gyrus and the anterior insula, in contrast to needling KI 3, which strengthened the connection between the **superior temporal gyrus and the postcentral gyrus.**[22]
- Electroacupuncture at GB 40 treated **migraine** significantly more effectively than did ST 25.[5]
- Electroacupuncture at GB 40, BL 63, LR 3, TH 5, ST 36, and LI 4 reduced requirements for sevoflurane and shortened recovery time after general anesthesia for patients undergoing **supratentorial craniotomy.**[23]

References

1. Lektrakul N, Chung CB, Lai Y-M, et al. Tarsal sinus: Arthrographic, MR imaging, MR arthrographic, and pathologic findings in cadavers and retrospective study data in patients with sinus tarsi syndrome. *Radiology.* 2001;219:802-810.
2. Parano E, Pavone V, Greco F, et al. Reflex sympathetic dystrophy associated with deep peroneal nerve entrapment. *Brain & Development.* 1998;20:80-82.
3. Yilmaz U, Rothman I, Ciol MA, Yang CC, and Berger RE. Toe spreading ability in men with chronic pelvic pain syndrome. *BMC Urology.* 2005;5:11.
4. Fang JL, Krings T, Weidemann J, Meister IG, and Thron A. Functional MRI in healthy subjects during acupuncture: different effects of needle rotation in real and false acupoints. *Neuroradiology.* 2004;46:359-362.
5. Jia CS, Ma XS, Shi J, et al. Electroacupuncture at Qiuxu (GB 40) for treatment of migraine – a clinical multicentral random controlled study. J Tradit Chin Med. 2009;29(1):43-49.
6. Cho J, Lee WC, and Park C-H. Snapping of the extensor digitorum longus due to attenuated inferior extensor retinaculum: case report. *Foot & Ankle International.* 2012;33(4):336-339.
7. Lektrakul N, Chung CB, Lai Y-M, et al. Tarsal sinus: arthrographic, MR imaging, MR arthrographic, and pathologic findings in cadavers and retrospective study data in patients with sinus tarsi syndrome. *Radiology.* 2001;219:802-810.
8. Bonnel F, Toullec E, Mabit C, et al. Chronic ankle instability: Biomechanics and pathomechanics of ligaments injury and associated lesions. *Orthopaedics & Traumatology: Surgery and Research.* 2010;96:424-432.
9. Tu P and Bytomski JR. Diagnosis of heel pain. *Am Fam Physician.* 2011;84(8):909-916.
10. Tu P and Bytomski JR. Diagnosis of heel pain. *American Family Physician.* 2011;84(8):909-916.
11. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
12. McCrory P, Bell S, and Bradshaw C. Nerve entrapments f the lower leg, ankle and foot in sport. *Sports Med.* 2002;32(6):371-391.
13. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
14. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
15. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. Instructional Course Lectures. 1993;42:185-194.
16. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
17. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
18. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
19. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol.* 2006;291(1):H318-H326.
20. Schwarzenbach B, Dora C, Lang A, et al. Blood vessels of the sinus tarsi and the sinus tarsi syndrome. *Clinical Anatomy.* 1997;10:173-182.
21. Ding BC, Weatherall JM, Mroczek KJ, et al. Fractures of the proximal fifth metatarsal: keeping up with the Joneses. Bull NYU Hosp Jt Dis. 2012;70(1):49-55.
22. Zhong C, Bai L, Dai R, et al. Modulatory effects of acupuncture on resting-state networks: a functional MRI study combining independent component analysis and multivariate Granger causality analysis. J Magn Reson Imaging. 2012;35(3):572-581.
23. Yang C, An L, Han R, et al. Effects of combining electroacupuncture with general anesthesia induced by sevoflurane in patients undergoing supratentorial craniotomy and improvements in their clinical recovery profile & blood encephalin. Acupunct Electrother Res. 2012;37(2-3):125-138.
24. Lektrakul N, Chung CB, Lai Y-M, et al. Tarsal sinus: arthrographic, MR imaging, MR arthrographic, and pathologic findings in cadavers and retrospective study data in patients with sinus tarsi syndrome. Radiology. 2001;219:802-810.
25. Jotoku T, Kinoshita M, Okuda R, et al. anatomy of ligamentous structures in the tarsal sinus and canal. Foot Ankle Int. 2006;27(7):533-538.

GB 41

Zu Lin Qi "Foot Governor of Tears", "Foot Overlooking Tears", "Foot Tears Control"

On the dorsum of the foot, in a depression distal to the junction of the bases of the 4th and 5th metatarsal bones, on the lateral aspect of the extensor digitorum longus tendon. Have the patient extend the little toe in order to identify the tendon.

Muscles and Tendons

- **4th dorsal interosseous muscle:** Abducts the digits and flexes the metatarsophalangeal joints.
- **Extensor digitorum longus tendon:** The extensor digitorum longus muscle extends the lateral four toes at the phalanges.
- **Extensor digitorum brevis tendon:** Extends digits II through IV at the metatarsophalangeal joint. Closely associated with the extensor hallucis brevis muscle; together, they form a fleshy mass on the lateral aspect of the dorsum of the foot, anterior to the lateral malleolus.

Clinical Relevance: Referred pain from extensor digitorum longus trigger points near GB 36 issue pain along the distal GB channel on the dorsum of the foot. Sustained myofascial dysfunction in the extensor digitorum along with the hallucis longus muscle can eventually deform the toes, leading to the "classic hammer toe" presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble "hammer heads". Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

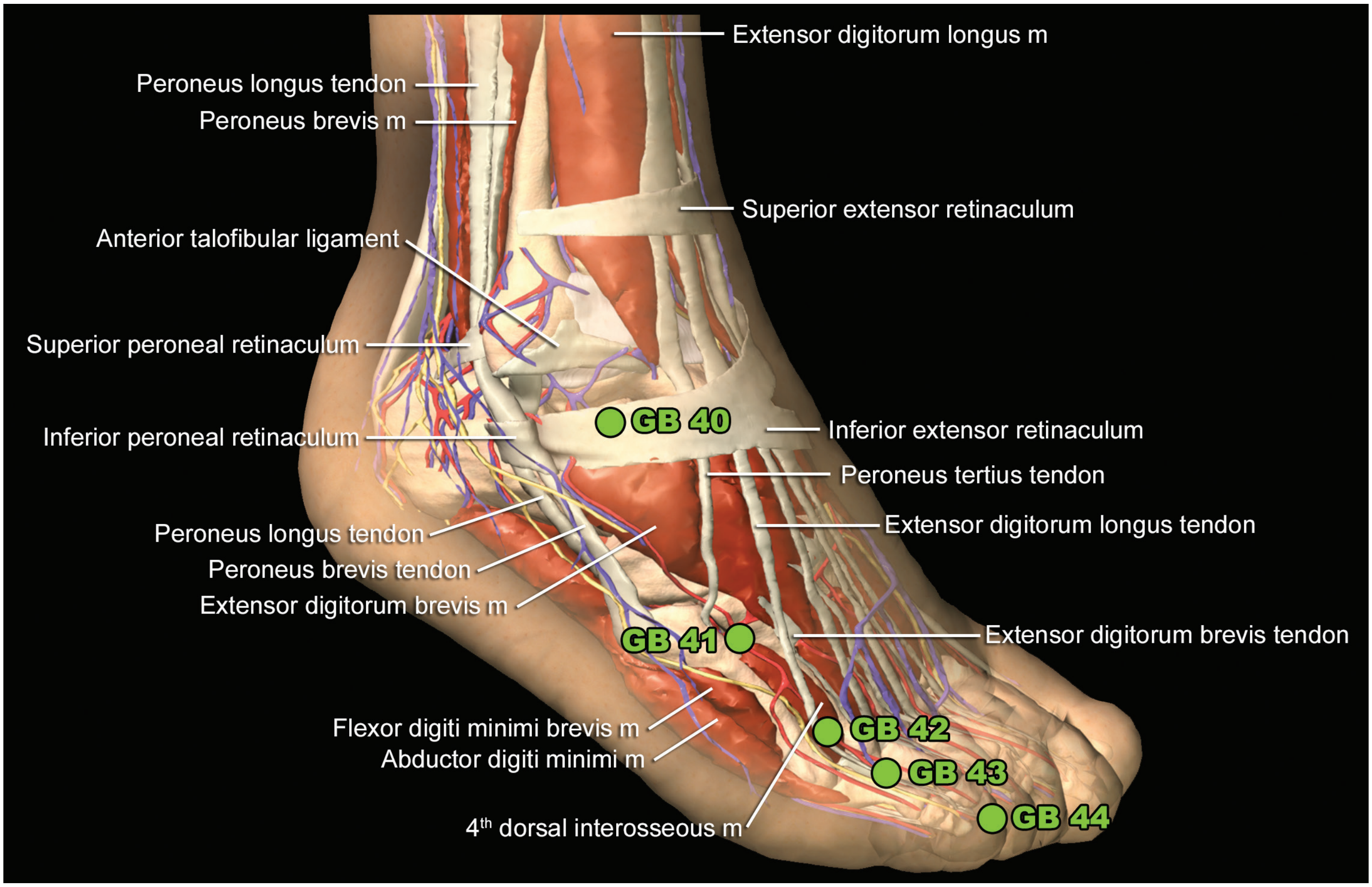
Hammer toes may cause or be worsened by trigger point pathology in the dorsal interosseous muscles. The interosseous muscles of the foot establish its architecture.[4] They provide for fine motor manipulation under normal circumstances.

Myofascial dysfunction in the superficial intrinsic muscles of the foot (including the extensor digitorum brevis muscle) leads to "sore feet". Trigger points in the extensor digitorum brevis near GB 40 send pain to the lateral dorsal surface, including GB 41 territory.

Thus, pain at GB 41 can manifest as a result of local pain from intrinsic muscles of the foot or referred pain from the long digital extensor muscle.

Nerves

- **Lateral plantar nerve, deep branches (S1, S2):** Supply the plantar and dorsal interossei, the lateral three lumbricals, and the adductor hallucis muscles.
- **Sural nerve:** Most commonly arises from the union of the medial sural cutaneous branch of the tibial nerve (L4-S3) and the sural communicating branch of the common peroneal



Extensor digitorum longus m
Peroneus longus tendon
Peroneus brevis m
Superior extensor retinaculum
Anterior talofibular ligament
Superior peroneal retinaculum
GB 40
Inferior extensor retinaculum
Inferior peroneal retinaculum
Peroneus tertius tendon
Extensor digitorum longus tendon
Peroneus longus tendon
Peroneus brevis tendon
Extensor digitorum brevis m
GB 41
Extensor digitorum brevis tendon
Flexor digiti minimi brevis m
GB 42
Abductor digiti minimi m
GB 43
GB 44
4th dorsal interosseous m

Figure 11-115. GB 41 is located lateral to the tendon of the extensor digitorum longus tendon that inserts on the little toe.

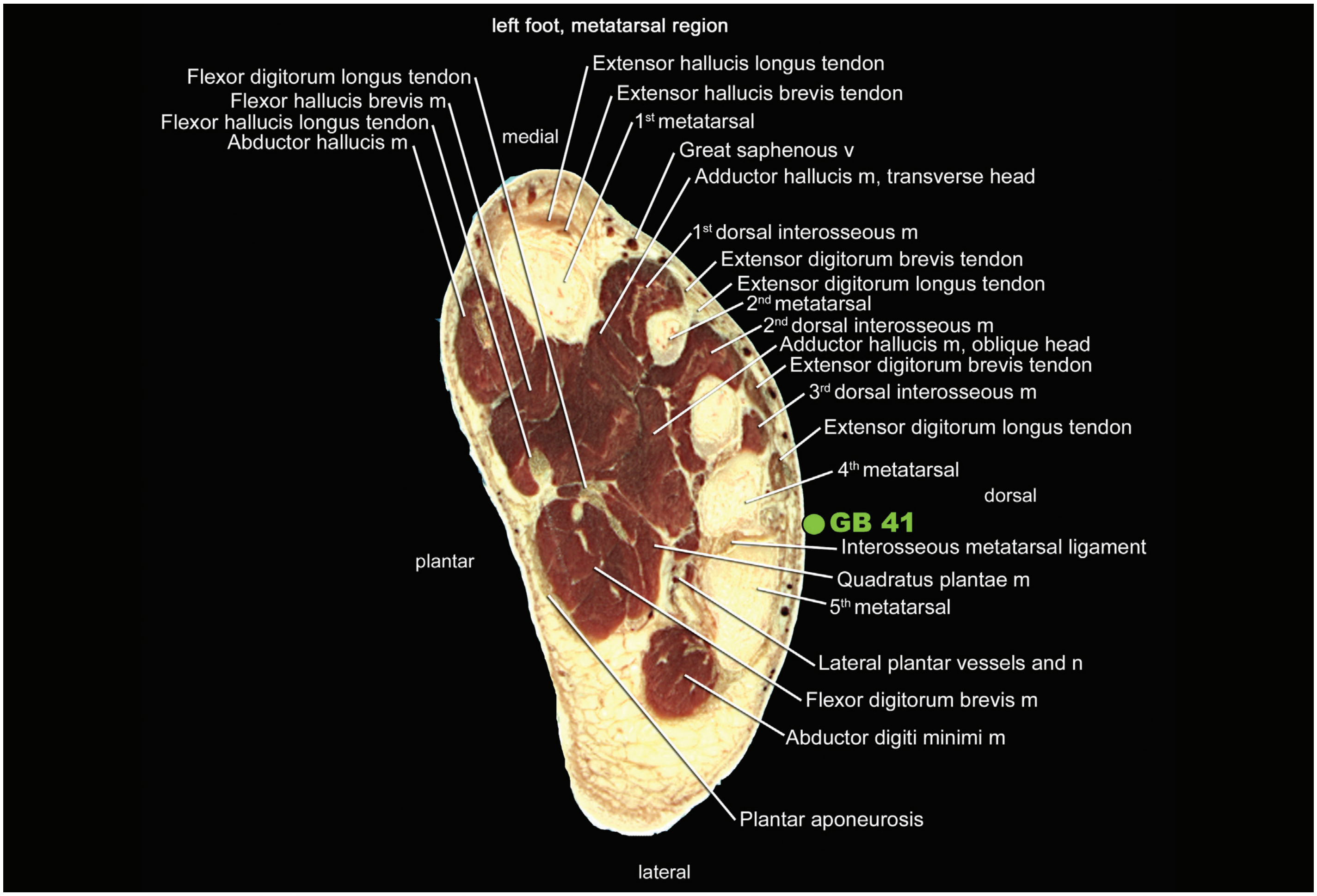

left foot, metatarsal region
Flexor digitorum longus tendon
Flexor hallucis brevis m
Flexor hallucis longus tendon
Abductor hallucis m
medial
Extensor hallucis longus tendon
Extensor hallucis brevis tendon
1st metatarsal
Great saphenous v
Adductor hallucis m, transverse head
1st dorsal interosseous m
Extensor digitorum brevis tendon
Extensor digitorum longus tendon
2nd metatarsal
2nd dorsal interosseous m
Adductor hallucis m, oblique head
Extensor digitorum brevis tendon
3rd dorsal interosseous m
Extensor digitorum longus tendon
4th metatarsal
dorsal
GB 41
Interosseous metatarsal ligament
plantar
Quadratus plantae m
5th metatarsal
Lateral plantar vessels and n
Flexor digitorum brevis m
Abductor digiti minimi m
Plantar aponeurosis
lateral

Figure 11-116. The cross section at GB 41 discloses the rather solid nature of the lateral foot, limiting the depth at which one can and should needle.

nerve (L4-S2). Innervates the lateral aspect of the foot. Courses posterior to the lateral malleolus, accompanying the small saphenous vein. Provides lateral calcaneal branches and terminates as the dorsal lateral cutaneous nerve of the foot. Certain afferent nerve neuromodulation techniques stimulate the sural nerve in order to treat voiding dysfunction, making use of the overlapping spinal cord of segments supplying both the pelvic limb and pelvic viscera.

- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot and all digits, except for the lateral side of the 5th pedal digit and the adjoining sides of the 1st and 2nd digits (which receives innervation from the deep peroneal nerve). Forms the dorsal digital nerves.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Emits articular branches to the joints it crosses.[1]

Clinical Relevance: In accordance with Hilton's Law, the majority of nerves supplying joints also supply muscles that cross (and therefore move) the joint or the skin covering the articular insertion of these muscles. The articular branches may innervate the fibrous joint capsule, articular ligaments, or the synovial membrane. Some nerves carry sensation, while others supply nervi vasorum to the accompanying arteries. In distal portions of the limb, such as the hands or feet, the articular nerves arise as branches of cutaneous nerves supplying skin over the joint. This law is significant, because nerves serving acupuncture points also supply nearby joints, which helps explain why the treatment of joint pain often involves needling sites near the painful arthrodial structure.

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[5] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-126) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Certain afferent nerve neuromodulation techniques stimulate the sural nerve in order to treat voiding dysfunction, making use of the overlapping spinal cord of segments supplying both the pelvic limb and pelvic viscera.[3]

The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression. Heel pain accompanied by tingling, burning, or loss of sensation suggest neuropathic injury by compression, traction, or other causes.[6]

From a functional perspective, mechanoreceptors located

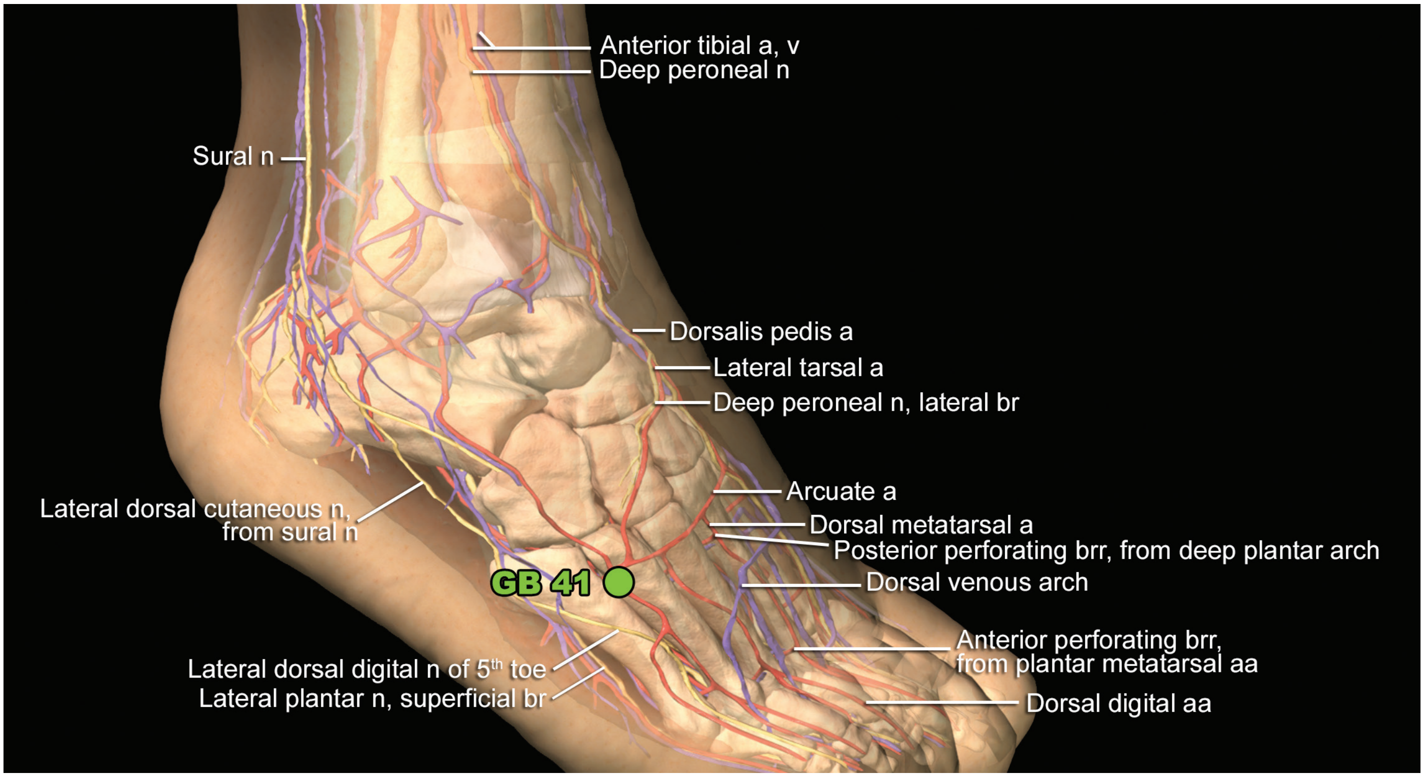

Anterior tibial a, v
Deep peroneal n
Sural n
Dorsalis pedis a
Lateral tarsal a
Deep peroneal n, lateral br
Lateral dorsal cutaneous n, from sural n
Arcuate a
Dorsal metatarsal a
Posterior perforating brr, from deep plantar arch
GB 41
Dorsal venous arch
Anterior perforating brr, from plantar metatarsal aa
Lateral dorsal digital n of 5th toe
Lateral plantar n, superficial br
Dorsal digital aa

Figure 11-117. GB 41, "Foot Overlooking Tears", has notoriety for treating disorders of the eyes. Anatomically, GB 41 connects to the LR channel via the arcuate artery and the deep peroneal nerve, and in Chinese medicine, the LR channel relates to the eyes. From a vascular perspective, the indications for GB 41 associated with autonomic normalization may stem from the confluence of arterial pathways at this site, providing avenues for neuromodulation via the nervi vasorum, balancing sympathetic and parasympathetic function. Neuroanatomically, points associated with the peroneal nerve, (including the GB, LR, and BL lines) have been connected to visual function through certain functional brain imaging studies involving techniques such as fMRI.

along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[7] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-121B) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Lateral heel pain from lateral calcaneal neuritis (branches of the sural nerve) produces discomfort that radiates along the nerve, although the pain may be difficult to localize in some cases. This contrasts with calcaneal stress fracture that leads to pain over the entire calcaneus or peroneal (fibularis) tendon disorders that cause pain on the lateral calcaneus and peroneal tubercle.

Compression of the superficial peroneal (fibular) nerve by crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 39, this nerve emerges through the crural fascia and divides into two cutaneous branches, the medial dorsal and intermediate dorsal cutaneous nerves. The intermediate dorsal cutaneous nerve follows the GB channel to GB 40 and the toes while the medial dorsal cutaneous nerve accompanies the ST channel. The LR channel on the dorsum of the foot (from about LR 1-LR 3) receives sensation by the lateral branch of the deep peroneal (fibular) nerve but may include some fibers from the intermediate dorsal cutaneous nerve from superficial peroneal (fibular) origin.[8]

Fascial restriction can compress cutaneous branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus and ankle (GB 40), the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve.

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation along the GB channel on the distal, lateral crus and dorsum of the foot that extends to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[9]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated by resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem.

Distal entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Compression at GB 39 affects the superficial peroneal (fibular) nerve where it branches into the medial and intermediate dorsal cutaneous nerves. Anatomically, the superficial peroneal (fibular) nerve exits from deep fascia here. A fascial edge may impinge on the nerve, as may muscle that has herniated through fascial defects.[10] The superficial peroneal (fibular) nerve courses along a short fibrous tunnel located between the anterior intermuscular septum and the fascia of the lateral compartment. Patients with nerve entrapment at this location may be considered to exhibit a local compartment syndrome. Chronic ankle instability and sprain reinjures the nerve and predisposes individuals to develop a fibrotic, low compliant nature to this tunnel. Surgery may also cause problems, as it may shift the fascia following anterior compartment fasciotomy and place added stretch on the nerve. Iatrogenic injuries to the common peroneal (fibular) nerve and its branches stem from procedures that take a lateral or craniolateral approach to the knee, ankle, fibular, or soft tissue.

Ankle injuries, whether traumatic or iatrogenic, have the capacity to cause damage either directly or by accentuating the pressure from the inferior extensor retinaculum onto the intermediate dorsal cutaneous branch of the superficial peroneal (fibular) nerve as well as the lateral branch of the deep peroneal (fibular) nerve.[11]

Patients experiencing superficial peroneal (fibular) nerve entrapment complain of pain on the craniolateral calf and dorsum of the ankle and foot. Pain often lasts for years and recurs intermittently. About a third of patients report sensory changes along the distribution of the nerve, in the form of numbness or paresthesias. Activities such as running, squatting, jogging, or even walking worsen the problem. Focused palpation along the entire GB channel from GB 34 to GB 40 as well as the entire pelvic limb should provide insight into the source of myofascial dysfunction and the sites to needle or otherwise neuromodulate.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[12]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[13,14]

Vessels

- **Dorsal venous arch of the foot:** Arises from the dorsal metatarsal veins.
- **4th dorsal metatarsal artery:** Arises from the arcuate artery, supplies the 4th metatarsal region.
- **4th dorsal metatarsal vein:** Arises from dorsal digital vein; drains into the dorsal venous arch.
- **Arcuate artery:** The 2nd, 3rd, and 4th metatarsal arteries arise from the arcuate artery, and divide into two dorsal digital arteries that course along the sides of adjoining toes. The metatarsal arteries are, in turn, connected to the plantar arch and plantar metatarsal arteries via the perforating arteries. The arcuate artery is not always present, but instead a dorsal arterial network consisting of the lateral tarsal artery and dorsal metatarsal arteries and proximal perforating arteries may[15] contribute to the blood supply of metatarsal arteries II through IV.

Clinical Relevance: The nervi vasorum associated with the arcuate artery may be responsible for autonomic neuromodulation derived from needling this site.

Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[16]

Indications and Potential Point Combinations

- **Cramping or pain of the lateral dorsum of the foot:** GB 41, GB 42, GB 36, ST 43, ST 44, BL 60.
- **Ocular disorders and visual disturbances:** GB 41, LR 3, GB 1, TH 23, BL 2, GB 14, BL 10.Note that despite its illustrative name, GB 41 does not ordinarily appear in treatments for eye conditions. The local points likely have a far greater impact. However, as critical thinkers about acupuncture argue, we must measure the traditional indications of acupuncture points as presented in ancient literature against what actually occurs in the clinic, and modify recommendation as necessary.[2,3]

References

1. Yilmaz U, Rothman I, Ciol MA, Yang CC, and Berger RE. Toe spreading ability in men with chronic pelvic pain syndrome. *BMC Urology.* 2005;5:11.
2. Wu XD and Huang LX. (Chinese) Study on the indications of acupoints presented in verses of acupuncture and moxibustion. *Zhongguo Zhen Jiu.* 2006;26(5):381-384.
3. Wu XD and Huang LX. (Chinese) Discussion on the citation of acu-moxibustion treatment verses in textbook acupuncturology. *Zhen Ci Yan Jiu.* 2008;33(4):272-276.
4. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
5. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
6. Tu P and Bytomski JR. Diagnosis of heel pain. *American Family Physician.* 2011;84(8):909-916.
7. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res.* 2009;196:217-227.
8. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
9. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice.* 2012;28(7):552-561.
10. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
11. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993;42:185-194.
12. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation.* 2013;16(3):256-260.
13. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med.* 2012;18(2):130-136.
14. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. Am J Physiol Heart Circ Physiol. 2006;291(1):H318-H326.
15. DiLandro AC, Lilja EC, Lepore FL, et al. The prevalence of the arcuate artery: a cadaveric study of 72 feet. J Am Podiatr Med Assoc. 2001;91(6):300-305.
16. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2009;62:1227-1232.

GB 42

Di Wu Hui "Earth Five Meetings", "Earth Fivefold Convergence", "Pinched Ravine"

On the dorsum of the foot, in a depression proximal to the heads of the 4th and 5th metatarsal bones, on the medial side of the of the extensor digitorum longus tendon, approximately 0.5 cun distal to GB 41.

Muscles and Tendons

- **4th dorsal interosseous muscle:** Abducts the digits and flexes the metatarsophalangeal joints.
- **Extensor digitorum brevis tendon:** Extends digits II through IV at the metatarsophalangeal joint. Closely associated with the extensor hallucis brevis muscle; together, they form a fleshy mass on the lateral aspect of the dorsum of the foot, anterior to the lateral malleolus.
- **Extensor digitorum longus tendon:** The extensor digitorum longus muscle extends the lateral four toes at the phalanges.

Clinical Relevance: Proper function of the long digital extensors allows one to operate the toes normally during ambulation, clearing the ground with the foot during the swing phase. The extensor digitorum longus, thus critical for normal biomechanics of the foot, extends the proximal phalanx of the four lateral toes and assists in dorsiflexion and eversion of the foot.

Referred pain from extensor digitorum longus trigger points near GB 36 issue pain along the distal GB channel on the dorsum of the foot toward GB 42. Sustained myofascial dysfunction in the extensor digitorum along with the hallucis longus muscle can eventually deform the toes, leading to the "classic hammer toe" presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble "hammer heads". Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

Hammer toes may cause or be worsened by trigger point pathology in the dorsal interosseous muscles. The interosseous muscles of the foot establish its architecture.[2] They provide for fine motor manipulation under normal circumstances.

Myofascial dysfunction in the superficial intrinsic muscles of the foot (including the extensor digitorum brevis muscle) leads to "sore feet". Trigger points in the extensor digitorum brevis near GB 40 send pain to the lateral dorsal surface, including GB 41 and possibly even GB 42 territory. Thus, pain at GB 42 may manifest as a result of local pain from intrinsic muscles of the foot or referred pain from the long digital extensor muscle.

Deep intrinsic muscles of the foot such as the interosseous muscles support its strength and architecture.[3] They provide for fine motor manipulation under normal circumstances.

Nerves

- **Lateral plantar nerve, deep branches (S1, S2):** Supply the plantar and dorsal interossei, the lateral three lumbricals, and the adductor hallucis muscles.
- **Sural nerve:** Most commonly arises from the union of the medial sural cutaneous branch of the tibial nerve (L4-S3) and the sural communicating branch of the common peroneal nerve (L4-S2). Innervates the lateral aspect of the foot. Courses caudal to the lateral malleolus, accompanying the small saphenous vein. Provides lateral calcaneal branches and terminates as the dorsal lateral cutaneous nerve of the foot. Certain afferent nerve neuromodulation techniques stimulate the sural nerve in order to treat voiding dysfunction, making use of the overlapping spinal cord of segments supplying both the pelvic limb and pelvic viscera.[1]
- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot and all digits, except for the lateral side of the 5th pedal digit and the adjoining sides of the 1st and 2nd digits (which receives innervation from the deep peroneal (fibular) nerve). Becomes the dorsal digital nerves.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Emits articular branches to the joints it crosses.

Clinical Relevance: The lateral plantar nerve may suffer entrapments at several locations from where it branches off of the tibial nerve to its myriad destinations.

Ligamentous laxity or myofascial dysfunction in the foot may lead to nerve irritation. If this occurs between the 4th and 5th metatarsal bones, acupuncture stimulation of GB 42 may aid in its resolution.

In accordance with Hilton's Law, the majority of nerves supplying

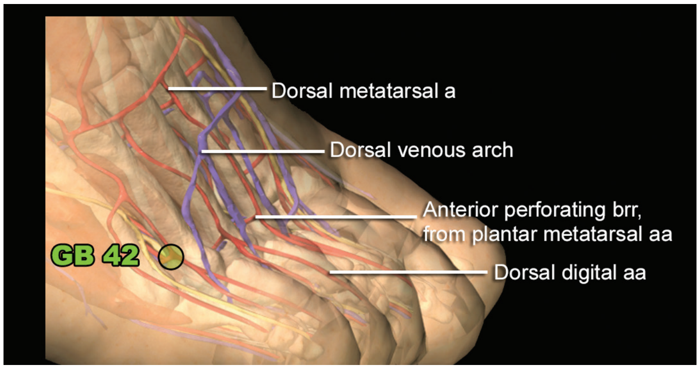


Figure 11-118. The illustrative name for GB 42, indicating a convergence of "five" components connotes several possibilities. Five arteries feed this site, as suggested by the names "Earth Five Meetings" and "Earth Fivefold Convergence", with "Earth" in Chinese medicine representing the nourishing nature of blood. The five arteries converging here include a dorsal and ventral metatarsal artery, an adjoining anterior perforating branch connecting the two metatarsal arteries, and the two dorsal digital arteries that bifurcate distal to this point. Alternatively, the number five might allude to the five toes touching the ground (Earth). The name "Pinched Ravine" for GB 42 speaks to the narrowness of the intertarsal groove through which the fluid-bearing channels of the metatarsal artery and vein ferry nutrients.

joints also supply muscles that cross (and therefore move) the joint or the skin covering the articular insertion of these muscles. The articular branches may innervate the fibrous joint capsule, articular ligaments, or the synovial membrane. Some nerves carry sensation, while others supply nervi vasorum to the accompanying arteries. In distal portions of the limb, such as the hands or feet, the articular nerves arise as branches of cutaneous nerves supplying skin over the joint. This law is significant, because nerves serving acupuncture points also supply nearby joints, which helps explain why the treatment of joint pain often involves needling sites near the painful arthrodial structure.

Distal points such as GB 42 exhibit a relatively greater proportion of sensory and sympathetic fibers than do more proximal sites. As such, they offer, perhaps, greater opportunities to neuromodulate the autonomic flavor of the associated nerve's actions than do their proximal counterparts.

From a functional perspective, mechanoreceptors located along the lateral foot and supplied by the sural nerve branches assist in maintaining upright stance and control over posture.[4] The body accomplishes this by means of reflexes connecting cutaneous receptors of the foot (supplied by the lateral dorsal cutaneous nerve, shown in Figure 7-126) with the erector spinae muscles of the lower back. Acupuncture and related techniques that activate nerve endings along the BL channel of the foot thus aid in balance and support of an upright posture and dynamic stabilization during gait and ground contact.

Certain afferent nerve neuromodulation techniques stimulate the sural nerve in order to treat voiding dysfunction, making use of the overlapping spinal cord of segments supplying both the pelvic limb and pelvic viscera.[4]

The fascial sheath surrounding the caudal calf muscles will at times entrap the sural nerve as it emerges near BL 58. At the ankle, branches of the sural nerve can also experience compression. Heel pain accompanied by tingling, burning, or loss of sensation suggest neuropathic injury by compression, traction, or other causes.[5]

Lateral heel pain from lateral calcaneal neuritis (branches of the sural nerve) produces discomfort that radiates along the nerve, although the pain may be difficult to localize in some cases. This contrasts with calcaneal stress fracture that leads to pain over the entire calcaneus or peroneal (fibularis) tendon disorders that cause pain on the lateral calcaneus and peroneal tubercle.

Compression of the superficial peroneal (fibular) nerve by crural fascia causes "superficial peroneal (fibular) nerve syndrome". Near GB 39, this nerve emerges through the crural fascia and divides into two cutaneous branches, the medial dorsal and intermediate dorsal cutaneous nerves. The intermediate dorsal cutaneous nerve follows the GB channel to GB 40 and the toes while the medial dorsal cutaneous nerve accompanies the ST channel. The LR channel on the dorsum of the foot (from about LR 1-LR 3) receives sensation by the lateral branch of the deep peroneal (fibular) nerve but may include some fibers from the intermediate dorsal cutaneous nerve from superficial peroneal (fibular) origin.[6]

Fascial restriction can compress cutaneous branches as they cross the cranial ankle. If this occurs, sensation may be lessened to the craniolateral distal crus and ankle (GB 40), the dorsum of the foot, and the dorsal skin of the great, second, third, and medial fourth toes. It spares a wedge of skin between the great and second toe, as this site section receives sensory supply from the deep peroneal (fibular) nerve.

Patients with superficial peroneal (fibular) nerve syndrome report pain or impaired sensation along the GB channel on the distal, lateral crus and dorsum of the foot that extends to the ST and LR channels. Exacerbating athletic activities include running, dancing, bodybuilding, tennis, horseback riding (specifically in jockeys), and soccer. Nonsurgical approaches that release the nerve and surrounding fascial restriction should be considered prior to surgery.[7]

Typically, nerve entrapment syndromes manifest as burning or "pins and needles" sensations, loss of coordination and proprioception in the limbs, symptoms that include dysfunctional thermoregulation, pain at night or at rest, pelvic limb or

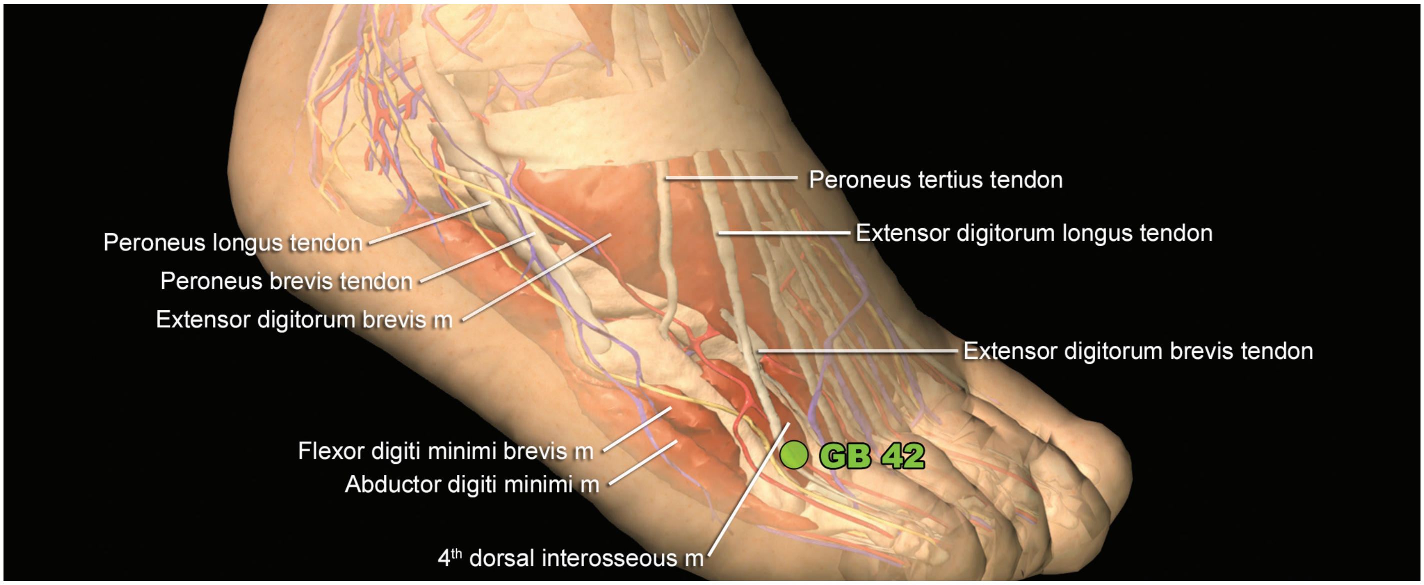

Peroneus tertius tendon
Peroneus longus tendon
Extensor digitorum longus tendon
Peroneus brevis tendon
Extensor digitorum brevis m
Extensor digitorum brevis tendon
Flexor digiti minimi brevis m
GB 42
Abductor digiti minimi m
4th dorsal interosseous m

Figure 11-119. The tendon of the extensor digitorum longus (or extensor digiti minimi) muscle inserts on the little toe in this location, superficial to the 4th dorsal interosseous muscle. Trigger points in either the extensor digitorum longus or interosseous muscle may refer pain across the dorsum of the foot.

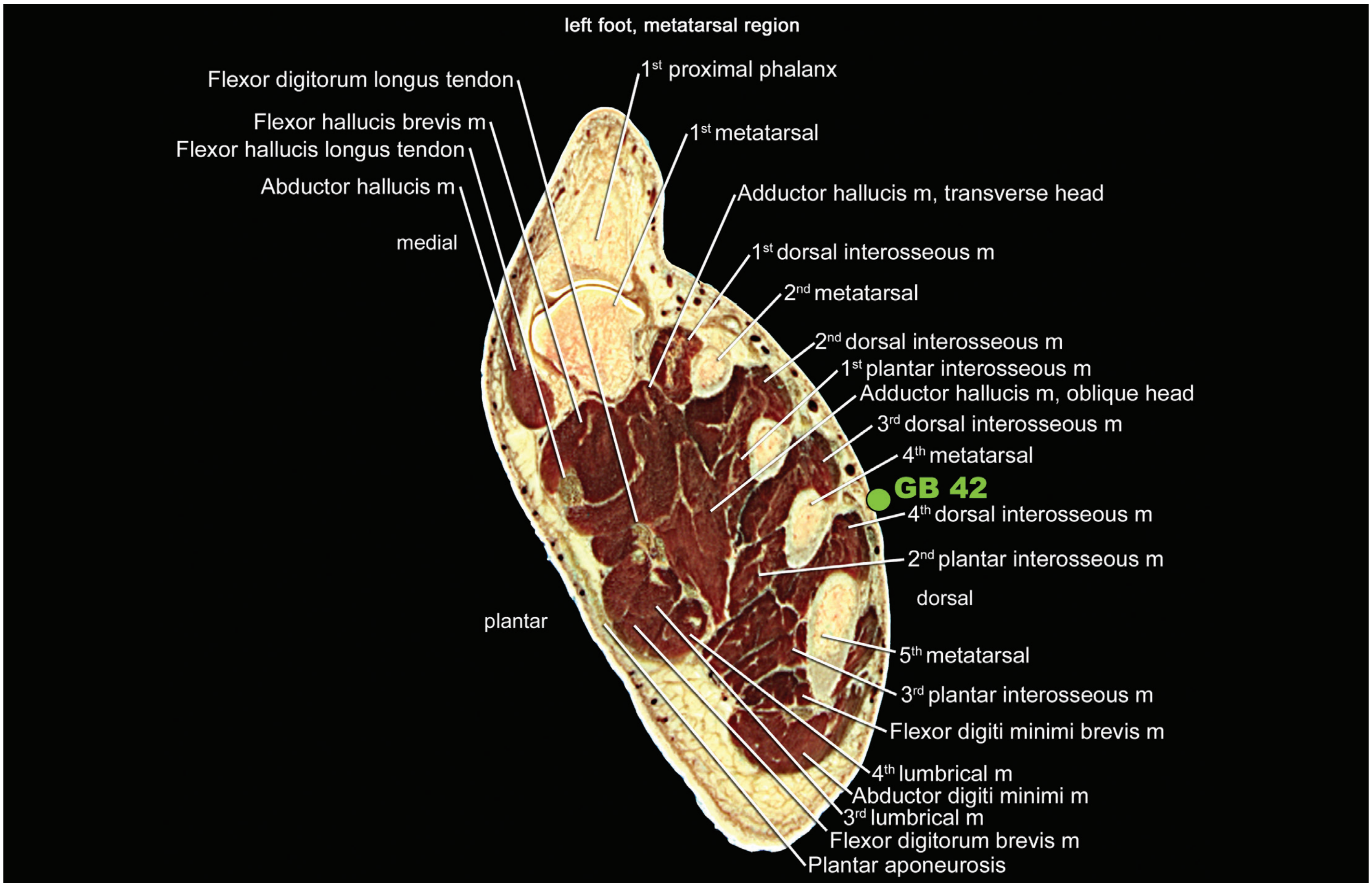

left foot, metatarsal region
Flexor digitorum longus tendon
1st proximal phalanx
Flexor hallucis brevis m
1st metatarsal
Flexor hallucis longus tendon
Adductor hallucis m, transverse head
Abductor hallucis m
medial
1st dorsal interosseous m
2nd metatarsal
2nd dorsal interosseous m
1st plantar interosseous m
Adductor hallucis m, oblique head
3rd dorsal interosseous m
4th metatarsal
GB 42
4th dorsal interosseous m
2nd plantar interosseous m
dorsal
plantar
5th metatarsal
3rd plantar interosseous m
Flexor digiti minimi brevis m
4th lumbrical m
Abductor digiti minimi m
3rd lumbrical m
Flexor digitorum brevis m
Plantar aponeurosis

Figure 11-120. The small and tightly packaged intrinsic muscles of the foot reveal its intricate architecture that affords nuanced control of balance and movement. This cross section exposes the number of vessels under the skin, each ready to ferry autonomic information to and fro through their nervi vasorum. Both local and whole body autonomic neuromodulation can result from acupuncture applied to distal points on the hands and feet.

gluteal pain that worsens with movement, and/or unilateral pain or swelling in the limb. The superficial peroneal (fibular) nerve syndrome causes pain or sensory loss over the lateral calf and/or dorsum of the foot, accentuated by resistive dorsiflexion and eversion of the ankle. Acupuncture and related techniques applied to the site of constriction or compression should help alleviate the problem.

Distal entrapment of the deep peroneal (fibular) nerve can occur where the nerve travels under the extensor retinaculum at the ankle or where it travels beneath the extensor hallucis brevis, further distal on the limb.

Compression at GB 39 affects the superficial peroneal (fibular) nerve where it branches into the medial and intermediate dorsal cutaneous nerves; the latter impacts GB 42. Anatomically, the superficial peroneal (fibular) nerve exits from deep fascia here. A fascial edge may impinge on the nerve, as may muscle that has herniated through fascial defects.[8] The superficial peroneal (fibular) nerve courses along a short fibrous tunnel located between the anterior intermuscular septum and the fascia of the lateral compartment. Patients with nerve entrapment at this location may be considered to exhibit a local compartment syndrome. Chronic ankle instability and sprain reinjures the nerve and predisposes individuals to develop a fibrotic, low compliant nature to this tunnel. Surgery may also cause problems, as it may shift the fascia following anterior compartment fasciotomy and place added stretch on the nerve. Iatrogenic injuries to the common peroneal (fibular) nerve and its branches stem from procedures that take a lateral or craniolateral approach to the knee, ankle, fibular, or soft tissue.

Ankle injuries, whether traumatic or iatrogenic, have the capacity to cause damage either directly or by accentuating the pressure from the inferior extensor retinaculum onto the intermediate dorsal cutaneous branch of the superficial peroneal (fibular) nerve as well as the lateral branch of the deep peroneal (fibular) nerve.[9]

Patients experiencing superficial peroneal (fibular) nerve entrapment complain of pain on the craniolateral calf and dorsum of the ankle and foot. Pain often lasts for years and recurs intermittently. About a third of patients report sensory changes along the distribution of the nerve, in the form of numbness or paresthesias. Activities such as running, squatting, jogging, or even walking worsen the problem. Focused palpation along the entire GB channel from GB 34 to GB 40 as well as the entire pelvic limb should provide insight into the source of myofascial dysfunction and the sites to needle or otherwise neuromodulate.

Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[10]

Fibular nerve connections to the brain and spinal cord produce autonomic neuromodulation and pro-homeostatic influences when activated. The effects commonly involve reduction of sympathetic nervous system activity.[11,12]

Vessels

- **4th dorsal metatarsal artery:** Arises from the arcuate artery, supplies the 4th metatarsal region.
- **4th dorsal metatarsal vein:** Arises from dorsal digital vein; drains into the dorsal venous arch.

Clinical Relevance: Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[13]

Indications and Potential Point Combinations

- **Dorsal foot pain, night cramps in the long extensors of the toes, and "growing pains" in children due to myofascial trigger points:** GB 42, GB 35, GB 36, other pertinent trigger points involved in the patient's individual pain problem.
- **Sore feet with pain on walking:** GB 42, GB 40, palpate for trigger points in the superficial intrinsic foot muscles, including the extensor digitorum brevis, the extensor hallucis brevis, the abductor hallucis, the abductor digiti minimi, and the flexor digitorum brevis.

References

1. Yilmaz U, Rothman I, Ciol MA, Yang CC, and Berger RE. Toe spreading ability in men with chronic pelvic pain syndrome. *BMC Urology*. 2005;5:11.
2. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.
3. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.
4. Clair JM, Okuma Y, Misiaszek JE, et al. Reflex pathways connect receptors in the human lower leg to the erector spinae muscles of the lower back. *Exp Brain Res*. 2009;196:217-227.
5. Tu P and Bytomski JR. Diagnosis of heel pain. *American Family Physician*. 2011;84(8):909-916.
6. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am*. 2011;16:255-274.
7. Anandkumar S. Physical therapy management of entrapment of the superficial peroneal nerve in the lower leg: a case report. *Physiotherapy Theory and Practice*. 2012;28(7):552-561.
8. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures*. 1993;42:185-194.
9. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. Instructional Course Lectures. 1993;42:185-194.
10. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation*. 2013;16(3):256-260.
11. Sun X, Lan QQ, Cai Y, et al. Electrical stimulation of deep peroneal nerve mimicking acupuncture inhibits the pressor response via capsaicin-insensitive afferents in anesthetized rats. *Chin J Integr Med*. 2012;18(2):130-136.
12. Michikami D, Kamiya A, Kawada T, et al. Short-term electroacupuncture at Zusanli resets the arterial baroreflex neural arc toward lower sympathetic nerve activity. *Am J Physiol Heart Circ Physiol*. 2006;291(1):H318-H326.
13. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.

GB 43

Xia Xi "Clamped Stream", "Pinched Ravine", "Tight Torrent"

Distal to the 4th and 5th metatarsophalangeal joints, 0.5 cun proximal to the web margin between the 4th and 5th toes.

Tendons

- **Tendons of the extensor digitorum longus and brevis muscles for the 4th and 5th toes:** Extend the toes.

Clinical Relevance: Proper function of the long digital extensors allows one to operate the toes normally during ambulation, clearing the ground with the foot during the swing phase. The extensor digitorum longus, thus critical for normal biomechanics of the foot, extends the proximal phalanx of the four lateral toes and assists in dorsiflexion and eversion of the foot.

Myofascial dysfunction in the superficial intrinsic muscles of the foot (including the extensor digitorum brevis muscle) leads to "sore feet". Trigger points in the extensor digitorum brevis near GB 40 send pain to the lateral dorsal surface, including landscape as far as GB 43. Thus, pain at GB 43 may manifest as a result of local pain from intrinsic muscles of the foot or referred pain from the long digital extensor muscle. Deep intrinsic muscles of the foot such as the interosseous muscles support its strength and architecture.[3] They provide for fine motor manipulation under normal circumstances.

Referred pain from extensor digitorum longus trigger points near GB 36 issues pain along the distal GB channel on the dorsum of the foot toward GB 43. Sustained myofascial dysfunction in the extensor digitorum along with the hallucis longus muscle can eventually deform the toes, leading to the "classic hammer toe" presentation. In this condition, the metatarsophalangeal joint of all four lesser toes extends while the proximal interphalangeal joint flexes. The distal interphalangeal joint also extends. These abnormal toe positions cause them to resemble "hammer heads". Wearing tight shoes precipitates the problem; as such, the remedy calls for switching to wide or box-toed shoes and pursuing a course of physical medicine to help undo the damage.

Hammer toes may cause or be worsened by trigger point pathology in the dorsal interosseous muscles. The interosseous muscles of the foot establish its architecture.[4] They provide for fine motor manipulation under normal circumstances.

Nerves

- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot and all digits, except for the lateral side of the 5th pedal digit and the adjoining sides of the 1st and 2nd digits (which receives innervation from the deep peroneal (fibular) nerve). Forms the dorsal digital nerves.
- **Deep peroneal (fibular) nerve (L5-S1):** Innervates the extensor digitorum longus and brevis, the extensor hallucis longus, and the peroneus (fibular) tertius muscles. Innervates the skin of between the first and second digits and metatarsi. Emits articular branches to the joints it crosses.

Clinical Relevance: Nerve stimulation via acupuncture and related techniques at GB 43 and its partner points near neighboring web spaces may aid in the restoration of sensation and motor control to the distal pelvic limb. Stimulation of the fibular nerve with functional electrical stimulation (which possesses similar mechanisms of action to electroacupuncture) reduces foot drop and increases walking speed in patients with spastic paraparesis.[5]

Distal points such as GB 43 exhibit a relatively greater proportion of sensory and sympathetic fibers than do more proximal sites. As such, they offer, perhaps, greater opportunities to neuromodulate autonomic aspects of the associated nerve's actions than do their proximal counterparts.

Vessels

- **4th dorsal metatarsal artery:** Arises from the 4th metatarsal artery, where it divides into two dorsal digital arteries, going to the 4th and 5th toes.

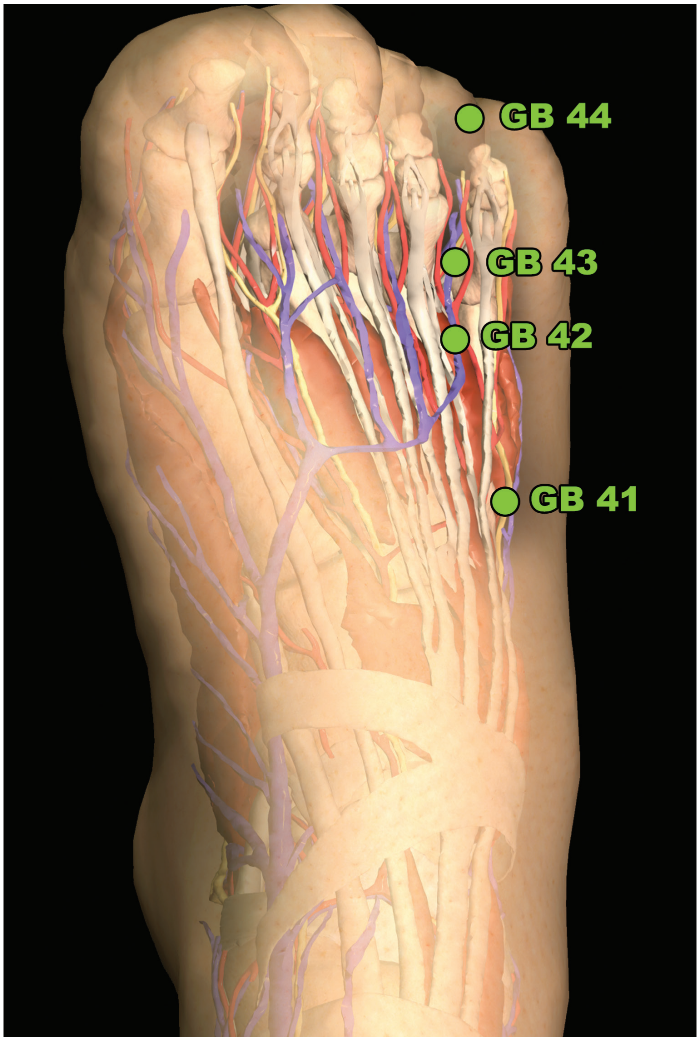


Figure 11-121. Points within the webs between the toes such as GB 43 access digital nerve bifurcations. Stimulation here promotes recovery of nerve function in cases of pelvic limb paresis or paralysis. Web space points on the foot called "Bafeng", or "Eight Winds", for their elimination of metaphorical "wind", i.e., nerve injury or pain. Corresponding points on the hand, "Baxie", go by the name "Eight Pathogens" or "Eight Evils", referring to the invasion of metaphorical pernicious influences into the hand through the web spaces.

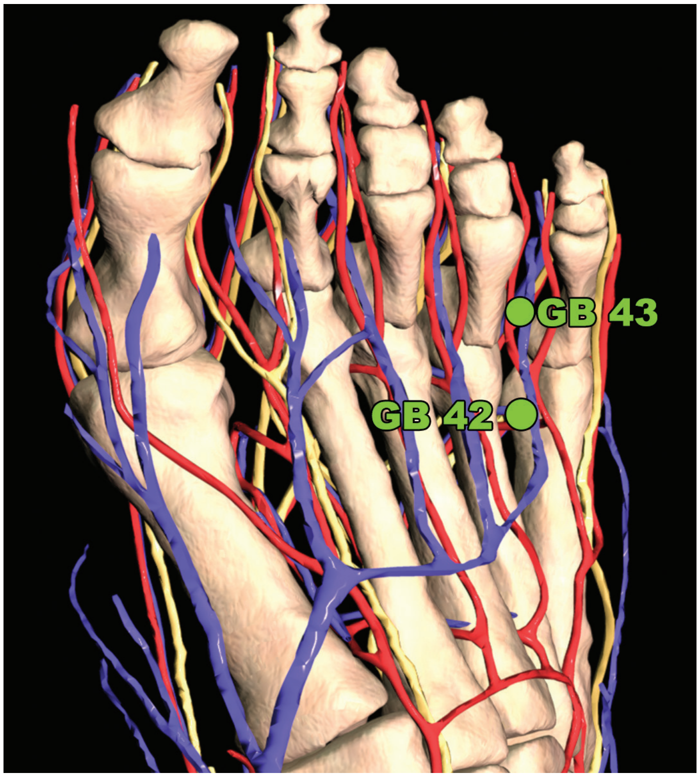


Figure 11-122. As the vessels feeding the GB channel narrow, the relative proportion of sympathetic fiber supply increases, causing stimulation of these sties to deliver progressively greater impacts on systemic autonomic function and local hemodynamics. The descriptive titles for GB 43 of "Tight Torrent", "Pinched Ravine", and "Clamped Stream" pertain to the diminishing diameter of the arterial architecture at this distal site.

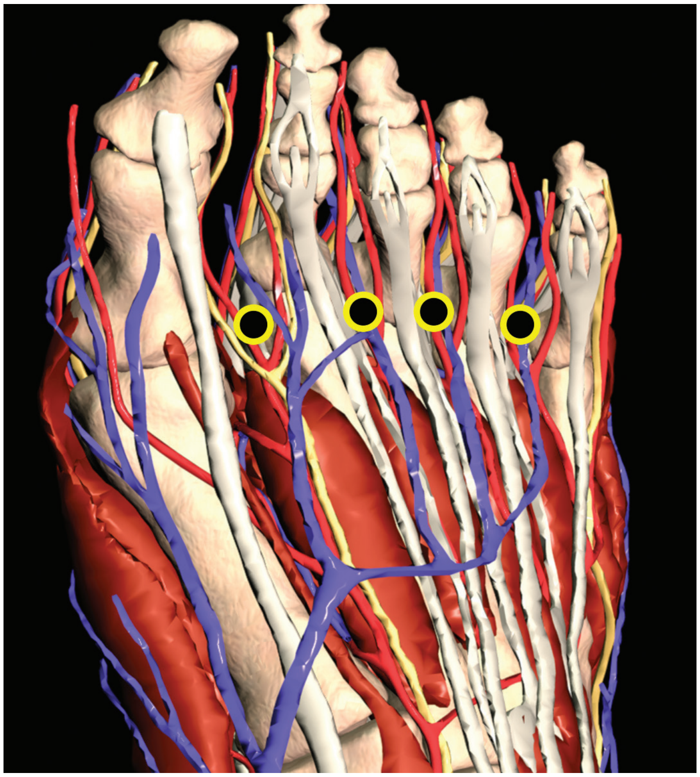


Figure 11-123. The "Bafeng" or "Eight Wind" points comprise four locations on each foot, located at the web spaces between the toes. These areas exhibit high neurovascular traffic and thus provide excellent options for acupuncture intervention in patients with problems of impaired neurologic function and circulation. Three of the Bafeng points overlap with standard acupuncture points, including LR 2 between the big and 2nd toe, ST 44 between the 2nd and 3rd toes, and GB 43, between the 4th and 5th toes, leaving the spot between the 3rd and 4th toes without an alternate designation. However, given its anatomical similarity to the other points, clinical indications for pain, circulatory insufficiency, and neurologic impairment still apply.

- **4th dorsal metatarsal vein:** Arises from dorsal digital vein; drains into the dorsal venous arch.

Clinical Relevance: Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[6]

Distal osteotomies performed to treat claw toe deformities and metatarsalgia may damage the intraosseous arterial network of the metatarsal head. The nutrient arteries that feed the head are terminal end arteries, making this section more prone to osteonecrosis following iatrogenic or traumatic injury than the metatarsal diaphysis.[7] If injury does occur to this vascular network, points such as GB 43 may suggest sites for acupuncture, massage, and laser therapy that may aid in restoring circulation by improving tissue perfusion, limiting inflammation, and stimulating regrowth.

Indications and Potential Point Combinations

- **Cold feet and legs:** GB 43 and the remaining three "Bafeng" points on each foot (See Figure 3). LR2, SP6.
- **Swollen feet:** GB 43 and the other Bafeng, SP 5, SP 6, ST 36.
- **Tension or pain in the toes:** GB 43 and pertinent trigger points evoking referred pain in the digits; consider Bafeng. GB 35, GB 36, ST 36 for referred pain by the extensor digitorum and anterior tibial muscles.
- **Lumbosacral pain:** GB 43, BL 40, local back points tender to palpation. Examine BL 23, BL 25, GV 3, GV 4, BL 32.
- **Impaired brain processing of sound and language:** GB 43, GB and TH points around the ear that exhibit tenderness to palpation.
- **Inflammation in the eyes:** GB 43, GB 2, GB 1, TH 23, BL 2, GV 20.

Evidence-Based Applications

- Laser stimulation of GB 43 showed significant brain activation in the ipsilateral thalamus, nucleus subthalamicus, nucleus ruber, midbrain, and Brodmann Areas (BA) 40 and 22. On the right side of the brain, BA 40 and 22 help **process sound and**

language, which are consistent with some of the classical applications of this point.[1]

- Acupuncture at the spinal nerve points from L4-S1, along with GB 43, GB 36, BL 40, and an injection of Gegensu Zhusheye (Puerarin Injectio) improved the signs and symptoms related to **lumbar intervertebral disk disease,** the activities of daily living, and analgesic states as compared to injection alone. The mechanism putatively involved at least in part, changes in cytokine and hemodynamic states.[2]
- Laser acupuncture (50 mW, continuous radiation for 90 seconds, totaling 4.5 J and 1250 W per cm2) applied to GB 43, GB 20, LI 4, LR 3, ST 6, SI 19, NT3, and EX-HN 3 reduced chronic pain associated with **temporomandibular dysfunction.**[8]

References

1. Siedentopf CM, Koppelstaetter F, Haala IA, Haid V, Rhomberg P, Ischebeck A, Buchberger W, Felber S, Schlager A, and Golaszewski SM. Laser acupuncture induced specific cerebral cortical and subcortical activations in humans. *Lasers in Medical Science*. 2005;20:68-73.
2. Zhuang Z and Jiang G. Thirty cases of the blood-stasis type prolapse of lumbar intervertebral disc treated by acupuncture at the xi (cleft) point plus herbal intervention injection. *J Tradit Chin Med*. 2008;28(3):178-182.
3. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.
4. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.
5. Marsden J, Stevenson V, McFadden C, et al. The effects of functional electrical stimulation on walking in hereditary and spontaneous spastic paraparesis. *Neuromodulation*. 2013;16(3):256-260.
6. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2009;62:1227-1232.
7. Petersen WJ, Lankes JM, Paulsen F, et al. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot & Ankle International*. 2002;23(6):491-495.
8. Ferreira LA, de Oliveira RG, Guimaraes JP, et al. Laser acupuncture in patients with temporomandibular dysfunction: a randomized controlled trial. *Lasers Med Sci*. 2013;28(6):1549-1558.

GB 44

Zu Qiao Yin "Yin Portals of the Foot", "Foot Orifice Yin"

On the lateral side of the base of the nail of the 4th toe, the width of a Chinese leek leaf from the corner of the nail.

Nerves

- **Superficial peroneal (fibular) nerve (L5-S2):** Innervates the peroneus longus and brevis muscles. Supplies the skin on the distal third of the leg and dorsum of the foot and all digits, except for the lateral side of the 5th pedal digit and the adjoining sides of the 1st and 2nd digits (which receive innervation from the deep peroneal nerve). Forms the dorsal digital nerves.

Clinical Relevance: The abundant supply of sensory nerve fibers at the ting points of the digits provide ample opportunities to neuromodulate and improve nerve function in cases of sensory or motor compromise.

Vessels

- **4th dorsal digital artery:** Arises from the 4th metatarsal artery.
- **4th dorsal digital vein:** Communicates with the plantar digital veins.

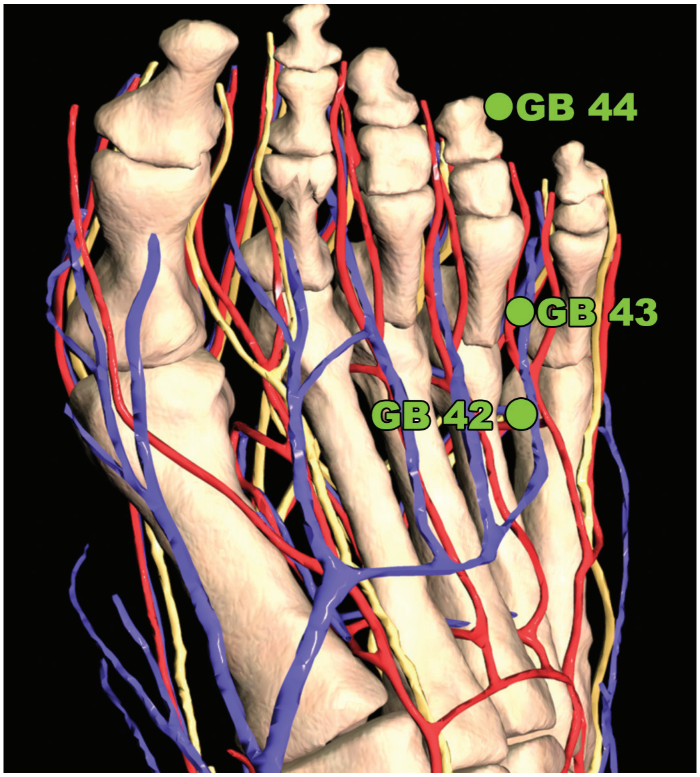


Figure 11-124. "Foot Orifice Yin" for GB 44 suggests the ancient idea of the "five orifices" connoting the sensory organs on the head; i.e., the eyes, mouth, nose, tongue, and ears. In Chinese medicine, each of these facial features relates to internal organs, specifically the liver, spleen, lungs, heart, and kidney, respectively. As such, stimulating GB 44 was viewed as a means to impact physiologic function not only on the head but also internally. The neuromodulatory impact of GB 44 relates to its heavy investment of sympathetic fibers at these distal arterioles and capillaries. Note: Only the larger distal vessels appear in this image.

Clinical Relevance: The characteristics of "ting" points (i.e., those most distal on the channel) that tend to produce strong hemodynamic shifts result from the abundant nervi vasorum associated with the ever-narrowing arterioles. Despite their small size, these "nerves of the vessels" are capable of inducing profound autonomic shifts.

Indications and Potential Point Combinations

- **Fever:** GB 44, LI 4, LI 11, GV 14, GV 20, ST 36.
- **Headaches around the eyes:** GB 44, GB 20, BL 9, BL 2, Tai Yang, relevant trigger points, LR 3.
- **Dizziness, vertigo:** GB 44, Tai Yang, GV 20, GB 20, ST 36.
- **Foot pain or swelling on the dorsum:** Palpate to define trigger points in the crus potentially responsible for referred pain. Add local points, GB 44, laser therapy, and massage.
- **Deafness, tinnitus:** GB 44, GB 20, temporalis trigger points, BL 10.
- **Eye pain:** GB 44, GB 1, TH 23, BL 2, LI 4, GV 14, ST 36.

Evidence-Based Applications

- A case series reported that the following points, in combination with local tender points, offer benefit for the management of **back pain:** KI 3, KI 10, SI 3, BL 40, BL 60, BL 23, BL 25, BL 27, BL 29, BL 67, GB 44, and SI 18.[1]
- Acupuncture at GB 44, BL 67, ST 45, SP 1, SP 6, KI 1 (as located on the midpoint of the third toe rather than the bottom of the foot), KI 7, BL 58, ST 40, ST 36, TH 1, HT 9, SI 1, LR 1, LU 11, LI 1, LI 4, LU 9, CV 17, and moxa at GV 14 promoted rapid resolution of **staphylococcal skin wounds** otherwise unresponsive to 50 days of treatment with antibiotics and deemed life-threatening in a 13-month-old child with Noonan's syndrome.[2]

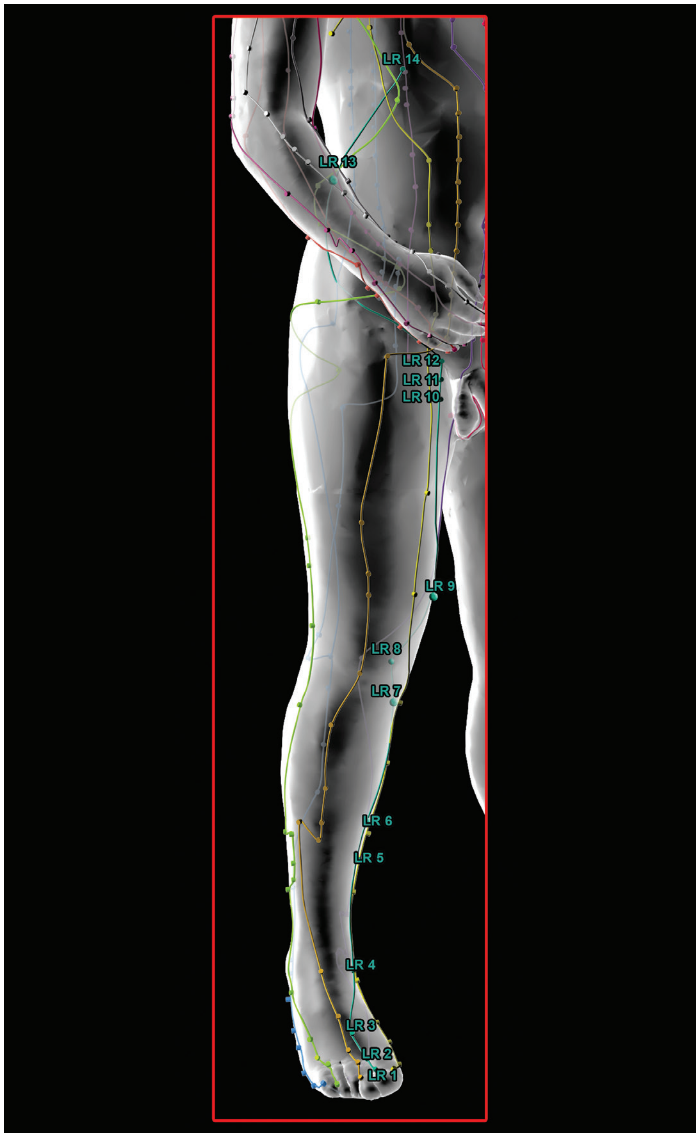
References

1. Kuruvilla AC. Acupuncture in the management of back pain. *Medical Acupuncture.* 2004;15(3):17-18.

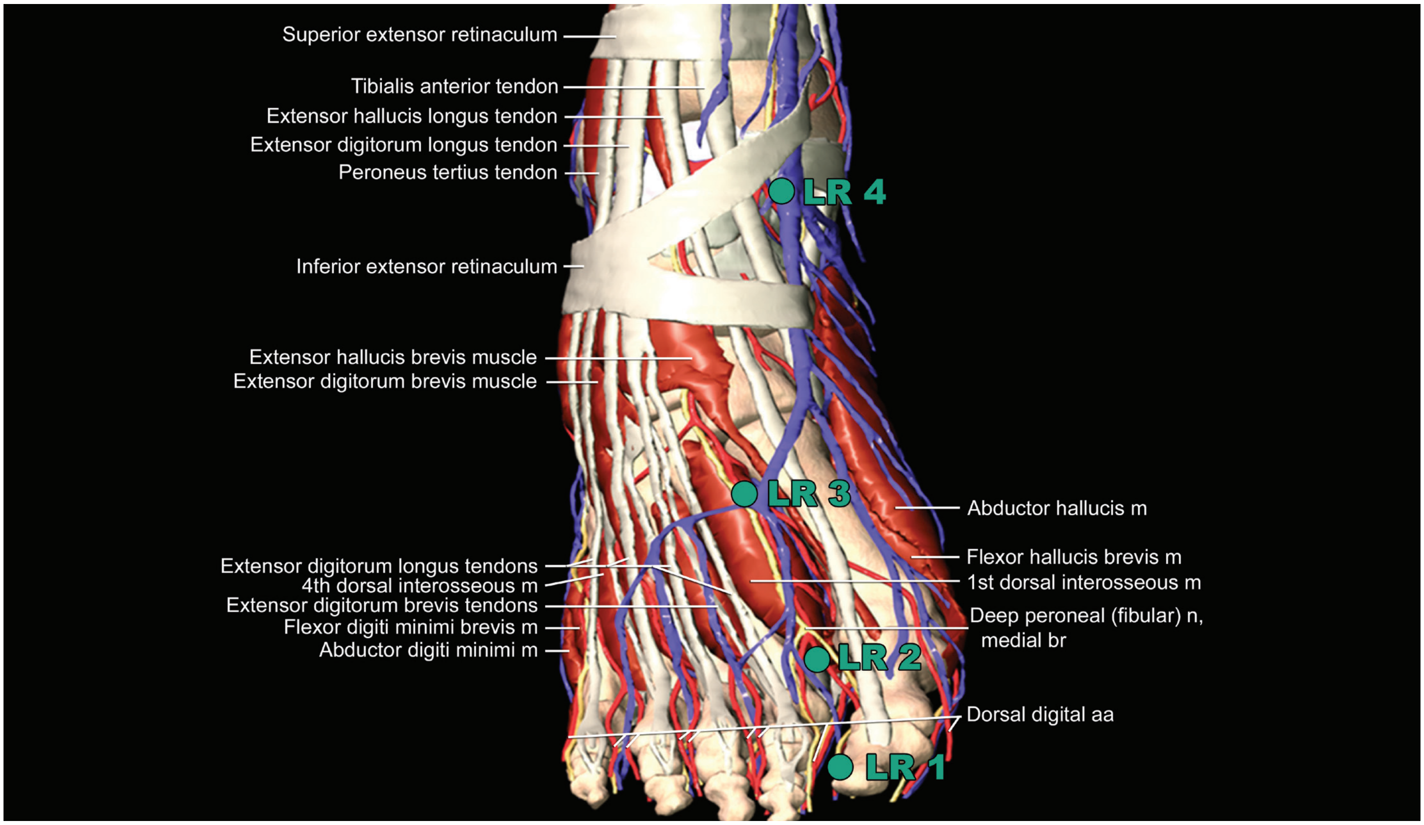
2. Diogenes MSB, Carvalho ACC, and Tabosa AMF. Acupuncture and moxibustion as fundamental therapeutic complements for full recovery of staphylococcal skin infection after a poor 50-day treatment response to antibiotics. *Journal of Alternative and Complementary Medicine.* 2008;14(6):757-761.

Channel 12:: The Liver (LR)

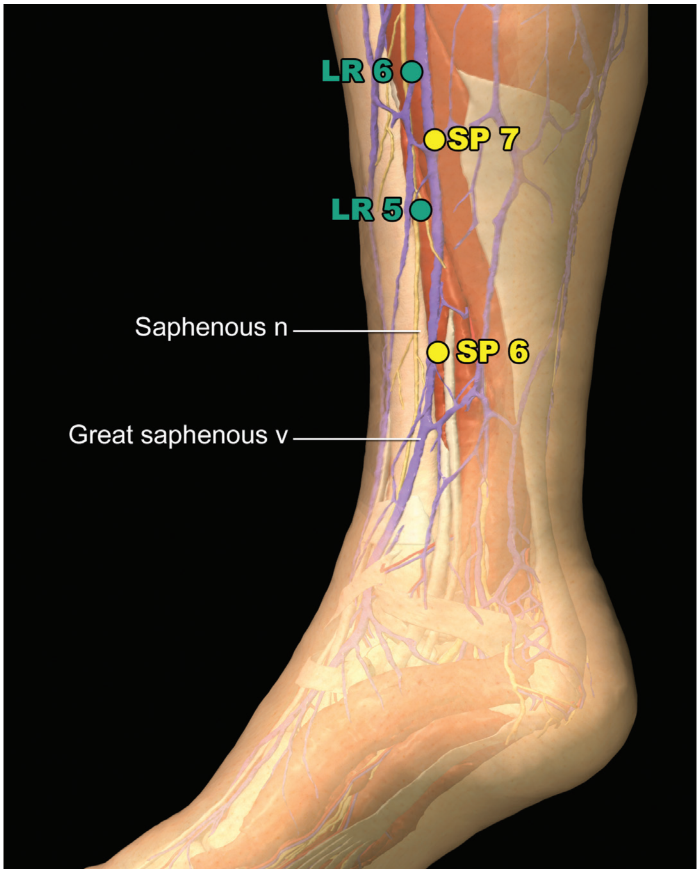
The LR channel starts its trek at LR 1 on the lateral aspect of the big toe. It ascends the medial surface of the leg and thigh to reach the femoral vein at the groin. From here, the Liver channel deviates backward then forward, ending over the liver at LR 14. The Liver channel pathway follows its neighboring channel, the Spleen line, in a roughly parallel voyage from the big toe to the femoral triangle. They crisscross over great saphenous vein and its tributaries, and crisscross as they migrate toward the trunk.



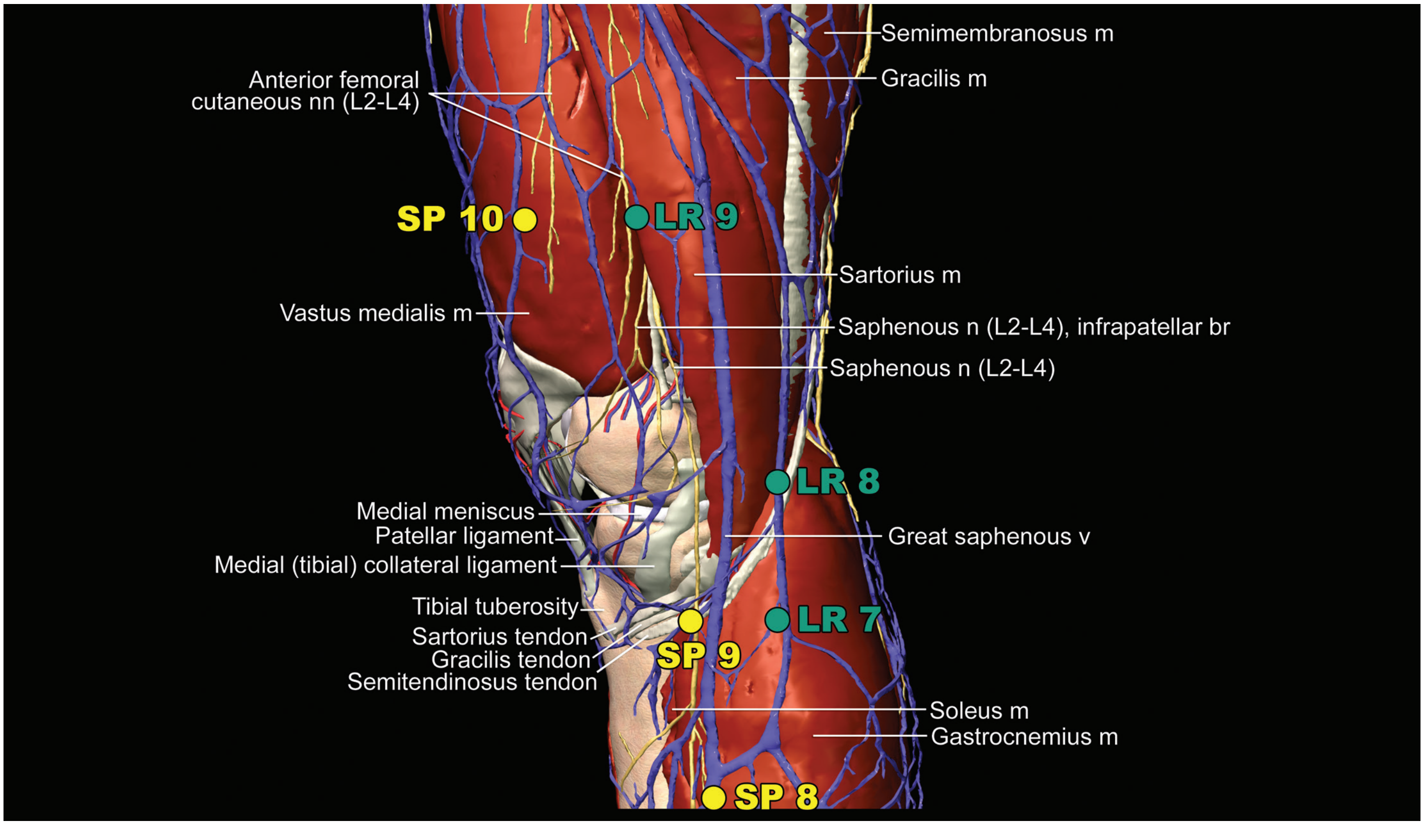
The LR channel starts its trek toward the liver organ on the big toe. It ascends the medial pelvic limb to reach the femoral vein in the groin. From there, the LR line reaches back to the 11th rib, then forward toward the liver.


Superior extensor retinaculum
Tibialis anterior tendon
Extensor hallucis longus tendon
Extensor digitorum longus tendon
Peroneus tertius tendon
LR 4
Inferior extensor retinaculum
Extensor hallucis brevis muscle
Extensor digitorum brevis muscle
LR 3
Abductor hallucis m
Extensor digitorum longus tendons
4th dorsal interosseous m
Extensor digitorum brevis tendons
Flexor digiti minimi brevis m
Abductor digiti minimi m
Flexor hallucis brevis m
1st dorsal interosseous m
Deep peroneal (fibular) n, medial br
LR 2
Dorsal digital aa
LR 1

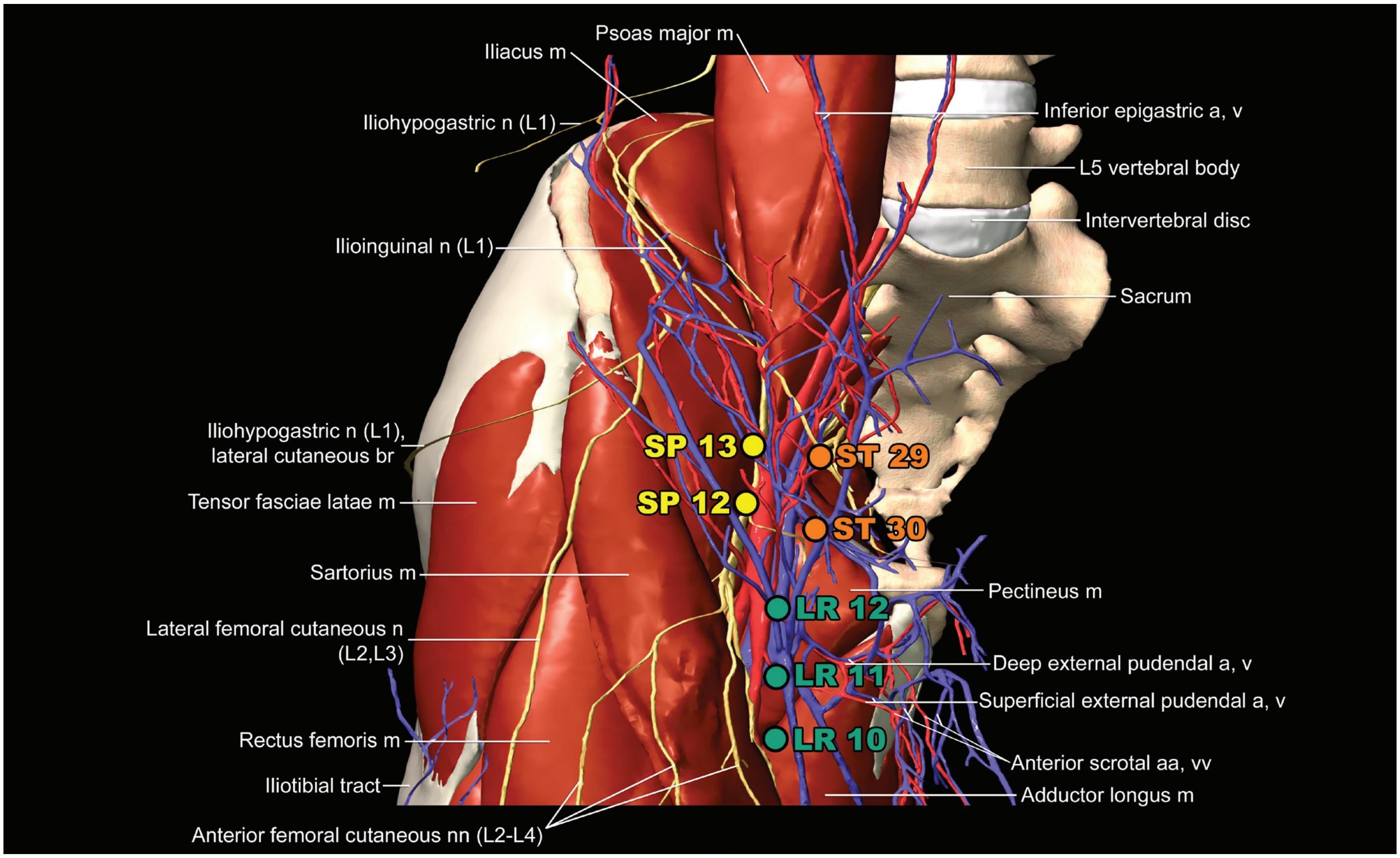
The first few points of the LR line occupy a unique strip of territory on the dorsum of the foot supplied by the deep peroneal (fibular) nerve. This sets the LR line apart from other channels on the foot. The SP, ST, and GB lines share superficial peroneal (fibular) nerve supply while the BL line derives its sensory supply from the lateral dorsal cutaneous nerve.


LR 6
SP 7
LR 5
Saphenous n
SP 6
Great saphenous v

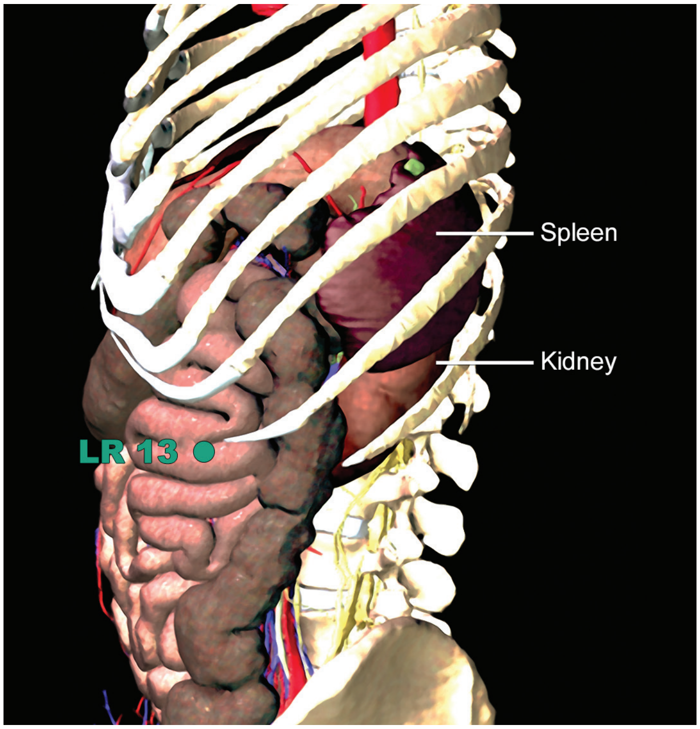
On the medial crus, the SP and LR lines crisscross the great saphenous vein. The saphenous nerve supplies sensation to the entire medial calf region, encompassing the LR, SP, and KI lines within its territory.


Semimembranosus m
Gracilis m
Anterior femoral cutaneous nn (L2-L4)
SP 10
LR 9
Sartorius m
Vastus medialis m
Saphenous n (L2-L4), infrapatellar br
Saphenous n (L2-L4)
LR 8
Medial meniscus
Patellar ligament
Great saphenous v
Medial (tibial) collateral ligament
Tibial tuberosity
LR 7
Sartorius tendon
Gracilis tendon
SP 9
Semitendinosus tendon
Soleus m
Gastrocnemius m
SP 8

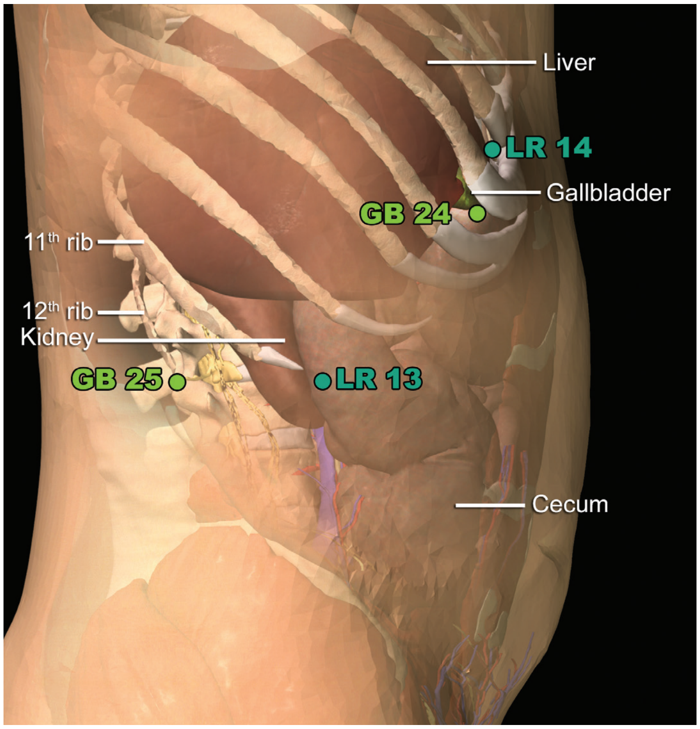
At the medial knee, the LR channel courses caudal to the SP line. It follows the inseam of a pair of trousers while the GB line, its coupled channel, roughly coincides with the outer seam.


Psoas major m
Iliacus m
Iliohypogastric n (L1)
Inferior epigastric a, v
L5 vertebral body
Intervertebral disc
Ilioinguinal n (L1)
Sacrum
Iliohypogastric n (L1), lateral cutaneous br
SP 13
ST 29
Tensor fasciae latae m
SP 12
ST 30
Sartorius m
Pectineus m
LR 12
Lateral femoral cutaneous n (L2,L3)
Deep external pudendal a, v
LR 11
Superficial external pudendal a, v
Rectus femoris m
LR 10
Anterior scrotal aa, vv
Iliotibial tract
Adductor longus m
Anterior femoral cutaneous nn (L2-L4)

The LR, SP, and ST channels converge in a canal that cradles the femoral vein, artery, and nerve.


Spleen
Kidney
LR 13

The close relationship between the LR and SP manifests most saliently at LR 13, the Front Mu, or “alarm” point for the spleen. LR 13, at the distal limit of the 11th rib, lands at about the same intercostal level as the spleen organ.


Liver
LR 14
Gallbladder
GB 24
11th rib
12th rib
Kidney
GB 25
LR 13
Cecum

The LR line ends its journey over the liver organ at LR 14, the Front Mu point for the Liver. Its next-door neighbor, GB 24, the Front Mu point for Gallbladder, lives in the next intercostal space over the gallbladder.

LR 1

Da Dun "Big Mound", "Big Thick", "Large Pile"

On the lateral side of the base of the nail of the great toe, the width of a Chinese leek leaf from the corner of the nail. Or, midway between the proximal lateral corner of the nail and the interphalangeal joint.

Nerves

- **Deep peroneal (fibular) nerve:** Supplies the skin on the adjoining sides of the 1st and 2nd toes.
- **Proper plantar digital branches of the medial plantar nerve:** Supply the dorsal surfaces of the distal tips of the toes (in the nail bed regions).

Clinical Relevance: The abundance of somatic and autonomic nerve fibers at ting (i.e., most distal) points on the digits offers ample opportunities for somatic and sympathetic neuromodulation. However, these points are rarely needled due to their heightened sensitivity. Clinically, the deep peroneal (fibular) nerve may provide a stronger effect on autonomic regulation than its superficial counterpart. Consider, for example, the impact of ST 36 on the autonomic nervous system, derived largely from its deep peroneal (fibular) connections. LR 1, LR 2, and LR 3 continue in this tradition with some differences. ST 36 surrounds itself with a rich supply of muscle afferents whereas distal LR points live in tissue replete with nervi vasorum. Different afferent fibers activated during acupuncture and related techniques cause different neuromodulatory outcomes.

Vessels

- **Proper plantar digital artery:** Supplies the dorsum of the distal phalangeal segment and nail bed. Arises from the metatarsal artery, which in turn arose from the plantar arterial arch.
- **Dorsal digital artery:** Supplies the great toe. Arises from the 1st dorsal metatarsal artery.
- **Dorsal venous arch of the foot:** Formed by the union of the dorsal metatarsal veins. The dorsal venous arch communicates with the plantar venous arch. Both drain into the great saphenous vein on the medial aspect and the small saphenous vein on the lateral aspect of the distal pelvic limb.

Clinical Relevance: Vessels of the foot and hand afford opportunities for local and systemic autonomic neuromodulation and hemodynamic regulation. Hemodynamic changes result from ting point needling and improve local circulation to the acral extremity. This may promote nerve health in cases of peripheral neuropathy. Nervi vasorum connect to higher centers and influence systemic sympathetic control as well.

Indications and Potential Point Combinations

- **Gynecologic issues:** Metrorrhagia, menorrhagia, uterine prolapse, vaginitis: LR 1, SP 6, SP 10, CV 4.
- **Urinary problems:** urethritis, urinary incontinence, enuresis, voiding dysfunction: LR 1, SP 6, KI 3, KI 10, CV 3.
- **Seizures:** LR 1, LR 2, GB 34, ST 36, GV 20, GB 20, HT 7.

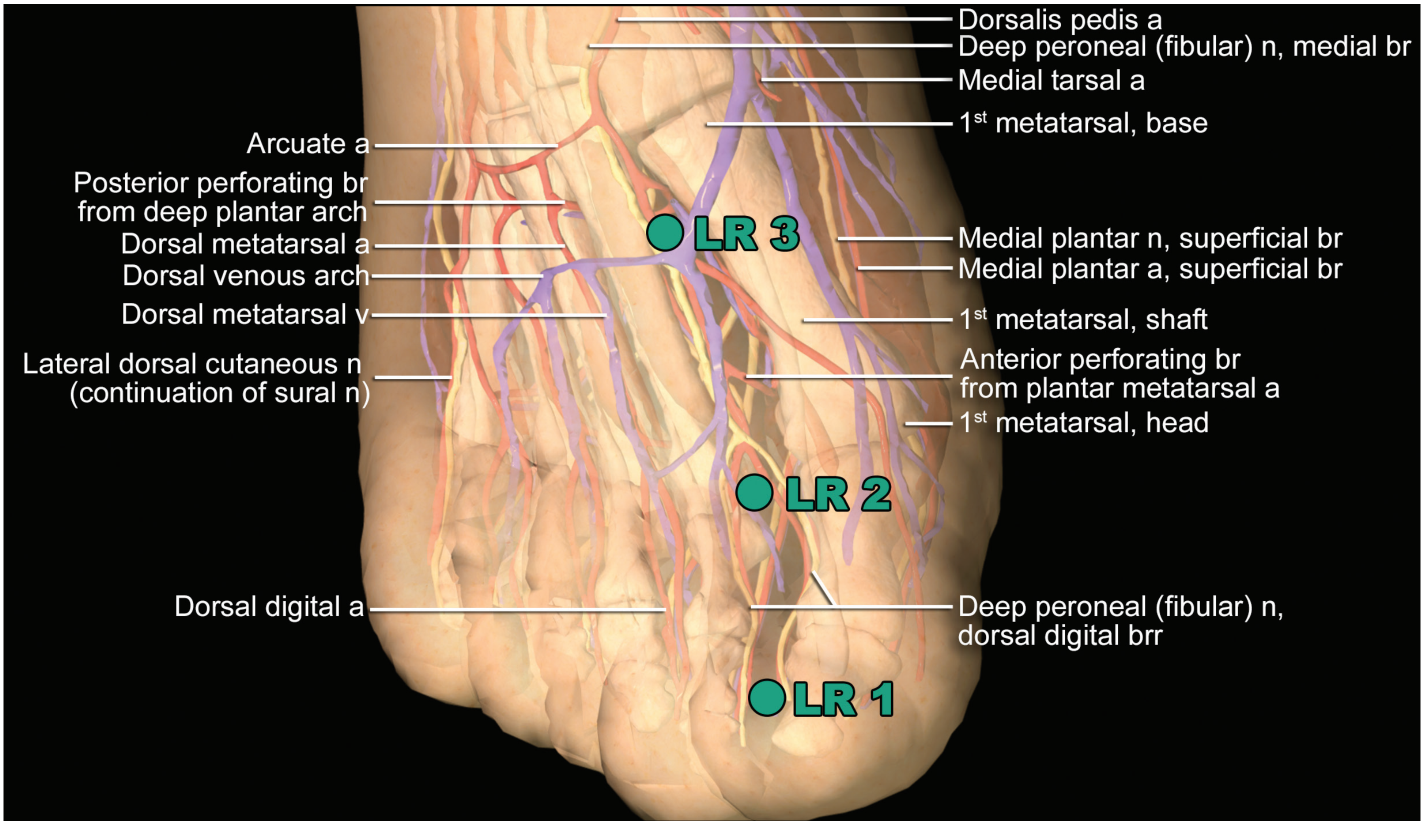

Dorsalis pedis a
Deep peroneal (fibular) n, medial br
Medial tarsal a
1st metatarsal, base
Arcuate a
Posterior perforating br from deep plantar arch
Dorsal metatarsal a
Dorsal venous arch
Dorsal metatarsal v
Lateral dorsal cutaneous n (continuation of sural n)
LR 3
Medial plantar n, superficial br
Medial plantar a, superficial br
1st metatarsal, shaft
Anterior perforating br from plantar metatarsal a
1st metatarsal, head
LR 2
Dorsal digital a
Deep peroneal (fibular) n, dorsal digital brr
LR 1

Figure 12-1. LR 1 occupies the position of "ting" point on the LR line that, like distal points on other lines, resides at the proximal angle of a nail bed in an area of abundant autonomic afferent supply.

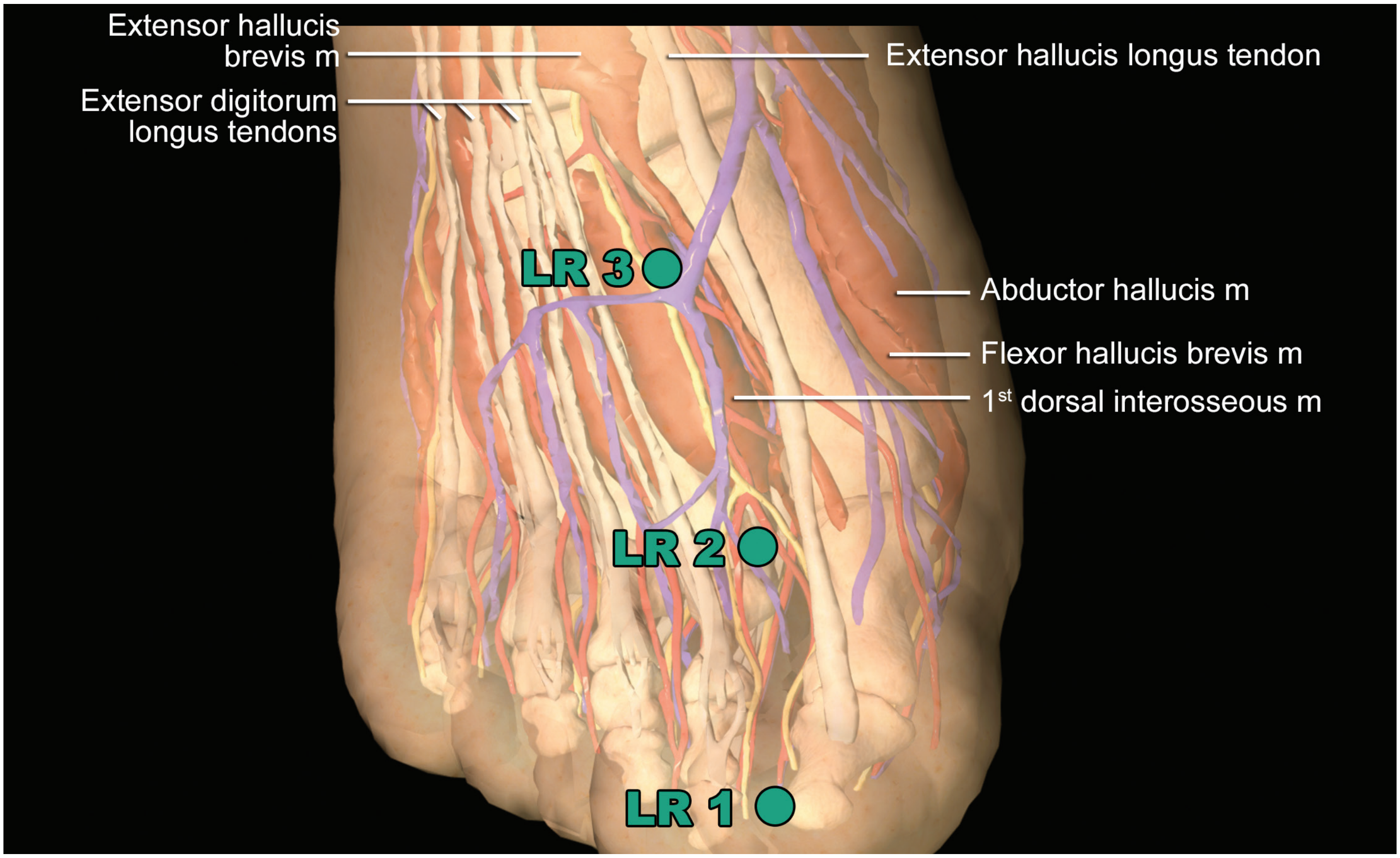

Extensor hallucis brevis m
Extensor digitorum longus tendons
Extensor hallucis longus tendon
LR 3
Abductor hallucis m
Flexor hallucis brevis m
1st dorsal interosseous m
LR 2
LR 1

Figure 12-2. LR 1 lives at the start of the LR channel where tiny vessels turn into venules from arterioles.

Evidence-Based Application

- Electroacupuncture at LR 1 connected to SP 1 increased thermal thresholds likely by inhibiting C fibers and A-delta afferents.[1]

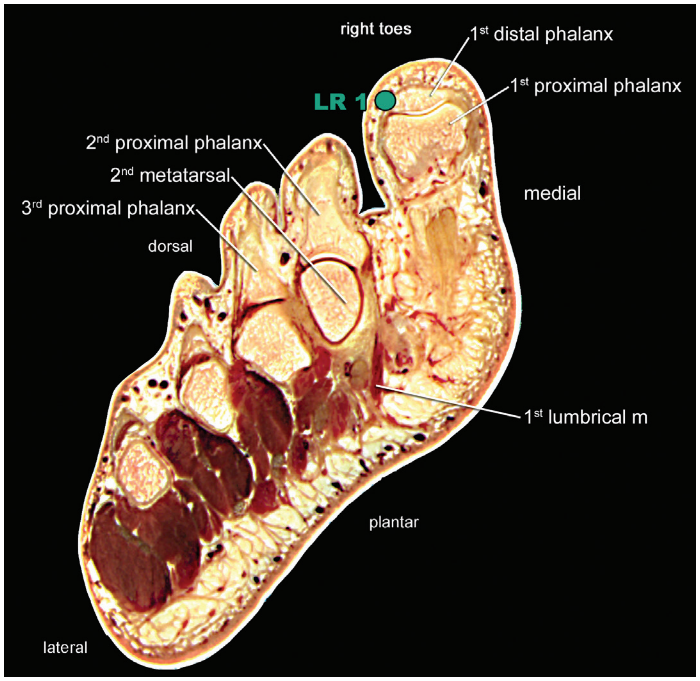

right toes
1st distal phalanx
LR 1
1st proximal phalanx
2nd proximal phalanx
2nd metatarsal
3rd proximal phalanx
dorsal
medial
1st lumbrical m
plantar
lateral

Figure 12-3. This transverse cut explains the name "Big Thick" or "Large Pile" for LR 1.

References

1. Leung A, Khadivi B, Duann J-R, et al. The effect of ting point (tendinomuscular meridians) electroacupuncture on thermal pain: a model for studying the neuronal mechanism of acupuncture analgesia. J Alt Complement Med. 2005;11(4):653-661.

LR 2

Xing Jian "Moving Between"

On the dorsum of the foot, distal to the 1st and 2nd metatarsophalangeal joints, 0.5 cun proximal to the web margin.

Muscles

- **1st dorsal interosseous muscle:** Abducts the digits and flexes the metatarsophalangeal joints.

Clinical Relevance: Deep intrinsic muscles of the foot such as the interosseous muscles support its strength and architecture.[6] They provide for fine motor manipulation under normal circumstances.

Nerves

- **Deep peroneal nerve (L4-S1):** Supplies the skin on the adjoining sides of the 1st and 2nd toes. Also supplies the extensor digitorum brevis muscle and other muscles in the anterior compartment.
- **Proper plantar digital branches of the medial plantar nerve:** Supply the dorsal surfaces of the distal tips of the toes (in the nail bed regions).
- **Lateral plantar nerve (S2-S3):** Supplies all dorsal interosseous muscles of the foot. A branch of the tibial nerve.

Clinical Relevance: The abundance of somatic and autonomic nerve fibers points on the digits offers ample opportunities for somatic and sympathetic neuromodulation. Clinically, the deep peroneal (fibular) nerve may provide a stronger effect on autonomic regulation than its superficial counterpart. Consider, for example, the impact of ST 36 on the autonomic nervous system, derived largely from its deep peroneal (fibular) connections. LR 1, LR 2, and LR 3 continue in this tradition with some differences. ST 36 surrounds itself with a rich supply of muscle afferents whereas distal LR points live in tissue replete with nervi vasorum. Different afferent fibers activated during acupuncture and related techniques cause different neuromodulatory outcomes.

Like the ulnar nerve in the hand that supplies the dorsal interosseous muscles, the lateral plantar nerve supplies all of the foot's dorsal interosseous muscles. Resemblances between acupuncture points and neural control of the thoracic and pelvic limbs include more than merely anatomical similarities.

Fast-adapting afferents at LR 2 and LR 3, among other locations on the dorsal foot, demonstrate a significant coupling response with muscles of the thoracic limb. Through these connections, cutaneous afferents from the foot have the capacity to influence kinesthesia, reflexes, and tactile perception in the thoracic limb.[7] These findings suggest that cutaneous input from the foot may play an important role in coordinating interlimb activity. Clinical implications include acupuncture and related techniques for stroke recovery, spinal cord injury, degenerative neurologic conditions, and peripheral nerve injury. Clearly, LR 2 and LR 3 should be considered for supporting recovery of thoracic limb strength.

Vessels

- **Dorsal digital artery:** Supplies the great toe. Arises from the 1st dorsal metatarsal artery.
- **Dorsal digital veins:** Drain to the dorsal venous arch of the foot, which is in turn formed by the union of the dorsal metatarsal veins.

The dorsal venous arch and plantar venous arch communicate. These veins give rise to the great saphenous vein on the medial aspect and the small saphenous vein on the lateral aspect.

Clinical Relevance: Vessels of the foot and hand afford opportunities for local and systemic autonomic neuromodulation and hemodynamic regulation. Hemodynamic changes result from ting point needling and improve local circulation to the acral extremity. This may promote nerve health in cases of peripheral neuropathy. Nervi vasorum connect to higher centers and influence systemic sympathetic control as well. These connections help explain the clinical indications of LR 2 and LR 3 for sympathetic hyperactivity and fever, known as "Liver Fire" and "Excess Heat" in Chinese medicine.

Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[8]

Forefoot surgery risks injury of the arterial supply of the lesser metatarsal head, such as at LR 2. The dorsal and plantar metatarsal arteries form a vascular ring around the head and an extensive extraosseous arterial network. Small branches from this anastomosis enter the head; nutrient arteries travel

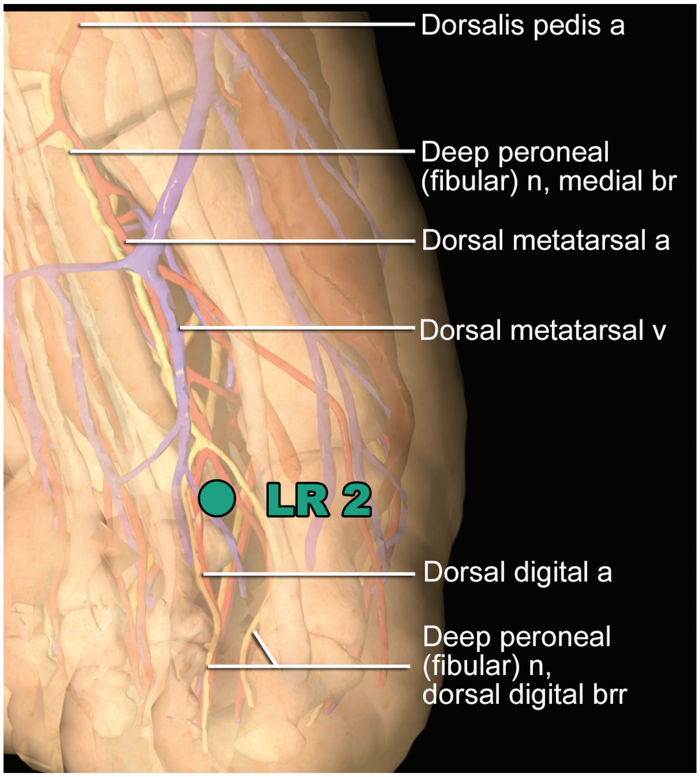

Dorsalis pedis a
Deep peroneal (fibular) n, medial br
Dorsal metatarsal a
Dorsal metatarsal v
LR 2
Dorsal digital a
Deep peroneal (fibular) n, dorsal digital brr

Figure 12-4. The descriptive name for LR 2 of "Moving Between" denotes the groove between metatarsals I and II through which the LR channel and its neurovascular conduits course.

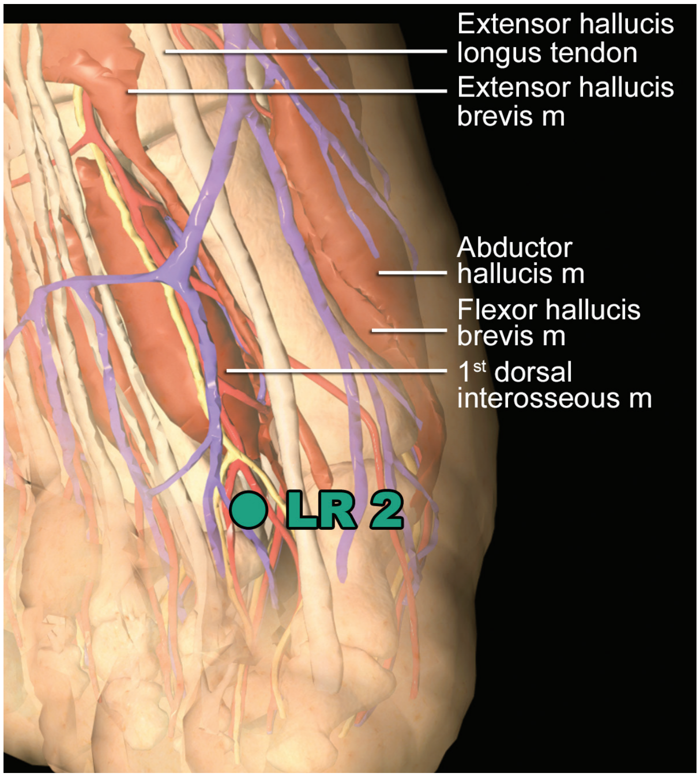

Extensor hallucis longus tendon
Extensor hallucis brevis m
Abductor hallucis m
Flexor hallucis brevis m
1st dorsal interosseous m
LR 2

Figure 12-5. The first dorsal interosseous muscle of the foot, shown here, resembles in structure and, perhaps, function that of the same muscle in the hand; i.e., activities strongly associated with muscular coordination and whole-body interrelationships, both somatic and autonomic.

along the cortex of the metaphysis near insertions of ligaments and joint capsules. Branches from the nutrient arteries send branches into the subchondral bone to provide intraosseous blood supply. Thus, osteotomies that strip the capsular region of the metatarsal heads may negatively impact the medial and lateral vessels supplying that section of bone.[9]

Venous ulcers on or near the toes occur in patients with chronic venous insufficiency secondary to local trauma or skeletal deformities.[10] Whereas arterial ulcers are found on protruding areas, venous ulcers appear in valleys between the digits or at the dorsal base of the toe, such as near LR 2. Foot veins may be affected by venous thrombosis similar to leg veins. Superficial veins in the foot may exhibit varicose degeneration and direct damage by intravenous drug abuse. Perforating vein incompetence also takes place in the foot. Normally, perforating veins support blood flow from deep to superficial veins. Pedal veins have few valves, making them susceptible to reflux.

Indications and Potential Point Combinations

- **Genitourinary conditions:** LR 2, SP 6, CV 3, BL 23, BL 32, GV 20.
- **Eye pain, redness, swelling:** LR 2, LR 3, TH 23, BL 2, GB 1.
- **Seizures:** LR 2, LR 3, GB 20, GV 20, ST 36, BL 10.
- **Headaches (especially behind the eyes):** LR 2, LI 4, BL 10, GB 20, GV 20.

Evidence-Based Applications

- Acupuncture stimulation of HT 8, BL 66, and LR 2 effectively reduced elevated body temperature induced by **bacterial inflammation,** in part by suppressing hypothalamic production of pro-inflammatory cytokines.[1]
- Manual acupuncture at LR 2, HT 8, or BL 66 resolved experimentally induced **fever** in rats.[2] The mechanism of action of the antipyretic actions of acupuncture may be mediated through the down-regulation of two cytokines, IL-6 and IL-1-beta.
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[3]
- Acupuncture at HT 7, BL 40, and other points as needed for reinforcement such as LR 2 and LR 3 effectively treated children exhibiting **nocturnal enuresis.**[4]
- Hemodynamic and psychophysical responses to acupuncture stimulation at LR 2, LR 3, and ST 44, as well as a nearby sham point (the Bafeng point at the web space between the 3rd and 4th toes), exhibited great overlap, resulting in **extensive deactivation of a limbic-paralimbic-neocortical network** connected functionally and structurally.[5] This argues against acupuncture point specificity and in favor of significant overlap in its brain effects.
- Stimulation of LR 2 produced significant **activation of motor function-related brain regions.** These sites included the caudate, claustrum, and cerebellum. The limbic system also showed activation in the medial frontal gyrus, cingulate gyrus, and fusiform gyrus.[11]
- Stimulation of LR 2 produces **acute and delayed patterns of neuronal activation** that may be differentiated with fMRI. Acute effects were seen as activation in the insula and parahippocampal gyrus; the amygdala remained activated after 19 minutes following stimulation of the acupuncture needle.

References

1. Son Y-S, Park H-J, Kwon O-B, Jung S-C, Shin H-C, and Lim S. Antipyretic effects of acupuncture on the lipopolysaccharide-induced fever and expression of interleukin-6 and interleukin-1β mRNAs in the hypothalamus of rats. *Neuroscience Letters.* 2002;319:45-48.
2. Son Y-S, Park H-J, Kwon O-B, et al. Antipyretic effects of acupuncture on the lipopolysaccharide-induced fever and expression of interleukin-6 and interleukin-1-beta mRNA's in the hypothalamus of rats. *Neuroscience Letters.* 2002;319:45-48.
3. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care.* 1998;16:37-39.
4. Yuping W, Runfang L, and Hua K. Acupuncture treatment of children nocturnal enuresis – a report of 56 cases. *J Tradit Chin Med.* 2006;26(2):106-107.
5. Fang J, Jin Z, Wang Y, et al. The salient characteristics of the central effects of acupuncture needling: limbic-paralimbic-neocortical network modulation. *Human Brain Mapping.* 2009;30:1196-1206.
6. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
7. Bent LR and Lowrey CR. Single low-threshold afferents innervating the skin of the human foot modulate ongoing muscle activity in the upper limbs. *J Neurophsyiol.* 2013;109:1614-1625.
8. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. J*ournal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
9. Petersen WJ, Lankes JM, Paulsen F, et al. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot & Ankle International.* 2002;23(6):491-495.
10. Van Bemmelen PS, Spivack D, and Kelly P. Reflux in foot veins is associated with venous toe and forefoot ulceration. *J Vasc Surg.* 2011;53:394-398.
11. Chae Y, Lee H, Kim H, et al. The neural substrates of verum acupuncture compared to non-penetrating placebo needle: an fMRI study. *Neurosci Lett.* 2009;450(2):80-84.
12. Rheu K-H, Jahng G-H, Ryu C-W, et al. Investigation of the delayed neuronal effects of acupuncture manipulation. *J Alt Complement Med.* 2011;17:1021-1027.

LR 3

Tai Chong "Great Rushing", "Large Surge", "Great Thoroughfare"

On the dorsum of the foot in a depression distal to the junction of the 1st and 2nd metatarsal bones. Locate by palpating the groove to its proximal limit until finding a depression between the adjacent metatarsals.

Muscles

- **1st dorsal interosseous muscle:** Abducts the digits and flexes the metatarsophalangeal joints.

Clinical Relevance: Deep intrinsic muscles of the foot such as the interosseous muscles support its strength and architecture.[29] They provide for fine motor manipulation under normal circumstances.

LR 3 is located midway along the shaft of the 2nd metatarsal in the belly of the 1st dorsal interosseous muscle; this site represents a homologue for LI 4 on the hand. Stimulating LR 3 and LI 4 together constitutes treating "The Four Gates" for autonomic harmony and rejuvenation.

Nerves

- **Deep peroneal nerve (L4-S1):** Supplies the skin on the adjoining sides of the 1st and 2nd toes. Also supplies the extensor digitorum brevis muscle and other muscles in the anterior compartment.
- **Lateral plantar nerve (S2-S3):** Supplies all dorsal interosseous muscles of the foot. A branch of the tibial nerve.

Clinical Relevance: The oblique inferior medial band of the inferior extensor retinaculum as well as the tendon of the extensor hallucis longus muscle may compress the deep peroneal (fibular) nerve proximal to LR 3.[30] This constitutes the anterior tarsal tunnel syndrome. Other sites of nerve compress include the site where the deep peroneal (fibular) nerve travels deep to the extensor hallucis brevis and along the superior edge of the inferior retinaculum where the extensor hallucis longus travels over the nerve. Dorsal osteophytes of the talonavicular joint or an os intermetatarseum may push the nerve against the retinaculum and produce problems. Most patients developing anterior tarsal tunnel syndrome report a history of trauma, commonly recurring ankle sprain. Plantarflexion and supination of the foot maximally stretches the nerve at the cranial ankle and over the talonavicular joint. Tight-fitting ski boots and shoes are additional risk factors. Pain from anterior tarsal tunnel syndrome follows the course of the nerve undergoing entrapment. That is, it extends over the dorsum of the foot and into the web space between the first and second metarsals (LR 2-LR 3 territory). Treatment calls for myofascial release of the soft tissue surrounding the ankle and especially at the cranial surface, along with laser therapy for soft tissue relaxation and nerve regeneration. Acupuncture at LR 2, LR 3, and ST 41 is also indicated.

The abundance of somatic and autonomic nerve fibers points on the digits offers ample opportunities for somatic and sympathetic neuromodulation. Sympathetic innervation to the foot travels along the peripheral nerves. By the time vessels in the foot reach the ankle, they have already received their sympathetic fibers from the peripheral nerves.[31] An extensive network of sympathetic nerves supplies the foot, as it does the hand.

Clinically, the deep peroneal (fibular) nerve may provide a stronger effect on autonomic regulation than its superficial counterpart. Consider, for example, the impact of ST 36 on the autonomic nervous system, derived largely from its deep peroneal (fibular) connections. LR 1, LR 2, and LR 3 continue in this tradition with some differences. ST 36 surrounds itself with a rich supply of muscle afferents whereas distal LR points live in tissue replete with nervi vasorum. Different afferent fibers activated during acupuncture and related techniques cause different neuromodulatory outcomes.

Like the ulnar nerve in the hand that supplies the dorsal interosseous muscles, the lateral plantar nerve supplies all of the foot's dorsal interosseous muscles. Resemblances between acupuncture points and neural control of the thoracic and pelvic limbs include more than merely anatomical similarities.

Fast-adapting afferents at LR 2 and LR 3, among other locations on the dorsal foot, demonstrate a significant coupling response with muscles of the thoracic limb.[32] Through these connections, cutaneous afferents from the foot have the capacity to influence kinesthesia, reflexes, and tactile perception in the thoracic limb. These findings suggest that cutaneous input from the foot may play an important role in coordinating interlimb activity. Clinical implications include acupuncture and related techniques for stroke recovery, spinal cord injury, degenerative neurologic conditions, and peripheral nerve injury. Clearly, LR 2 and LR 3 should be considered for supporting recovery of thoracic limb strength and coordination.

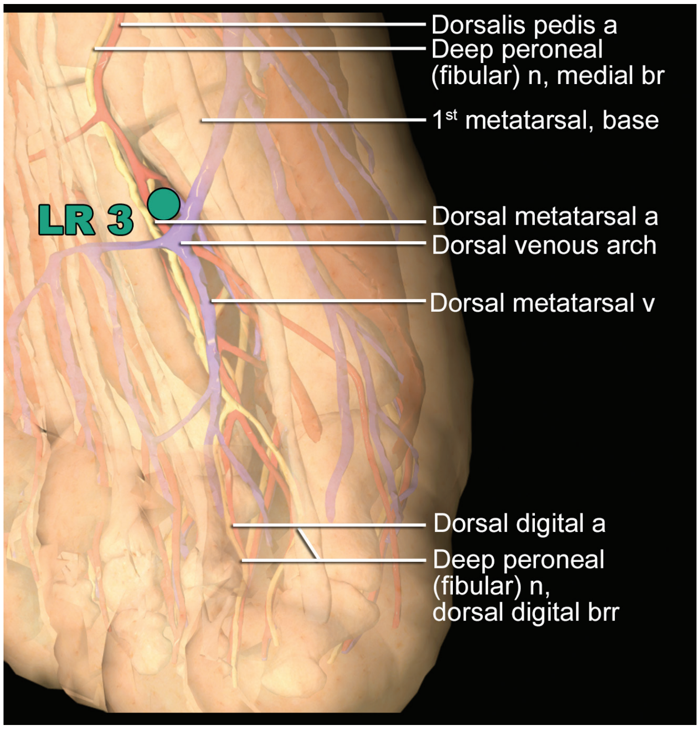


Figure 12-6. LR 3 resides at the intersection of the dorsal venous arch, the dorsal metatarsal artery running between the 1st and 2nd metatarsals, and a perforating arterial branch. Note the presence of the deep peroneal (fibular) nerve as well. This neurovascular traffic explains the reason behind the name "Great Thoroughfare" for LR 3.

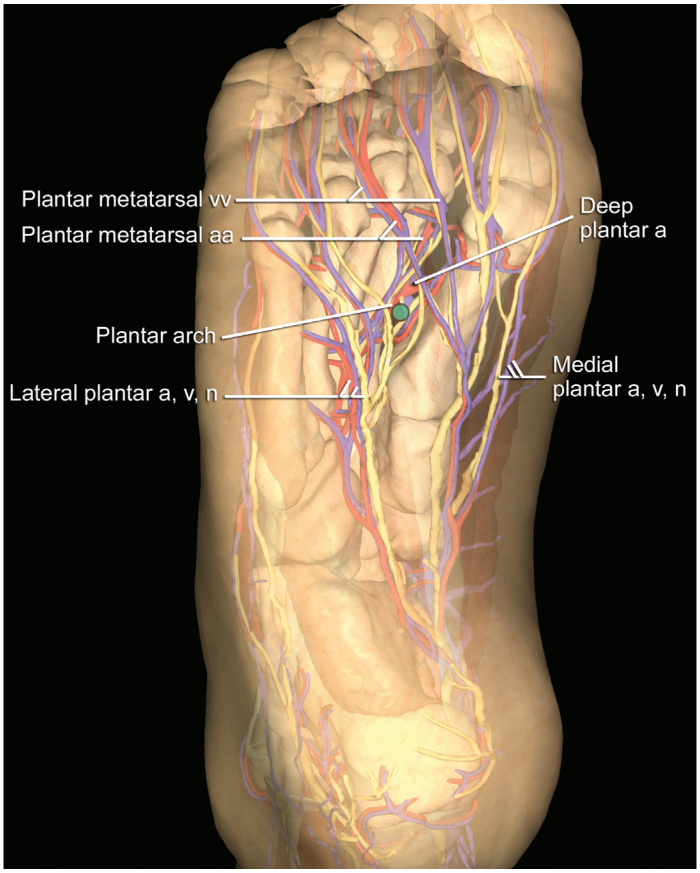


Figure 12-7. This view of the neurovascular architecture on the plantar foot and even the caudal heel and ankle describes in detail the sources of the nerves and vessels that literally "underlie" LR 3, though needled from above (shown as a blue-green circle). While one would not needle LR 3 deeply enough to access these vessels, they do connect to structures on the dorsal surface of the foot. Too, the double arterial arch system of the plantar foot becomes apparent here, mirroring a similar double arch system in the palmar hand, opposite LI 4.

Vessels

- **First dorsal metatarsal artery from the dorsalis pedis artery:** Branches into vessels that supply both sides of the great toe and the medial aspect of the 2nd toe.
- **Deep plantar artery:** Dives between the 1st and 2nd metatarsals to join the deep plantar arch.
- **Dorsal metatarsal veins:** Drain to the dorsal venous arch of the foot. The arch is, in turn, formed by the union of the dorsal metatarsal veins. The dorsal venous arch and plantar venous arch communicate. These veins give rise to the great saphenous vein on the medial aspect and the small saphenous vein on the lateral aspect.

Clinical Relevance: Vessels of the foot and hand afford opportunities for local and systemic autonomic neuromodulation and hemodynamic regulation. Hemodynamic changes result from ting point needling and improve local circulation to the acral extremity. This may promote nerve health in cases of peripheral neuropathy. Nervi vasorum connect to higher centers and influence systemic sympathetic control as well. These connections help explain the clinical indications of LR 2 and LR 3 for sympathetic hyperactivity and fever, known as "Liver Fire" and "Excess Heat" in Chinese medicine.

Dorsal interosseous muscles receive arterial blood via segmental branches off of their respective dorsal metatarsal arteries. The dorsal metatarsal arteries originate from the dorsalis pedis artery and connect with the vascular network on the plantar foot through a proximal and dorsal perforating artery. Microangiopathy or other vascular failures in patients such as diabetic individuals can compromise circulation and limit collateral vessel support, should one channel become obstructed or damaged.[33]

Forefoot surgery risks injury of the arterial supply of the lesser metatarsal head, such as at LR 2. The dorsal and plantar metatarsal arteries form a vascular ring around the head and an extensive extraosseous arterial network. Small branches from this anastomosis enter the head; nutrient arteries travel along the cortex of the metaphysis near insertions of ligaments and joint capsules. Branches from the nutrient arteries send branches into the subchondral bone to provide intraosseous blood supply. Thus, osteotomies that strip the capsular region of the metatarsal heads may negatively impact the medial and lateral vessels supplying that section of bone.[34] Treatment for this condition would include laser therapy and acupuncture in the immediate vicinity as well as at LR 3.

Venous ulcers on or near the toes occur in patients with chronic venous insufficiency secondary to local trauma or skeletal deformities.[35] Whereas arterial ulcers are found on protruding areas, venous ulcers appear in valleys between the digits or at the dorsal base of the toe, such as near LR 2. Foot veins may be affected by venous thrombosis similar to leg veins. Superficial veins in the foot may exhibit varicose degeneration and direct damage by intravenous drug abuse. Perforating vein incompetence also takes place in the foot. Normally, perforating veins support blood flow from deep to superficial veins. Pedal veins have few valves, making them susceptible to reflux. Treating this condition would call for a "surround the dragon" (i.e., circle the lesion) acupuncture in normal tissue at the perimeter of the problem, along with local laser therapy at appropriate power and wavelength and inclusion of LR 3 in the needling protocol.

Indications and Potential Point Combinations

- **Liver or gallbladder disease:** LR 3, ST 36, GB 34, GB 24, LR 14, BL 18, BL 19.
- **Muscle tension in the foot, particularly on the dorsum along the groove between the 1st and 2nd metatarsal:** LR 3, LR 2, GB 36.
- **Nausea and vomiting:** LR 3, ST 36, PC 6.
- **Eye problems such as myopia, glaucoma, visual disorders:** LR 3, LI 4, ST 36, GB 1, TH 23, BL 9, BL 10.
- **Headaches related to allergies, particularly referring to the eye or vertex:** LR 3, LI 20, GB 14, ST 3, Yintang.
- **Insomnia:** LR 3, HT 3, HT 7, GV 20, ST 36.
- **Migraine headaches:** LR 3, LI 4, BL 10, GB 20, Taiyang, associated trigger points.
- **Irritability:** LR 3, HT 3, PC 6, GV 20.
- **Depression:** LR 3, LI 4, GV 20, Yintang, ST 36.
- **Seizures:** LR 3, KI 3,ST 36, GB 34, BL 10, BL 7, BL 8, GV 20.

- **Cold feet:** LR 3, LI 4, Bafeng, KI 3.
- **Endocrine and metabolic disorders:** LR 3, ST 36, GV 20, PC 6.
- **Premenstrual syndrome:** LR 3, SP 6, ST 36, GV 20, CV 2, CV 6, CV 12, LI 4, LI 11.

Evidence-Based Applications

- Case report indicated improvement with acupuncture at LR 3, KI 3, SP 6, and ST 36 for sweating **associated with malignancy** that was unresponsive to other measures.[1]
- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in prophylaxis of **migraine** compared to flunarizine.[2]
- Acupuncture at LR 3, SP 6, LI 4, GB 20, GV 20, and Taiyang outperformed transcutaneous electrical nerve stimulation and laser therapy in reducing the frequency of **migraine**, although all three treatments were effective.[3]
- A case series involving acupuncture at LI 4, TH 5, LR 3, ST 36, ST 7, ST 6, and SI 17, splint therapy, and point injection therapy suggested that this combination was effective for managing **temporomandibular disorders.**[4]
- Electroacupuncture at LR 3, LI 4, GB 20, GB 21, and tender points provided relief of **myofascial pain in the upper trapezius muscle.**[36]
- Critically ill, postoperative pediatric patients found acupuncture at LR 3, LI 4, KI 3, and BL 60 to be a well tolerated and feasible **analgesic** method.[37]
- Acupuncture at SI 3, SI 14, LR 3, BL 10, BL 60, GB 20, GB 34, TH 5, trapezius myofascial trigger point, and the auricular point “cervical spine” provided greater pain relief of **chronic neck pain** compared to massage, but not sham laser.[5]
- Acupuncture at ST 36, SP 6, SP 9, LR 3, KI 3, BL 23, and BL 28 improved symptoms of **recurrent cystitis** in women.[6]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[7]
- Both laser and needle acupuncture at GB 1, BL 2, ST 5, Yintang, LI 4, SI 3, LR 3, KI 6, and TH 5 worked equally well in improving objective measurements of **(keratoconjunctivitis sicca, or KCS).**[8]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction.**[9]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in improvement in **sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[10]
- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud’s syndrome,** demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[11]
- Acupuncture using magnetic needles at LI 11, ST 40, and LR 3 **lowered endothelin-1,** a potent vasoconstrictive peptide.[12]
- A case report indicated that acupuncture at ST 36, KI 3, and LR 3 produced dramatic improvement in **chronic venous ulceration.**[13]
- Acupuncture at LI 4, LR 3, and PC 6 inhibited sympathetic activation during mental stress in **advanced heart failure** patients.[14]

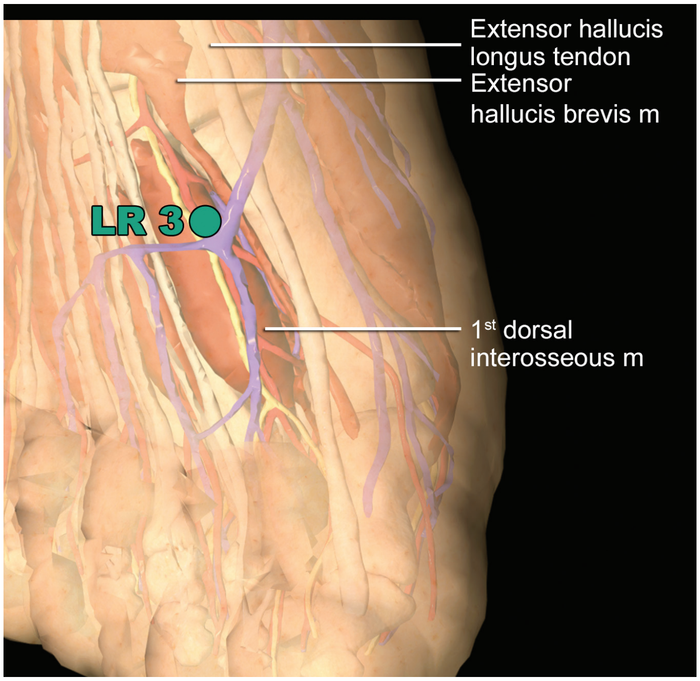

Extensor hallucis longus tendon
Extensor hallucis brevis m
LR 3
1st dorsal interosseous m

Figure 12-8. LR 3 and LI 4, known as the “Four Gates” in Chinese medicine, act as acupuncture homologues based on their anatomical similarity. This image highlights the bulk of the first dorsal interosseous muscle as it accepts a needle entering LR 3, as would the homologous muscle on the hand at LI 4.

- Acupuncture at LR 3, SP 6, SP 9, and ST 36 benefited patients with **chronic painful peripheral diabetic neuropathy.**[15]
- **HIV-related peripheral neuropathy** improved with electroacupuncture on BL 60, ST 36, KI 1, and LR 3.[16]
- Focused ultrasound stimulation of LR 3 increases blood flow in the brachial artery whereas LR 3 decreased blood flow volume.[38] This may be due to change in **peripheral vascular resistance** from needling at LR 3.[39]
- GB 34 and LR 3 delivered neuroprotective effects against neuronal death in a **Parkinson’s disease** model.[17]
- Acupuncture at LR 3, LI 4, GV 20, Yintang, as well as ear acupuncture produced as much benefit for **depressive neurosis** as Prozac and with fewer side effects.[18]
- Acupuncture at LR 3, LI 4, GB 20, Yintang, HT 7, PC 6, GV 20, GV 24, and GV 26 significantly benefited patients with **post-stroke anxiety neurosis.**[19]
- Acupuncture at various points including LR 3 may facilitate **post-exercise recovery and improve exercise performance.**[40]
- Acupuncture at LR 3, SP 6, LI 4, LI 11, GV 20, ST 36, and CV 2, CV 6, CV12 reduced complaints of myalgia, mastalgia, and dysmenorrhea in women with **premenstrual syndrome.** Acupuncture also increased nitric oxide levels in the blood.[41]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly **improved postmenopausal hot flushes and sweating episodes.**[20]
- Transcutaneous electrical nerve stimulation at SP 6 and LR 3 significantly increased the frequency and strength of uterine contractions in **post-dates pregnant women.**[21]
- Acupuncture at LI 4, LI 11, LR 3, SP 6, ST 25, ST 27, and ST 36 improved well-being and reduced bloating in patients **with**

irritable bowel syndrome.[22]

- Acupuncture at LR 3, ST 36, HT 7, and CV 12 produced better effects on **"gastrointestinal neurosis"** than the control medication.[23]
- Acupuncture at ST 36 and LR 3 significantly reduced liver injury markers when rats were acupunctured after, but not before, **CCL4-induced hepatotoxicity.**[24]
- A study evaluating the effects on cortical activation during stimulation of left LR 3 and left GB 40 revealed that, compared to the non-rotating stimulation method, rotating stimulation caused an increase in activation in both **secondary somatosensory cortical areas, frontal areas, the right thalamus and the left side of the cerebellum.** Stimulation of sham points did not strengthen the effects of acupuncture on brain activation.[25]
- Laserneedle® stimulation of LR 3 increased **cerebral blood flow** through the posterior cerebral artery but not the anterior cerebral artery.[42]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LI 14 significantly increased the percentage of normal sperm in patients with idiopathic **oligoasthenoteratozoospermia** (OAT syndrome).[26]
- Acupuncture at GV 20 and LR 3, local points, and either BL 60+SI 3, BL 22 –> BL 26, the gluteus minimus tendon, or the symphysis pubis, provided effective relief of **pelvic and low back pain in late pregnancy.**[27]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully treated sleep-related laryngospasm with **gastroesophageal reflux,** refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[28]

References

1. Hallam C and Whale C. Acupuncture for the treatment of sweating associated with malignancy. *Acupuncture in Medicine.* 2003;21(4):155-156.
2. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache.* 2002;42:855-861.
3. Allais G, De Lorenzo C, Quirico PE, Lupi G, Airola G, Mana O, and Benedetto C. Non-pharmacological approaches to chronic headaches: transcutaneous electrical nerve stimulation, lasertherapy, and acupuncture in transformed migraine treatment. *Neurol Sci.* 2003;24:S138-S142.
4. Wong Y-K and Cheng J. A case series of temporomandibular disorders treated with acupuncture, occlusal splint and point injection therapy. *Acupuncture in Medicine.* 2003;21(4):138-149.
5. Irnich D, Behrens N, Molzen H, Konig A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, and Schops P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ.* 2001;322:1-6.
6. Alraek T and Baerheim A. 'An empty and happy feeling in the bladder…': health changes experienced by women after acupuncture for recurrent cystitis. *Complementary Therapies in Medicine.* 2001;9(4):219-223.
7. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care.* 1998;16:37-39.
8. Nepp J, Wedrich A, Akramian J, Derbolav A, Mudrich C, Ries E, and Schauersberger J. Dry eye treatment with acupuncture. A prospective, randomized, double-masked study. In Sullivan et al. (eds.): *Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2.* New York: Plenum Press, 1998. pp. 1011-1016.
9. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.
10. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility.* 2005;84(1):141-147.
11. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine. 1997;241:119-124.*
12. Jiang X. Effects of magnetic needle acupuncture on blood pressure and plasma ET-1 level in the patient of hypertension. *Journal of Traditional Chinese Medicine.* 2003;23(4):290-291.
13. Mears T. Acupuncture for chronic venous ulceration. *Acupuncture in Medicine.* 2003;21(4):150-152.
14. Middlekauff HR, Hui K, Yu JL, Hamilton MA, Fonarow GC, Moriguchi J, Maclellan WR, and Hage A. Acupuncture inhibits sympathetic activation during mental stress in advanced heart failure patients. *Journal of Cardiac Failure.* 2002;8(6):399-406.
15. Abuaisha BB, Costanzi JB, and Boulton AJM. Acupuncture for the treatment of chronic painful peripheral diabetic neuropathy: a long-term study. *Diabetes Research and Clinical Practice.* 1998;29:115-121.
16. Galantino MLA, Eke-Okoro ST, Findley TW, and Condoluci D. Use of noninvasive electroacupuncture for the treatment of HIV-related peripheral neuropathy: a pilot study. *Journal of Alternative and Complementary Medicine.* 1999;5(2):135-142.
17. Park H-J, Lim S, Joo W-S, Yin C-S, Lee H-S, Lee H-J, Seo J-C, Leem K, Son Y-S, Kim Y-J, Kim C-J, Kim Y-S, and Chung J-H. Acupuncture prevents 6-hydroxydopamine-induced neuronal death in the nigrostriatal dopaminergic system in the rat Parkinson's disease model. *Experimental Neurology.* 2003;180:92-97.
18. Fu WB, Fan L, Zhu XP, et al. Depressive neurosis treated by acupuncture for regulating the liver – a report of 176 cases. *J Tradit Chin Med.* 2009;29(2):83-86.
19. Wu P and Liu S. Clinical observation on post-stroke anxiety neurosis treated by acupuncture. *J Tradit Chin Med.* 2008;28(3):186-188.
20. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society.* 1995;2(1):3-12.
21. Dunn PA, Rogers D, and Halford K. Transcutaneous electrical nerve stimulation at acupuncture points in the induction of uterine contractions. *Obstetrics & Gynecology.* 1989;73:286-290.
22. Chan J, Carr I, and Mayberry JF. The role of acupuncture in the treatment of irritable bowel syndrome. *Hepato-Gastroenterology.* 1997;44:1328-1330.
23. Zhao Y, Ding M, and Wang Y. Forty cases of gastrointestinal neurosis treated by acupuncture. *J Tradit Chin Med.* 2008;28(1):15-17.
24. Liu H-J, Hsu S-F, Hsieh C-C, Ho T-Y, Hsieh C-L, Tsai C-C, and Lin J-G. The effectiveness of Tsu-San-Li (St-36) and Tai-Chung (Li-3) acupoints for treatment of acute liver damage in rats. *American Journal of Chinese Medicine.* 2001;29(2):221-226.
25. Fang JL, Krings T, Weidemann J, Meister IG, and Thron A. Functional MRI in healthy subjects during acupuncture: different effects of needle rotation in real and false acupoints. *Neuroradiology.* 2004;46:359-362.
26. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.
27. Kvorning N, Homberg C, Grennert L, Aberg A, and Akeson J. Acupuncture relieves pelvic and low-back pain in late pregnancy. *Acta Obstet Gynecol Scand.* 2004;83:246-250.
28. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci.* 2003;326(2):107-109.
29. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
30. Baxter DE. Functional nerve disorders in the athlete's foot, ankle, and leg. *Instructional Course Lectures.* 1993; 42:185-194.
31. Dellon AL, Hoke A, Williams EH, et al. The sympathetic innervation of the human foot. *Plast Reconstr Surg.* 2012;129:905.
32. Bent LR and Lowrey CR. Single low-threshold afferents innervating the skin of the human foot modulate ongoing muscle activity in the upper limbs. *J Neurophsyiol.* 2013;109:1614-1625.
33. Alagoz MS, Orbay H, Uysal AC, et al. Vascular anatomy of the metatarsal bones and the interosseous muscles of hte foot. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2009;62:1227-1232.
34. Petersen WJ, Lankes JM, Paulsen F, et al. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot & Ankle International.* 2002;23(6):491-495.
35. Van Bemmelen PS, Spivack D, and Kelly P. Reflux in foot veins is associated with venous toe and forefoot ulceration. *J Vasc Surg.* 2011;53:394-398.
36. Aranha MFM, Alves MC, Berzin F, et al. Efficacy of electroacupuncture for myofascial pain in the upper trapezius muscle: a case series. *Rev Bras Fisioter, Sao Carlos.* 2011;15(5):371-379.
37. Wu X, Sapru A, Stewart MA, et al. Using acupuncture for acute pain in hospitalized children. *Pediatr Crit Care Med.* 2009;10:291-296.
38. Tsuruoka N, Watanabe M, Takayama S, et al. Brief effect of acupoint stimulation using focused ultrasound. *J Altern Complement Med.* 2013;19(5):416-419.

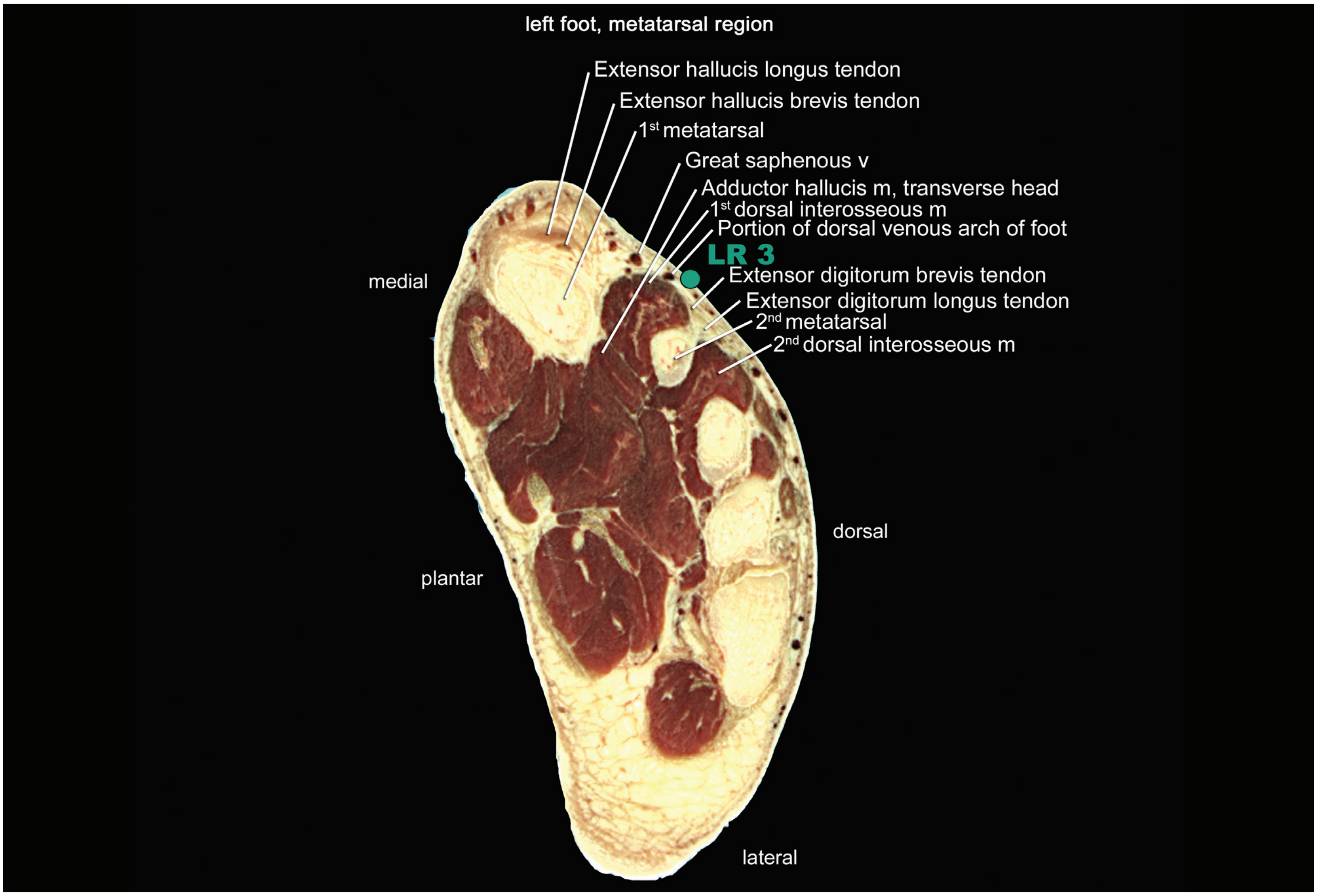

left foot, metatarsal region
Extensor hallucis longus tendon
Extensor hallucis brevis tendon
1st metatarsal
Great saphenous v
Adductor hallucis m, transverse head
1st dorsal interosseous m
Portion of dorsal venous arch of foot
LR 3
Extensor digitorum brevis tendon
Extensor digitorum longus tendon
2nd metatarsal
2nd dorsal interosseous m
medial
dorsal
plantar
lateral

Figure 12-9. The first dorsal interosseous muscle offers ample tissue for needle insertion. The muscle may develop a painful trigger point at LR 3 that refers pain to the dorsum of the foot as well as the plantar aspect of the 2nd metacarpal bone. The big toe may tingle and altered sensation may migrate from the dorsum of the foot to the distal cranial crus, implicating deep peroneal (fibular) nerve dysfunction or entrapment.

39. Takayama S, Seki T, Watanabe M, et al. Brief effect of acupuncture on the peripheral arterial system of the upper limb and systemic hemodynamics in humans. *J Altern Complement Med.* 2010;16(7):707-713.
40. Urroz P, Colagiuri B, Smith CA, et al. Effect of acute acupuncture treatment on exercise performance and postexercise recovery: a systematic review. *J Alt Complement Med.* 2013;19(1):9-16.
41. Anil A, Peker T, Goktas T, et al. Importance of acupuncture on premenstrual syndrome. *Clinical and Experimental Obstetrics & Gynecology.* 2012;39(2):209-213.
42. Litscher G. Cerebral and peripheral effects of laserneedle® stimulation. *Neurol Res.* 2003;25:722-728.

LR 4

Zhong Feng "Mound Center", "Middle Seal", "Suspended Spring"

On the dorsum of the foot, approximately 1 cun cranial to the tip of the medial malleolus, in the depression medial to the tendon of the tibialis anterior muscle. Dorsiflex the foot before locating this point. Can also be found by determining the midpoint between SP 5 and ST 41. Examine these relationships in Figure 12-11.

Connective Tissues

- **Anterior tibiotalar and tibionavicular ligaments:** Four medial ligaments fan out from the tibia's medial malleolus. They attach to the talus, calcaneus, and navicular bones. These ligaments include the anterior and posterior tibiotalar, the tibionavicular, and the tibiocalcaneal ligaments. Collectively, they are also called the deltoid ligament.

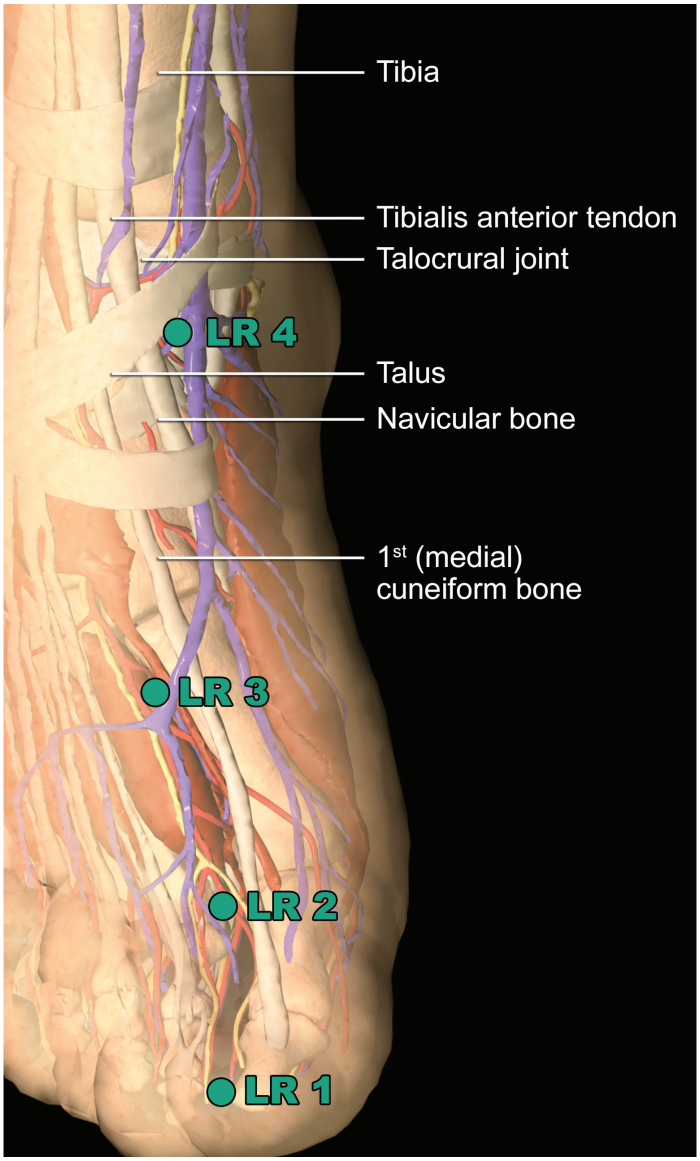


Figure 12-10. LR 4 relates to the talofibular and talocrural joints, as well as the great saphenous vein, shown here adjacent to the point. The "mound" upon which LR 4 ("Mound Center") rests is the ankle; LR 4 resides at a central location. An alternate name of "Suspended Spring" pertains to the saphenous vein suspended here from above. Located between the saphenous vein and the anterior tibialis tendon, LR 4, is "sealed".

Clinical Relevance: Joint stability requires fine interactions of static and dynamic components.[1] The aforementioned ligaments along with joint surface congruity limit joint translation while proprioceptive control over compressive and directional forces fall under the purview of nerves. Ligaments house mechanoreceptors, including Ruffini endings, Pacinian corpuscles, and Golgi-like endings (rare), as well as free nerve endings and various unclassifiable corpuscles. Sensory corpuscles and blood vessels occur, for the most part, close to ligamentous insertions onto bone, along with epiligamentous areas that provide support for the neurovascular bundles traveling into the ligament. Because most ligamentous disruption occurs in areas lacking neurovascular structures, proprioceptors and vessels are spared and thus can help heal a rupture ligament. Partial deafferentation of a ligament caused by damage to the sensory endings in the joint capsule and ligament may induce a functional instability in the ankle joint, leading to loss of position sense, reduced strength, delayed reaction time, and impaired control over posture. Acupuncture directed at restoring appropriate sensory input in periarticular structures at locations such as LR 4 may aid in restoring proprioceptive sensitivity to augment stabilization of the ankle joint.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: The distal saphenous nerve at the ankle may be injured during arthroscopy, fixation of distal tibia medial malleolar fractures, invasive approach to tarsal tunnel syndrome, and other surgical approaches to the ankle.[2]

Vessels

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein.
- **Medial malleolar arterial network:** Provides blood supply to the medial malleolar region.
- **Medial malleolar venous network:** Drains the medial malleolar region.

Clinical Relevance: Sympathetic fibers travel with the peripheral nerves to supply arteries and larger veins with nervi vasorum.[3]

The great saphenous vein is often targeted during procedures designed to treat varicose veins. Stripping of the great saphenous vein may lead to saphenous nerve injury.[4] Should saphenous nerve injury occur, acupuncture and related techniques may aid in the recovery of this peripheral nerve.

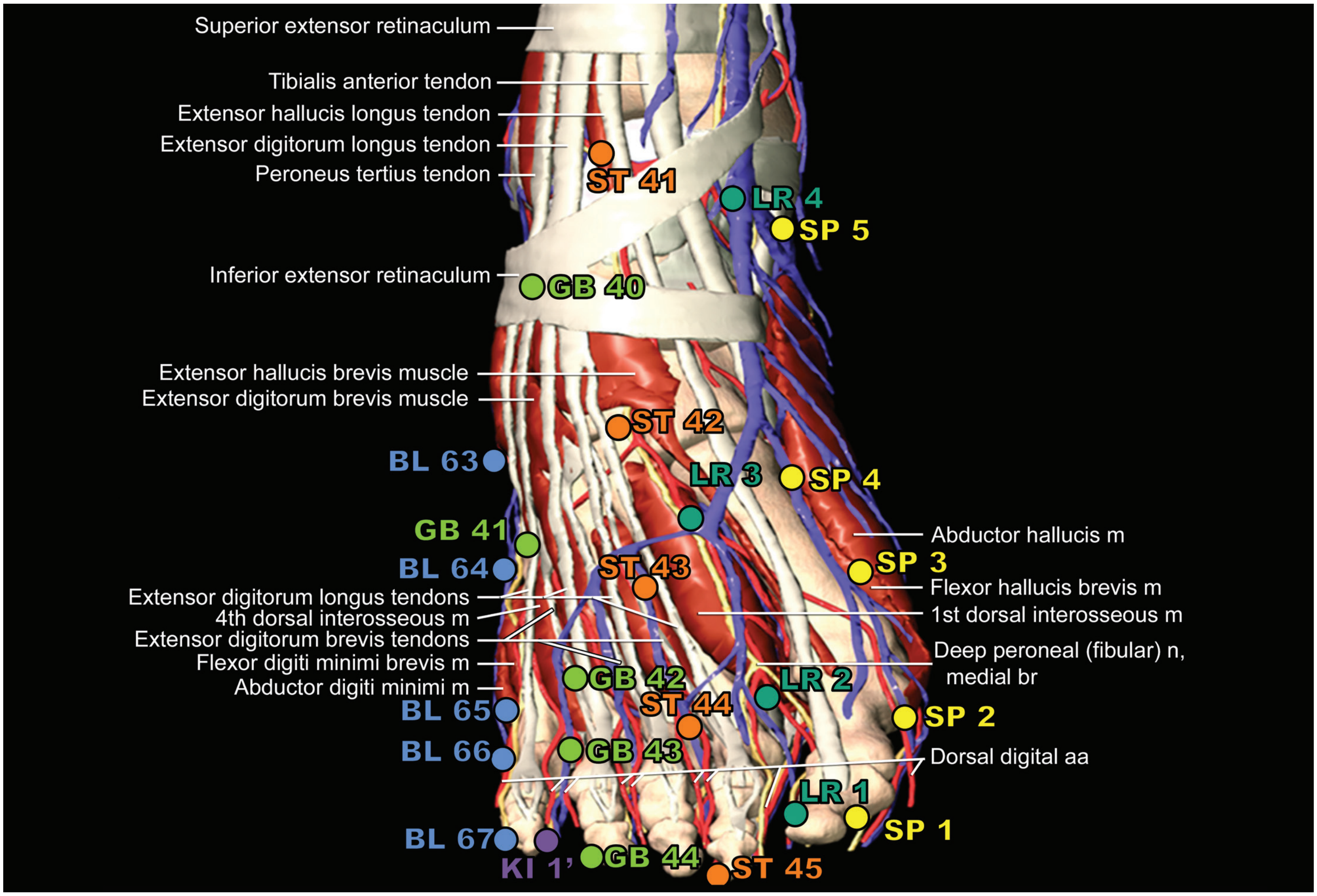

Superior extensor retinaculum
Tibialis anterior tendon
Extensor hallucis longus tendon
Extensor digitorum longus tendon
Peroneus tertius tendon
ST 41
LR 4
SP 5
Inferior extensor retinaculum
GB 40
Extensor hallucis brevis muscle
Extensor digitorum brevis muscle
ST 42
BL 63
LR 3
SP 4
Abductor hallucis m
GB 41
BL 64
ST 43
SP 3
Flexor hallucis brevis m
Extensor digitorum longus tendons
4th dorsal interosseous m
1st dorsal interosseous m
Extensor digitorum brevis tendons
Deep peroneal (fibular) n, medial br
Flexor digiti minimi brevis m
GB 42
LR 2
Abductor digiti minimi m
ST 44
BL 65
SP 2
BL 66
GB 43
Dorsal digital aa
LR 1
SP 1
BL 67
KI 1'
GB 44
ST 45

Figure 12-11. LR 4 sits between the tendon of the tibialis anterior muscle and the great saphenous vein, as shown here.

Indications and Potential Point Combinations

- **Ankle pain:** LR 4, assess for trigger points causing referred pain, including one at ST 36 in the tibialis anterior that sends pain to the dorsal ankle and the big toe.

References

1. Rein S, Hagert E, Hanisch U, et al. Immunohistochemical analysis of sensory nerve endings in ankle ligaments: a cadaver study. *Cells Tissues Organs*. DOI: 10.1159/000339877.
2. Mercer D, Morrell NT, Fitzpatrick J, et al. The course of the distal saphenous nerve: a cadaveric investigation and clinical implications. *Iowa Orthop J*. 2011;31:231-235.
3. Dellon AL, Hoke A, Williams EH, et al. The sympathetic innervation of the human foot. *Plast Reconstr Surg*. 2012;129(4):905-909.
4. Kostas TT, Ioannou CV, Veligrantakis M, et al. The appropriate length of great saphenous vein stripping should be based on the extent of reflux and not on the intent to avoid saphenous nerve injury. *J Vasc Surg*. 2007;46(6):1234-1241.

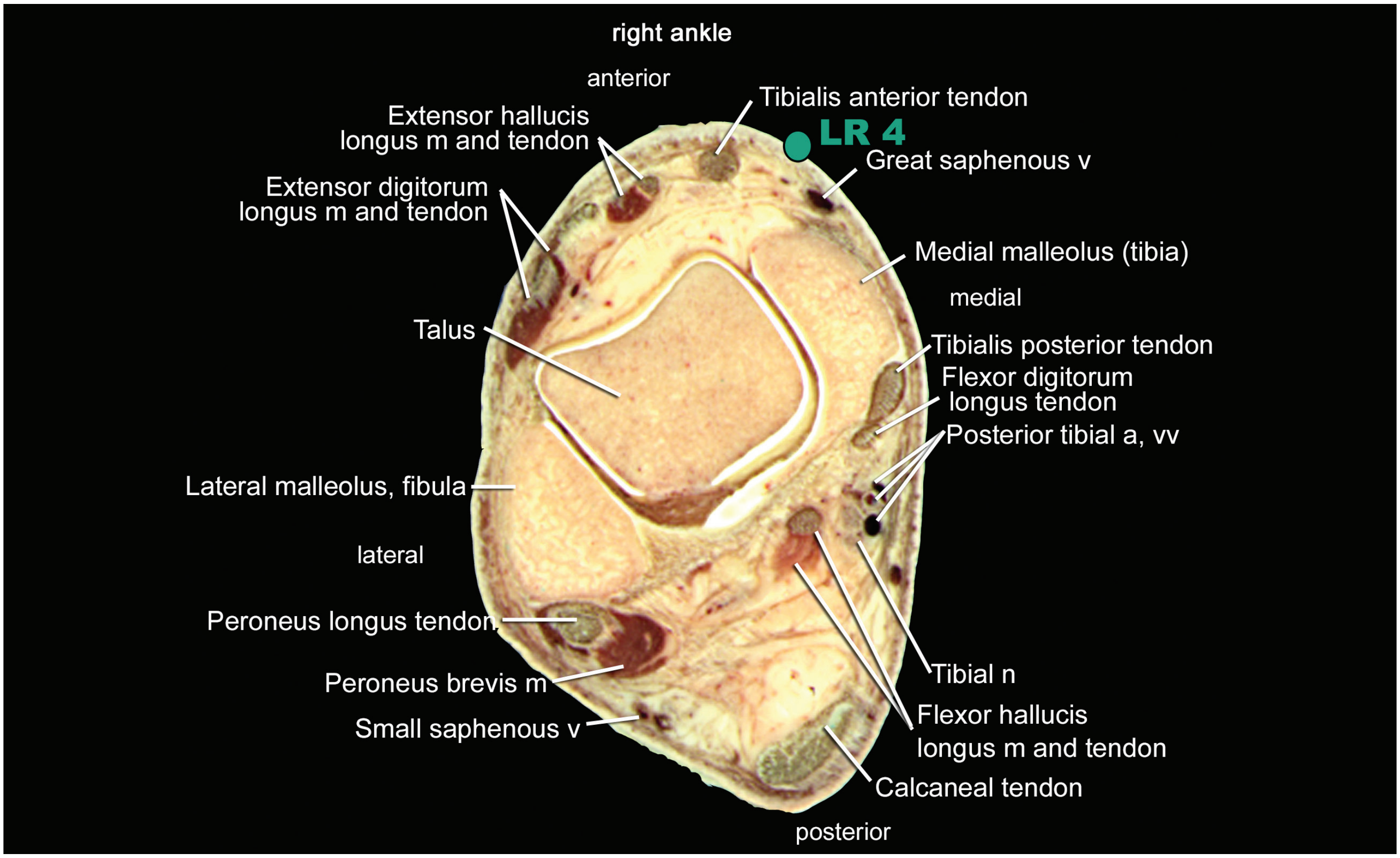

right ankle
anterior
Extensor hallucis longus m and tendon
Tibialis anterior tendon
LR 4
Great saphenous v
Extensor digitorum longus m and tendon
Medial malleolus (tibia)
medial
Talus
Tibialis posterior tendon
Flexor digitorum longus tendon
Posterior tibial a, vv
Lateral malleolus, fibula
lateral
Peroneus longus tendon
Peroneus brevis m
Tibial n
Flexor hallucis longus m and tendon
Small saphenous v
Calcaneal tendon
posterior

Figure 12-12. This cross-section through the ankle at this level shows the relationship between LR 4 and adjacent structures.

LR 5

Li Gou "Woodworm Canal"

On the medial crus, on the caudal border of the tibia, 5 cun proximal to the most prominent part of the medial malleolus. Because the distance between the popliteal crease and the tip of the medial malleolus measures 15 cun, one can find LR 5 at the junction of the middle and distal thirds in a depression between the tibia and the gastrocnemius muscle.

Muscles

- **Flexor digitorum longus muscle:** Flexes the lateral four pedal digits and plantarflexes the ankle. Helps support the longitudinal arch of the foot.
- **Posterior tibialis muscle:** Inverts the foot and provides ankle plantarflexion.

Clinical Relevance: Trigger point pathology in the flexor digitorum longus near LR 6 refers pain down the LR and SP channel to the medial malleolus as well as to the central plantar region of the foot. Deep needling at LR 5 may access a trigger point in the flexor hallucis longus, which refers pain to the plantar aspect of the great toe and first metatarsal. The long flexor muscles of the toes, i.e., the flexor digitorum and hallucis longus muscles, can participate in the development of "claw toes". Medial ankle pain and suspected tarsal tunnel syndrome may in actuality represent referred pain from long extrinsic flexor muscle trigger point pathology.

Trigger points in the tibialis posterior typically arise in the caudal calf but could pose problems at LR 5 as well. Referred pain from the tibialis posterior issues a pain pattern from about BL 57 to the calcaneal tendon and across over the entire plantar foot.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Indications for LR 5 related to genitourinary problems arise from the association of the tibial nerve with spinal cord segments that supply not only the somatic tissues at LR 5 but also genitourinary organs.

Venous structures of the pelvic limb may compress nerves, owing to their anatomical, vascular, and muscular relationships, especially in the standing position.[2] While microsurgery provides one course of action, acupuncture, laser therapy, and massage may aid patients suffering from saphenous nerve entrapment and obviate the need for surgery.

The saphenous nerve is subject to compression at a variety of sites along the medial pelvic limb; the nerve originates

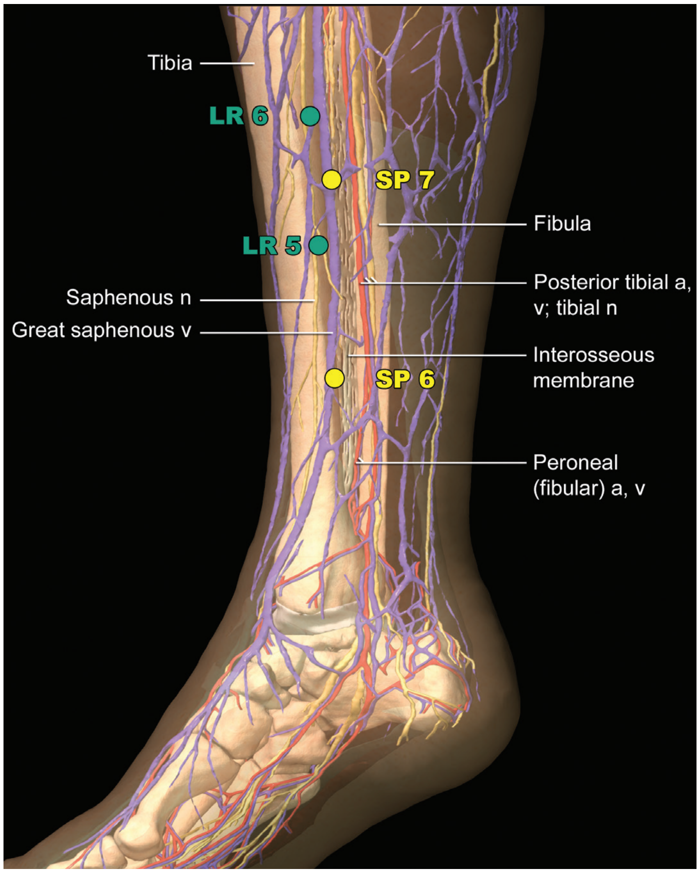


Figure 12-13. The LR and SP lines share territory over the saphenous nerve and great saphenous vein. Their overlapping indications for genitourinary conditions and saphenous nerve injury speak to their receiving innervation by the tibial and saphenous nerves, respectively.

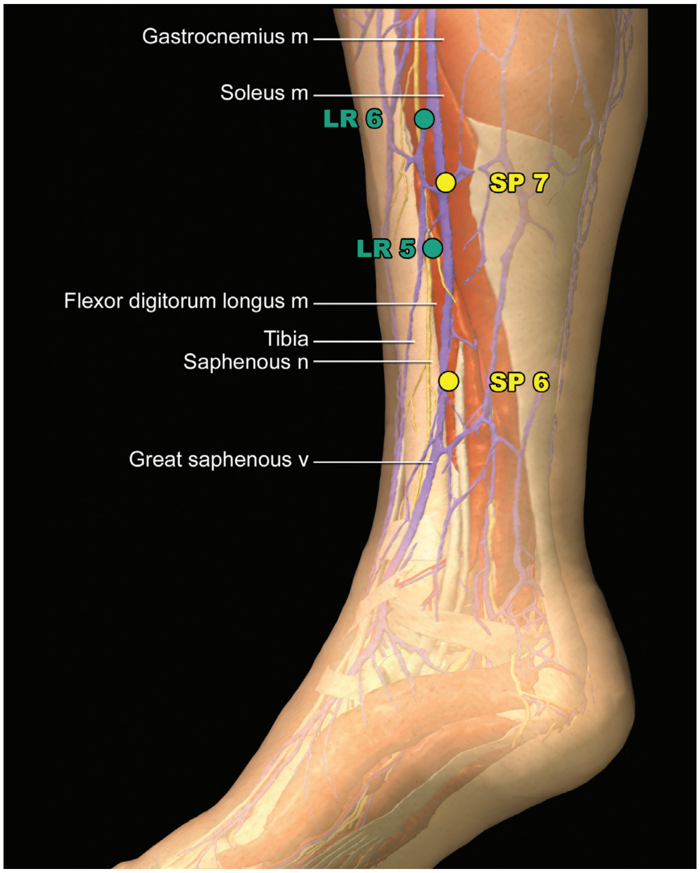


Figure 12-14. The name for LR 5 of "Woodworm Canal" refers to a hole made by a woodworm, similar to the small depression in which one locates LR 5. This "hole" appears as the flexor digitorum longus begins to disappear caudal to the tibia.

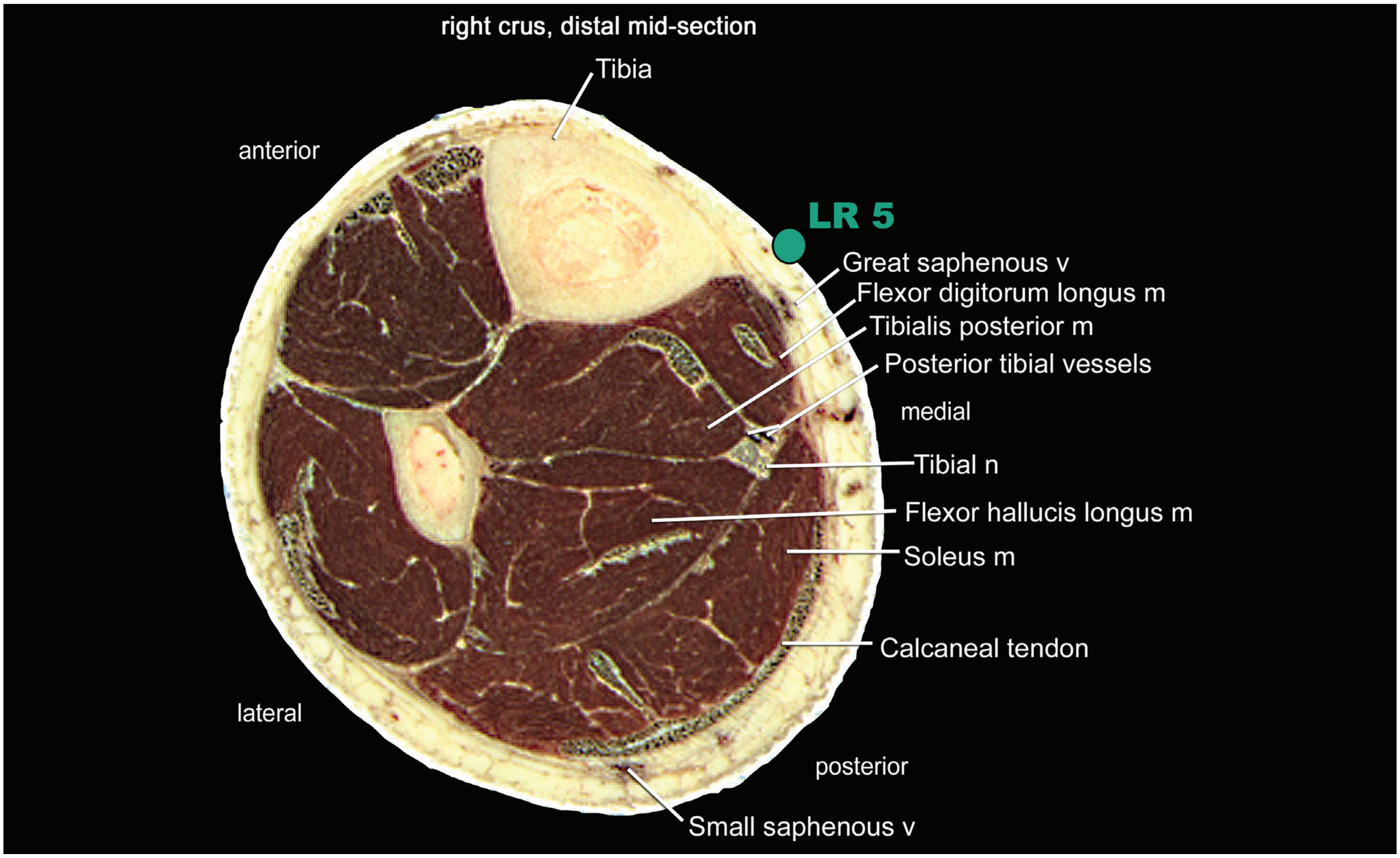


Figure 12-15. This cross-section exposes the way in which LR 5 provides a "direct hit" at the flexor digitorum longus muscle and, more deeply, the tibialis posterior. Trigger point pathology in either muscle can produce pain in the plantar aspect of the foot, causing the patient to believe she has plantar fasciitis when, in fact, she is harboring trigger points in the calf.

distal to the inguinal ligament, courses through the femoral triangle, and then accompanies the femoral vessels through the adductor canal.[3] The saphenous nerve then takes a more superficial course between the sartorius and gracilis muscles after penetrating the fascia lata. From here, the saphenous nerve travels on the medial aspect of the pelvic limb in the company of the great saphenous vein. An infrapatellar branch exits the adductor canal to supply the craniomedial knee. Here, the nerve supplies both the skin and the patellar ligament. The remainder of the saphenous nerve follows the great saphenous vein to the distal limb. Two branches form on the distal medial crus, becoming the medial and lateral crural cutaneous branches. The former communicates with cutaneous branches of the femoral nerve on the craniomedial crus. The lateral crural cutaneous branch descends between the anterior tibialis tendon and the medial malleolus, lateral to the great saphenous vein. This branch supplies sensation to the dorsal foot, medial malleolus, and skin of the first metatarsal head, abutting that supplied by the deep peroneal (fibular) nerve between LR 2 and LR 3.

The first locus of saphenous nerve entrapment occurs distal to the adductor canal where the saphenous nerve becomes superficial. Further down the limb, the infrapatellar branch may be injured or truncated during total knee replacement or other knee surgery that entails approaching the knee through a long incision that coincides with the nerve. Scar tissue may damage remaining branches. In other cases, compression or injury of the saphenous nerve causes acute and chronic medial knee pain. More distal compression of the saphenous nerve may refer pain proximad to the infrapatellar branch, leading to diagnostic and localizing ambiguity. Varicose vein surgery is a well-known culprit of saphenous nerve damage given how closely yet irregularly the nerve and great saphenous vein interrelate along their journeys. Removal of the great saphenous vein for use in coronary artery bypass surgery is perhaps the most common cause of saphenous nerve damage in the limb.

The differential diagnosis for saphenous nerve entrapment includes: medial meniscal tear, patellofemoral disorder, suprapatellar plica, pes tendinopathy, osteochondritis dissecans, nonspecific synovitis, and reflex sympathetic dystrophy.[4] Additional differentials include syndromes of the saphenous vein such as venous insufficiency and phlebitis; nerve root compression, arterial pathology, and knee or hip arthritis.[5]

Nonsurgical methods of treatment for saphenous nerve impingement pain and sensory disturbance should be tried prior to surgery.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and peroneal (fibular) veins.

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein. A rich, mixed, vascular network (vasa vasorum) and attendant nerve accompany the great saphenous vein from ankle to knee.[6]
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin off of the superficial veins. When they do so, they travel at an oblique angle so that muscular contraction and pressure within the compartment compresses the perforating veins. This phenomenon assists in encouraging unidirectional blood flow from superficial to deep veins and enables muscular contraction to assist in returning venous blood toward the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[7]

Indications and Potential Point Combinations

- **Genitourinary disorders, including: genital pain, genital itching, dysmenorrhea, orchitis, leukorrhea, urethritis, dysuria, urinary retention, enuresis:** LR 5, LR 12, SP 6, CV 2, CV 4.
- **Aching and pain in the crus:** Medial calf pain referred from the long flexors of the toes indicating trigger points in this muscle; add LR 6, LR 5, LR 2, SP 2, SP 3, acupressure at KI 1.
- **Saphenous nerve entrapment:** LR 5, LR 4; palpate along the entire course of the saphenous nerve to determine locus and cause of entrapment.
- **Medial knee pain:** LR 5, LR 8, LR 9, SP 9, relevant trigger points. Rule out neuropathy of the saphenous nerve, infrapatellar branch, before considering surgery for the knee when patients complain of medial knee pain!

Evidence-Based Applications

- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[1]
- Acupuncture at LR 5 plus movement therapy outperformed conventional acupuncture for **cervical spondylosis.**[8]

References

1. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. Archives of Andrology. 1997;39:155-161.

2. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *Br J Neurosurg.* 2012;26(3):386-391.

3. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.

4. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.

5. Nir-Paz R, Luder AS, Cozacov JC, et al. Saphenous nerve entrapment in adolescence. *Pediatrics.* 1999;103(1):161-163.

6. Nayak BB, Thatte RL, Thatte MR, et al. A microvascular study of the great saphenous vein in man and the possible implications for survival of venous flaps. *British Journal of Plastic Surgery.* 2000;53:230-233.

7. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. Phlebology. 2011;26(3):114-118.

8. Luo BH and Han JX. Cervical spondylosis treated by acupuncture at Ligou (LR 5) combined with movement therapy. *J Tradit Chin Med.* 2010;30(2):113-117.

LR 6

Zhong Du “Central Metropolis”

On the medial leg, along the caudal border of the tibia, 7 cun proximal to the most prominent part of the medial malleolus. Divide the distance between the popliteal crease and the tip of the medial malleolus into two; locate LR 6 0.5 cun distal to this midpoint, between the medial border of the tibia and the gastrocnemius muscle. Note its position relative to LR 5 in Figures 12-13 and 12-14.

Muscles

- **Flexor digitorum longus muscle:** Flexes the lateral four pedal digits and plantarflexes the ankle. Helps support the longitudinal arch of the foot.
- **Posterior tibialis muscle:** Inverts the foot and provides ankle plantarflexion.

Clinical Relevance: Trigger point pathology in the flexor digitorum longus near LR 6 refers pain down the LR and SP channel to the medial malleolus as well as to the central plantar region of the foot. The long flexor muscles of the toes, i.e., the flexor digitorum and hallucis longus muscles, can participate in the development of “claw toes”. Medial ankle pain and suspected tarsal tunnel syndrome may in actuality represent referred pain from long extrinsic flexor muscle trigger point pathology.

Trigger points in the tibialis posterior typically arise in the caudal calf at the level of LR 6 or over SP and BL channel territory. Referred pain from the tibialis posterior leads to a pain pattern from the trigger point site (somewhere between LR 5 and BL 57) to the calcaneal tendon and across over the entire plantar foot.

Nerves

- **Tibial nerve (L5-S3):** Innervates the flexor digitorum longus muscle, the flexor hallucis longus muscle, and the posterior tibialis muscle, as well as the other muscles in the posterior aspect of the leg and knee.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Indications for LR 6 related to genitourinary problems arise from the association of the tibial nerve with spinal cord segments that supply not only the somatic tissues at LR 6 but also genitourinary organs.

Venous structures of the pelvic limb may compress nerves, owing to their anatomical, vascular, and muscular relationships, especially in the standing position.[1] While microsurgery provides one course of action, acupuncture, laser therapy, and massage may aid patients suffering from saphenous nerve entrapment and obviate the need for surgery.

The saphenous nerve is subject to compression at a variety of sites along the medial pelvic limb; the nerve originates distal to the inguinal ligament, courses through the femoral triangle, and then accompanies the femoral vessels through the adductor canal.[2] The saphenous nerve then takes a more superficial course between the sartorius and gracilis muscles after penetrating the fascia lata. From here, the saphenous nerve travels on the medial aspect of the pelvic limb in the company of the great saphenous vein. An infrapatellar branch exits the adductor canal to supply the craniomedial knee. Here, the nerve supplies both the skin and the patellar ligament. The remainder of the saphenous nerve follows the great saphenous vein to the distal limb. Two branches form on the distal medial crus, becoming the medial and lateral crural cutaneous branches. The former communicates with cutaneous branches of the femoral nerve on the craniomedial crus. The lateral crural cutaneous branch descends between the anterior tibialis tendon and the medial malleolus, lateral to the great saphenous vein. This supplies sensation to the dorsal foot, medial malleolus, and skin of the first metatarsal head, abutting that supplied by the deep peroneal (fibular) nerve between LR 2 and LR 3.

The first locus of saphenous nerve entrapment occurs distal to the adductor canal where the saphenous nerve becomes superficial. Further down the limb, the infrapatellar branch may be injured or truncated during total knee replacement or other knee surgery that entails approaching the knee through a long incision that coincides with the nerve. Scar tissue may damage

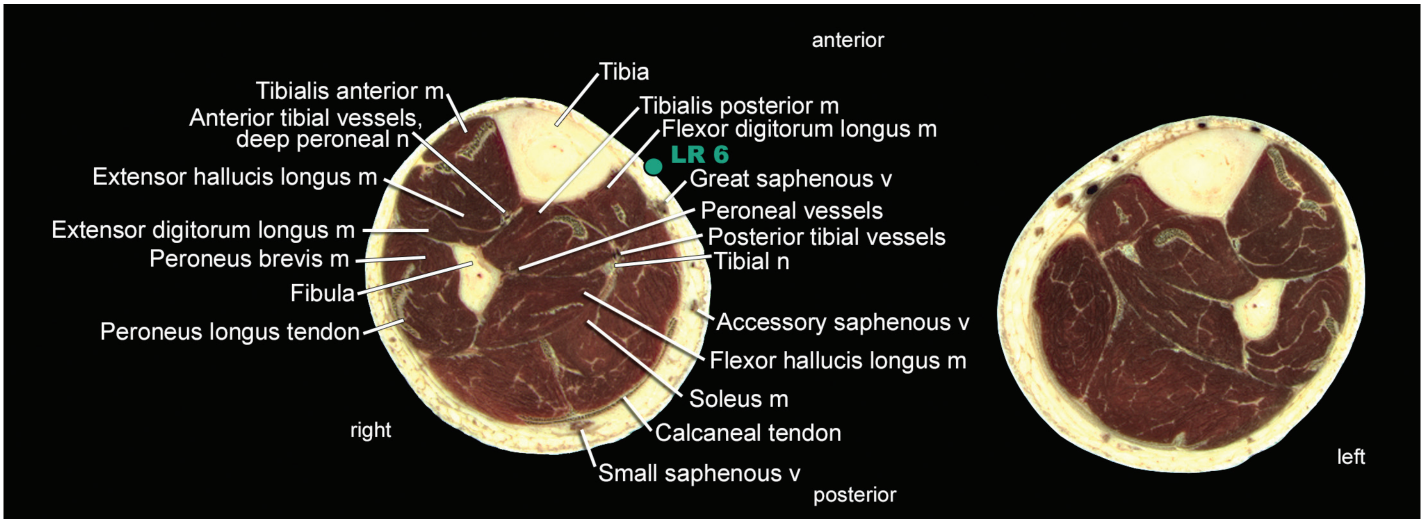


Figure 12-16. This cross section at the level of LR 6 shows the point sitting squarely atop the flexor digitorum longus muscle and, more deeply, the tibialis posterior muscle. Trigger points in either structure can cause the patient to feel pain in the calf, ankle, or plantar foot. Many cases of suspected plantar fasciitis are actually referred pain syndromes from trigger point pathology in the calf. Make sure to palpate the entire calf and foot exploring for trigger points before recommending invasive procedures for plantar fasciitis, as the assumption that the problem is in the foot may be incorrect.

remaining branches. In other cases, compression or injury of the saphenous nerve causes acute and chronic medial knee pain. More distal compression of the saphenous nerve may refer pain proximad to the infrapatellar branch, leading to diagnostic and localizing ambiguity. Varicose vein surgery is a well-known culprit of saphenous nerve damage given how closely yet irregularly the nerve and great saphenous vein interrelate along their journeys. Removal of the great saphenous vein for use in coronary artery bypass surgery is perhaps the most common cause of saphenous nerve damage in the limb.

The differential diagnosis for saphenous nerve entrapment includes: medial meniscal tear, patellofemoral disorder, suprapatellar plica, pes tendinopathy, osteochondritis dessicans, nonspecific synovitis, and reflex sympathetic dystrophy.[3] Additional differentials include syndromes of the saphenous vein such as venous insufficiency and phlebitis; nerve root compression, arterial pathology, and knee or hip arthritis.[4]

Nonsurgical methods of treatment for saphenous nerve impingement pain and sensory disturbance should be tried prior to surgery.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and peroneal (fibular) veins.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein. A rich, mixed, vascular network (vasa vasorum) and attendant nerve accompany the great saphenous vein from ankle to knee.[5]
- **Perforating veins:** These veins contain valves that allow flow from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin off of the superficial veins. When they do so, they travel at an oblique angle so that muscular contraction and pressure within the compartment compresses the perforating veins. This phenomenon assists in encouraging unidirectional blood flow from superficial to deep veins and enables muscular contraction to assist in returning venous blood toward the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[6]

Indications and Potential Point Combinations

- **Genitourinary disorders, including: genital pain, genital itching, dysmenorrhea, orchitis, leukorrhea, urethritis, dysuria, urinary retention, enuresis:** LR 5, LR 6, LR 12, SP 6, CV 2, CV 4.
- **Aching and pain in the crus:** Medial calf pain referred from the long flexors of the toes indicating trigger points in this muscle; add LR 6, LR 5, LR 2, SP 2, SP 3, acupressure at KI 1.

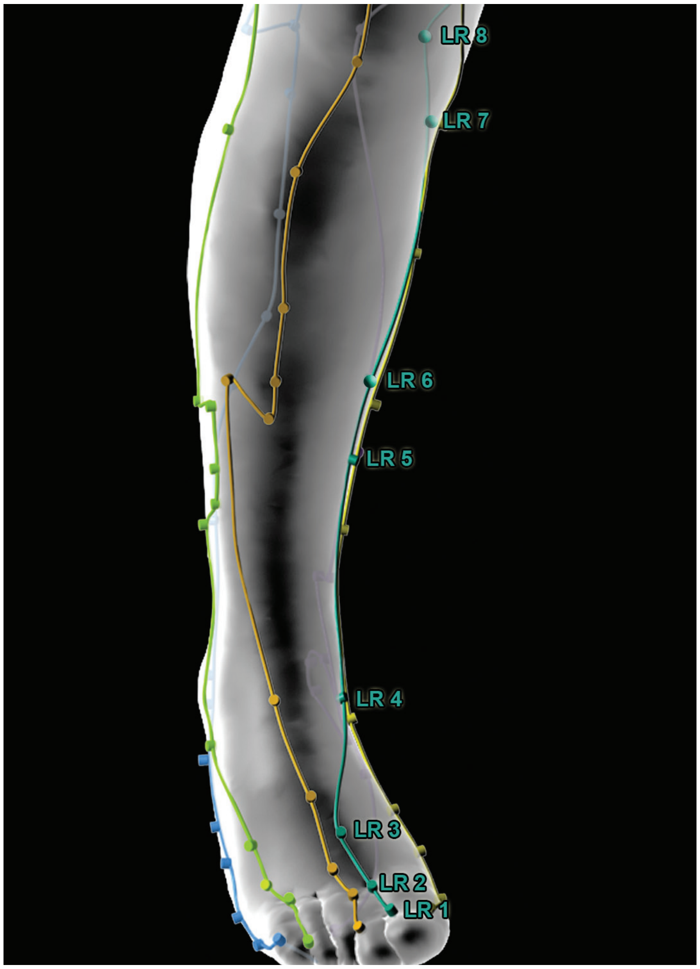


Figure 12-17. The name for LR 6, "Central Metropolis", refers to its location about midway along the crus in a busy, point-rich section of the leg. Many other points coexist in this region, including ST 38, ST 39, and ST 40 (shown in orange) and GB 35 and GB 36, in lime green. SP 7 is peeking around the corner medial and distal to LR 6 in shaded yellow.

- **Saphenous nerve entrapment:** LR 6, LR 4; palpate along the entire course of the saphenous nerve to determine locus and cause of entrapment.
- **Medial knee pain:** LR 6, LR 8, LR 9, SP 9, relevant trigger points. Rule out neuropathy of the saphenous nerve, infrapatellar branch, before considering surgery for the knee when patients complain of medial knee pain!
- **Heel pain:** Examine the soleus for a trigger point at LR 6 and/or LR 5.

References

1. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *Br J Neurosurg.* 2012;26(3):386-391.
2. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
3. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.
4. Nir-Paz R, Luder AS, Cozacov JC, et al. Saphenous nerve entrapment in adolescence. *Pediatrics.* 1999;103(1):161-163.
5. Nayak BB, Thatte RL, Thatte MR, et al. A microvascular study of the great saphenous vein in man and the possible implications for survival of venous flaps. *British Journal of Plastic Surgery.* 2000;53:230-233.
6. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology.* 2011;26(3):114-118.

LR 7

Xi Guan "Knee Joint", "Passageway to the Knee"

Caudal and distal to the medial condyle of the tibia, 1 cun caudal to SP 9, in the proximal portion of the medial head of the gastrocnemius muscle.

Muscles

- **Gastrocnemius muscle:** Plantarflexes the ankle when the knee is extended, raises the heel during ambulation, and flexes the leg at the knee joint.
- **Popliteus muscle:** Weakly flexes the knee and "unlocks" it by rotating the femur in a lateral direction atop the tibial plateau. Adheres to the joint capsule of the knee. Considered the "cornerstone stabilizer" of the posterolateral aspect of the knee in conjunction with its tendon, fascicles, and meniscocapsular attachment sites.[1] For the normal, intact lateral meniscus, the popliteus muscle acts as a retractor.[2]

Clinical Relevance: A trigger point in the gastrocnemius muscle at LR 7 send pain proximad and distad along the caudal thigh and calf, respectively. Referred pain extends to the plantar midfoot, mimicking plantar fasciitis pain like the long digitial flexors can. Myofascial trigger point pathology causes the calf to cramp, especially at night.

Trigger points in the popliteus muscle at or near LR 7 produce pain in the popliteal fossa and caudodistal femur over the medial epicondyle. Neuromodulation applied to structures around the knee such as the popliteus muscle has the potential to improve proprioception and general stability in conjunction with neuromuscular retraining. The popliteus muscle monitors and controls subtle movements in the knee, tantamount to a three-dimensional dynamic guidance system.[3] The popliteus musculotendinous complex and adjoining structures stabilize the knee by monitoring and controlling tibial external rotation, posterior translation during eccentric function (protecting the posterior cruciate ligament), and by causing tibial internal rotation and posterior translation during concentric function (protecting the anterior cruciate ligament). In short, LR 7 represents an access point through which to influence popliteus function.

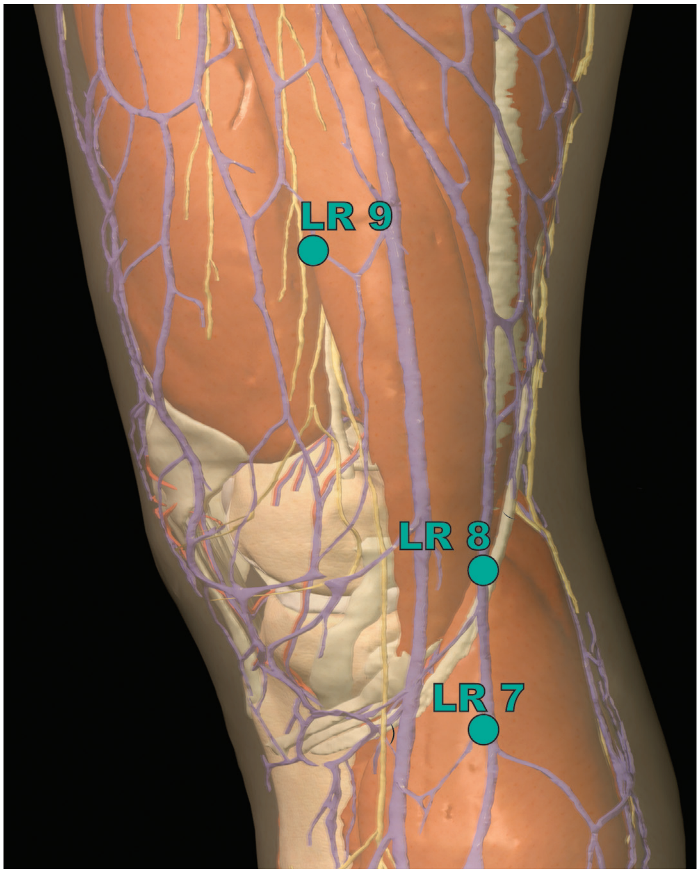


Figure 12-18. The descriptive name for LR 7, "Knee Joint", describes its proximity to the joint.

Nerves

- **Tibial nerve (L4, L5, S1, and S2):** The S1 and S2 branches innervate the plantaris, soleus, and gastrocnemius muscles, while the L4, L5, and S1 branches innervate the popliteus muscle.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Tibial nerve branches may differ in terms of the spinal cord segments from which they originate. For example, S1 and S2 course in the tibial nerve branches to the gastrocnemius, soleus, and plantaris. L4 and L5 supply the tibialis posterior, while L4, L5, and S1 course to the popliteus. S2 and S3 supply the flexor hallucis longus and flexor digitorum longus. Thus, when employing points innervated by the tibial nerve for somatovisceral influence (e.g., when treating voiding dysfunction), more distal structures receive more caudal spinal segmental supply (i.e., from sacral cord segments). This explains why points along the LR, SP, and KI channels appear more routinely in needling formulae for voiding dysfunction than, for example, BL 40 or BL 55, which would be supplied by more cranial spinal segments that have a less direct relationship with the pelvic organs than do more caudal spinal segments. Thus, indications for LR 7 related to genitourinary problems arise from the association of the tibial nerve with spinal cord segments that supply not only the somatic tissues at LR 7 but also genitourinary organs.

Tibial nerve entrapment produces gastrocnemius muscle atrophy as well as paresthesia and pain from the neuropathy that ensues.

Venous structures of the pelvic limb may compress nerves, owing to their anatomical, vascular, and muscular relationships, especially in the standing position.[4] While microsurgery provides one course of action, acupuncture, laser therapy, and massage may aid patients suffering from saphenous nerve entrapment and obviate the need for surgery.

The saphenous nerve is subject to compression at a variety of sites along the medial pelvic limb; the nerve originates distal to the inguinal ligament, courses through the femoral triangle, and then accompanies the femoral vessels through the adductor canal.[5] The saphenous nerve then takes a more superficial course between the sartorius and gracilis muscles after penetrating the fascia lata. From here, the saphenous nerve travels on the medial aspect of the pelvic limb in the company

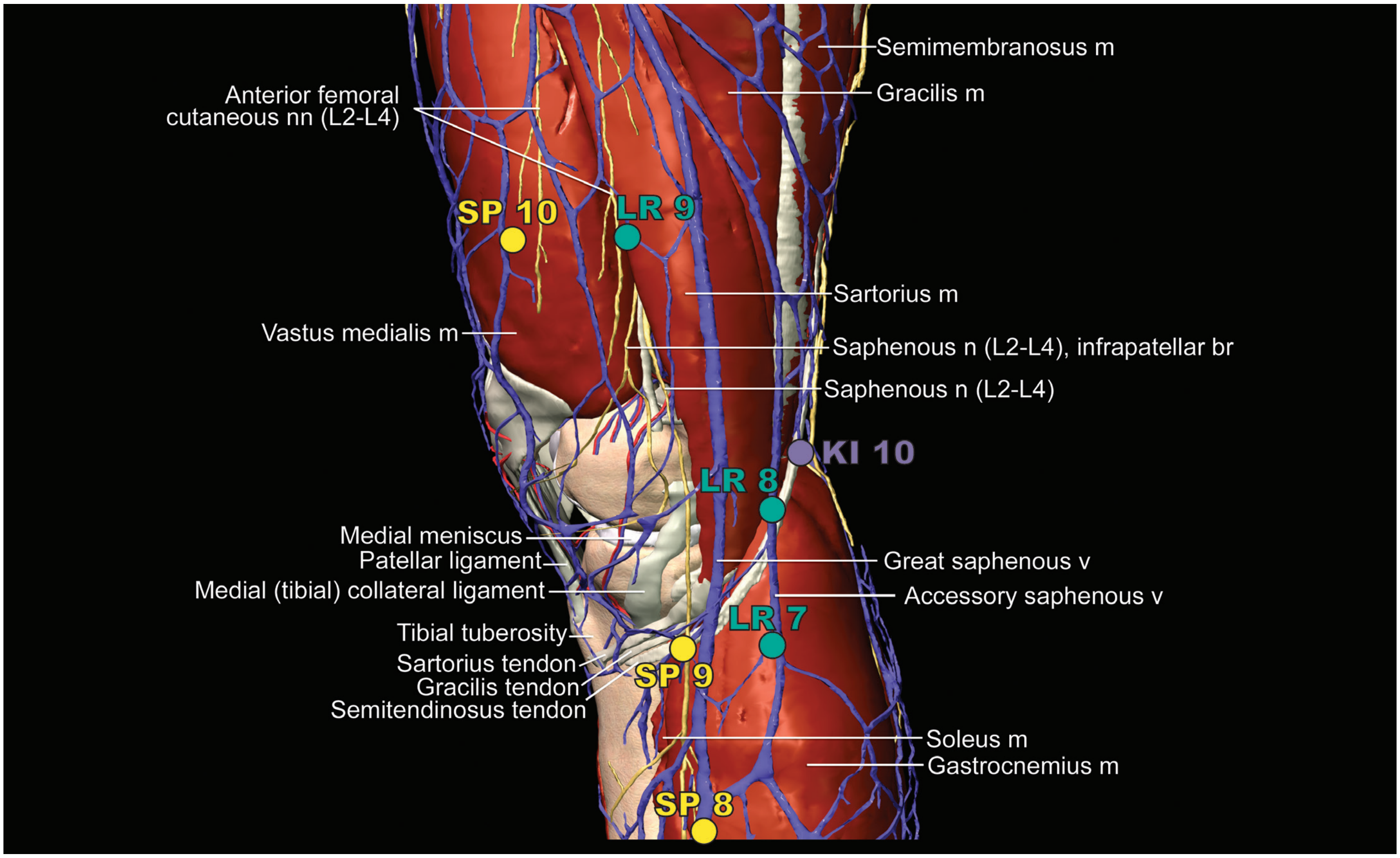

Semimembranosus m
Gracilis m
Anterior femoral cutaneous nn (L2-L4)
SP 10
LR 9
Sartorius m
Vastus medialis m
Saphenous n (L2-L4), infrapatellar br
Saphenous n (L2-L4)
KI 10
LR 8
Medial meniscus
Patellar ligament
Great saphenous v
Medial (tibial) collateral ligament
Accessory saphenous v
LR 7
Tibial tuberosity
Sartorius tendon
SP 9
Gracilis tendon
Semitendinosus tendon
Soleus m
Gastrocnemius m
SP 8

Figure 12-19. The alternate name for LR 7, "Passageway to the Knee", applies to the journey to the joint that the LR line travels along the accessory saphenous vein.

of the great saphenous vein. An infrapatellar branch exits the adductor canal to supply the craniomedial knee. Here, the nerve supplies both the skin and the patellar ligament. The remainder of the saphenous nerve follows the great saphenous vein to the distal limb. Two branches form on the distal medial crus, becoming the medial and lateral crural cutaneous branches. The former communicates with cutaneous branches of the femoral nerve on the craniomedial crus. The lateral crural cutaneous branch descends between the anterior tibialis tendon and the medial malleolus, lateral to the great saphenous vein. This supplies sensation to the dorsal foot, medial malleolus, and skin of the first metatarsal head, abutting that supplied by the deep peroneal (fibular) nerve between LR 2 and LR 3.

The first locus of saphenous nerve entrapment occurs distal to the adductor canal where the saphenous nerve becomes superficial. Further down the limb, the infrapatellar branch may be injured or truncated during total knee replacement or other knee surgery that entails approaching the knee through a long incision that coincides with the nerve. Scar tissue may damage remaining branches. In other cases, compression or injury of the saphenous nerve causes acute and chronic medial knee pain. More distal compression of the saphenous nerve may refer pain proximad to the infrapatellar branch, leading to diagnostic and localizing ambiguity. Varicose vein surgery is a well-known culprit of saphenous nerve damage given how closely yet irregularly the nerve and great saphenous vein interrelate along their journeys. Removal of the great saphenous vein for use in coronary artery bypass surgery is perhaps the most common cause of saphenous nerve damage in the limb.

The differential diagnosis for saphenous nerve entrapment includes: medial meniscal tear, patellofemoral disorder, suprapatellar plica, pes tendinopathy, osteochondritis dessicans, nonspecific synovitis, and reflex sympathetic dystrophy.[6] Additional differentials include syndromes of the saphenous vein such as venous insufficiency and phlebitis; nerve root compression, arterial pathology, and knee or hip arthritis.[7]

Nonsurgical methods of treatment for saphenous nerve impingement pain and sensory disturbance should be tried prior to surgery.

Vessels

- **Posterior tibial artery:** Arises from the popliteal artery. Supplies blood to the posterior and lateral compartments of the leg. Its circumflex fibular branch joins the genicular anastomoses. The posterior tibial artery provides a nutrient artery to the tibia.
- **Posterior tibial vein:** Perforating veins carry blood from the great saphenous vein to the posterior and peroneal (fibular) veins.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein. A rich, mixed, vascular network (vasa vasorum) and attendant nerve accompany the great saphenous vein from ankle to knee.[8]
- **Perforating veins:** These veins contain valves that allow flow

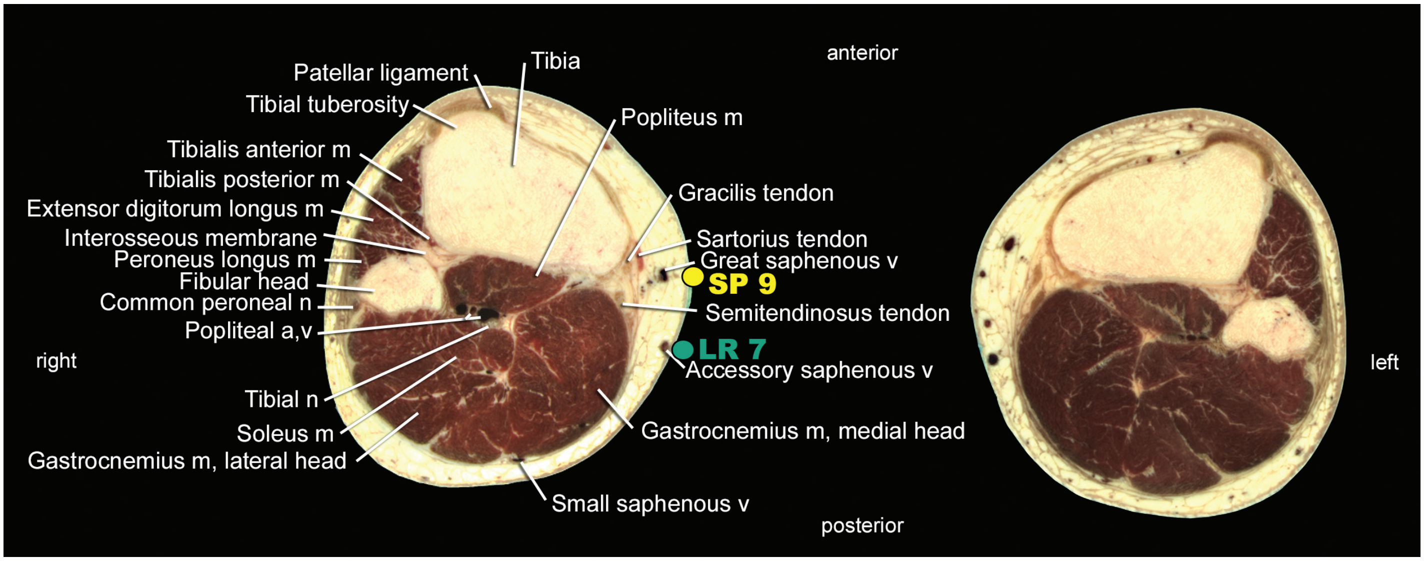

anterior
Patellar ligament
Tibia
Tibial tuberosity
Popliteus m
Tibialis anterior m
Tibialis posterior m
Gracilis tendon
Extensor digitorum longus m
Interosseous membrane
Sartorius tendon
Peroneus longus m
Great saphenous v
Fibular head
SP 9
Common peroneal n
Semitendinosus tendon
Popliteal a,v
LR 7
right
Accessory saphenous v
left
Tibial n
Soleus m
Gastrocnemius m, medial head
Gastrocnemius m, lateral head
Small saphenous v
posterior

Figure 12-20. Deeply needled, LR 7 treats trigger points in both the gastrocnemius and popliteus muscles. Referred pain from a gastrocnemius trigger point covers the caudodistal thigh and caudal calf as well as focusing strongly on the plantar midfoot. A popliteus muscle trigger point centralizes pain in the popliteal fossa.

from the superficial to the deep veins. Perforating veins pass through deep fascia close to their origin off of the superficial veins. When they do so, they travel at an oblique angle so that muscular contraction and pressure within the compartment compresses the perforating veins. This phenomenon assists in encouraging unidirectional blood flow from superficial to deep veins and enables muscular contraction to assist in returning venous blood toward the heart, against the force of gravity.

Clinical Relevance: Stripping of the great saphenous vein may injure the saphenous nerve, leading to sensory dysfunction along the medial calf. The two structures have a close but variable relationship, making iatrogenic injury of the latter a complication of endovenous laser therapy and radiofrequency ablation.[9]

Indications and Potential Point Combinations

- **Medial knee pain, swelling, and inflammation:** Examine gastrocnemius for trigger points in the medial head at LR 7, BL 40, or KI 10. Also evaluate the popliteus muscle for a trigger point deeply located beneath LR 7, as shown in Figure 12-20.

References

1. Staubli H-U and Birrer S. The popliteal tendon and its fascicles at the popliteal hiatus: gross anatomy and functional arthroscopic evaluation with and without anterior cruciate ligament deficiency. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 1990;6(3):209-220.
2. Jones CDS, Keene GCR, and Christie AD. The popliteus as a retractor of the lateral meniscus of the knee. *Arthroscopy: The Journal of Arthroscopic and Related Surgery.* 1995;11(3):270-274.
3. Nyland J, Lachman N, Kocabey Y, et al. Anatomy, function, and rehabilitation of the popliteus musculotendinous complex. *J Orthop Sports Phys Ther.* 2005;35:165-179.
4. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *Br J Neurosurg.* 2012;26(3):386-391.
5. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
6. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.
7. Nir-Paz R, Luder AS, Cozacov JC, et al. Saphenous nerve entrapment in adolescence. *Pediatrics.* 1999;103(1):161-163.
8. Nayak BB, Thatte RL, Thatte MR, et al. A microvascular study of the great saphenous vein in man and the possible implications for survival of venous flaps. *British Journal of Plastic Surgery.* 2000;53:230-233.
9. Veverkova L, Jedlicka V, Vicek P, et al. The anatomical relationship between the saphenous nerve and the great saphenous vein. *Phlebology.* 2011;26(3):114-118.

LR 8

Qu Quan "Spring at the Crook", "Spring at the Bend"

Just proximal to the medial end of the popliteal crease, in a depression cranial to the tendons of the semimembranosus and semitendinosus muscles, caudal to the sartorius muscle. Locate with patient's knee flexed. About 1 cun cranial to KI 10. Have the patient flex the knee to locate the popliteal crease and to identify the semimembranosus and semitendinosus tendons. Review the relationship of the point to the tendons in Figure 12-22.

Muscles and Tendons

- **Sartorius muscle:** The sartorius flexes, laterally rotates, and abducts the thigh at the hip joint. Flexes the leg at the knee.
- **Gracilis tendon:** Flexes the leg, helps rotate it in a medial direction, and adducts the thigh.
- **Semitendinosus tendon:** Flexes the leg. Extends the thigh. When the knee is flexed, the semitendinosus muscle rotates the leg medially. Then the thigh and leg are flexed, the semitendinosus extends the trunk.

Clinical Relevance: The "pes anserinus" ("foot of the goose") on the leg embodies the insertion of the conjoined tendons of the sartorius, gracilis, and semitendinosus muscles at SP 9 after passing LR 8. The pes anserinus is superficial to the tibial insertion of the medial collateral ligament. The bursa that separates the pes anserinus from the medial collateral ligament may become inflamed or irritated from overuse or injury leading to pain, swelling, and tenderness to palpation. "Pes anserine bursitis" has been proposed as a cause of chronic knee pain and weakness; palpation of the knee and surrounding regions should help identify contributing factors and trigger point pathology. Although many patients with this problem are athletes, pes anserine bursitis or swelling in this region may represent an extra-articular manifestation of gout,[3] mineralized fibroma of the tendon sheath,[4] or cystic periarticular knee lesions. The source of knee pain at SP 9 or LR 8 may be ambiguous, meaning that the term "pes anserinus tendino-bursitis syndrome" may be inaccurate if other structures are indeed involved.[5] The syndrome involves pain in the medial aspect of the knee, especially when ascending or descending stairs, tenderness to palpation, and possibly local edema. Differential diagnosis includes medial meniscus injury, osteoarthritis of the medial knee, radiculopathy of the L3-L4 nerve roots, and medial collateral ligament lesion.

Nerves

- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus and obturator externus muscles.
- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. Supplies the skin on the anteromedial thigh. Supplies the hip and knee joints and the anterior thigh muscles, including the sartorius muscle.
- **Sciatic nerve (L4-S3):** Supplies the hamstring muscles (i.e., the semimembranosus, semitendinosus, and long head of the biceps femoris muscles) by its tibial division (L5-S2).
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.

Clinical Relevance: Despite their common final destination, each muscle contributing to the pes anserinus carries a distinct innervation. That is, the femoral nerve supplies the sartorius, the obturator nerve innervates the gracilis, and the tibial portion of the sciatic nerve supplies the semitendinosus. Thus, needling

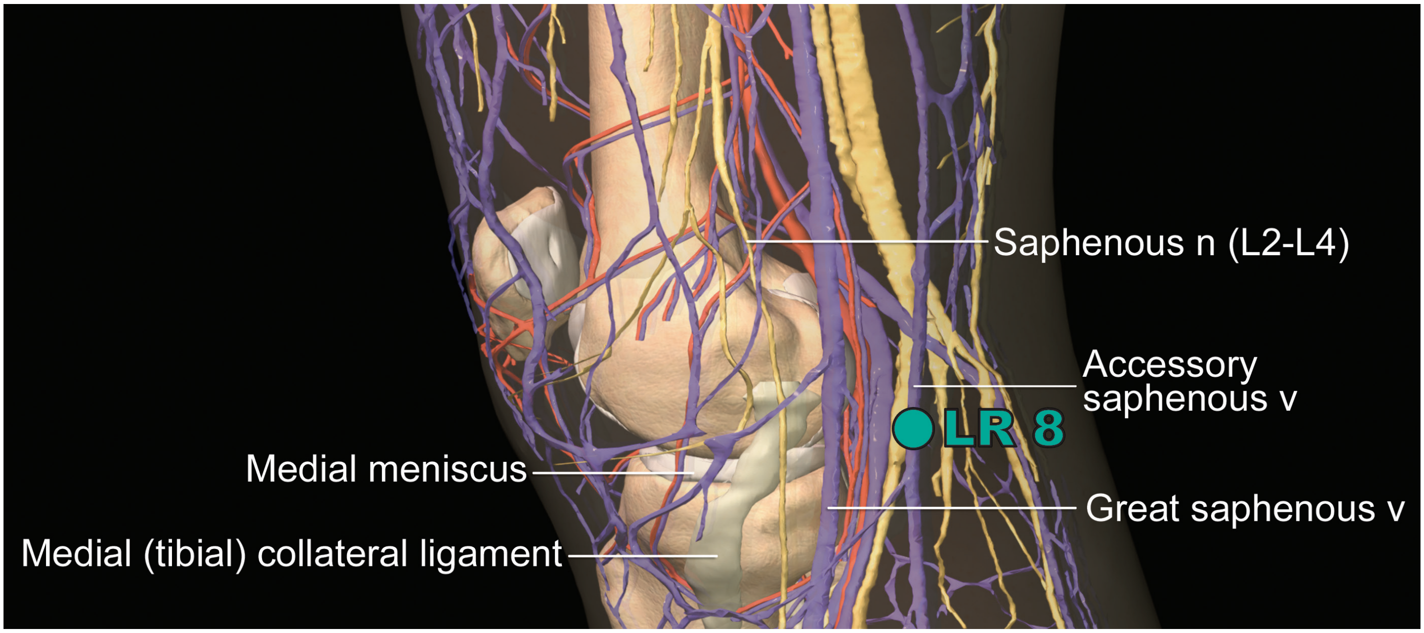


Figure 12-21. LR 8 is called "Spring at the Bend", signifying its relationship to the accessory saphenous vein (the "spring") level with the joint line (the "bend"). Other points around the knee with the term "spring" in their name include nearby GB 34 ("Yang Mound Spring") and SP 9 ("Yin Mound Spring").

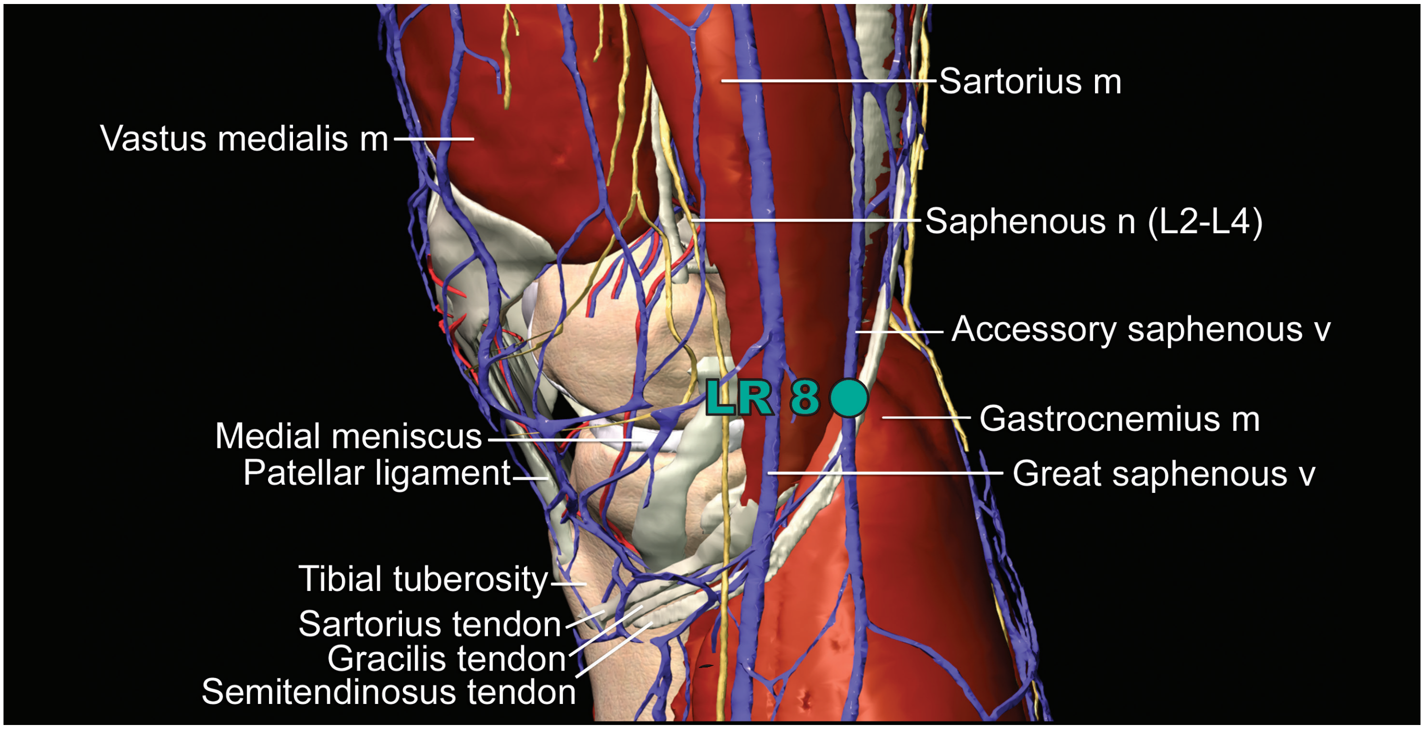


Figure 12-22. LR 8 lands along the myotendinous bundle destined to become the pes anserinus at SP 9. This structure contains a large number of mechanoreceptors that contribute to knee stability and position sense.

or otherwise stimulating the point LR 8, like SP 9, impacts three different myotendinous structures and their unique nerves.

John Hilton (1805-1878) was one of the first to note that patients with hip disease may also experience knee pain due to the common innervation of both joints.[6] He also lectured on his own "Hilton's Law", which states, "The same trunks of nerves, whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertions of the same muscles; and – what at this moment more especially merits our attention – the interior of the joint receives its nerves from the same source." Thus, the fact that the femoral, obturator, and tibial portion of the sciatic nerve all supply movers of the knee means, according to this law, that they each send branches to the overlying skin as well as the joint itself. This anatomical "law" highlights the relevance of SP 9 in treating disorders of the knee, including pain and proprioceptive abnormalities.

Venous structures of the pelvic limb may compress nerves, owing to their anatomical, vascular, and muscular relationships, especially in the standing position.[7] While microsurgery provides one course of action, acupuncture, laser therapy, and massage may aid patients suffering from saphenous nerve entrapment and obviate the need for surgery.

The saphenous nerve is subject to compression at a variety of sites along the medial pelvic limb; the nerve originates distal to the inguinal ligament, courses through the femoral triangle, and then accompanies the femoral vessels through the adductor canal.[8] The saphenous nerve then takes a more superficial course between the sartorius and gracilis muscles after penetrating the fascia lata. From here, the saphenous nerve travels on the medial aspect of the pelvic limb in the company of the great saphenous vein. An infrapatellar branch exits the adductor canal to supply the craniomedial knee. Here, the nerve supplies both the skin and the patellar ligament. The remainder of the saphenous nerve follows the great saphenous vein to the distal limb. Two branches form on the distal medial crus, becoming the medial and lateral crural cutaneous branches. The former communicates with cutaneous branches of the femoral nerve on the craniomedial crus. The lateral crural cutaneous branch descends between the anterior tibialis tendon and the medial malleolus, lateral to the great saphenous vein. This supplies sensation to the dorsal foot, medial malleolus, and skin of the first metatarsal head, abutting that supplied by the deep peroneal (fibular) nerve between LR 2 and LR 3.

The first locus of saphenous nerve entrapment occurs distal to the adductor canal where the saphenous nerve becomes superficial. Further down the limb, the infrapatellar branch may be injured or truncated during total knee replacement or other knee surgery that entails approaching the knee through a long incision that coincides with the nerve. Scar tissue may damage remaining branches. In other cases, compression or injury of the saphenous nerve causes acute and chronic medial knee pain. More distal compression of the saphenous nerve may refer pain proximad to the infrapatellar branch, leading to diagnostic and localizing ambiguity. Varicose vein surgery is a well-known culprit of saphenous nerve damage given how closely yet irregularly the nerve and great saphenous vein interrelate along their journeys. Removal of the great saphenous vein for use in coronary artery bypass surgery is perhaps the most common cause of saphenous nerve damage in the limb.

Saphenous neuropathy can cause knee pain.[9] Obesity, genu varum, and internal tibial torsion contribute to stress on the saphenous nerve. Symptoms of saphenous neuropathy include pain and paresthesia on the medial aspect of the knee. The differential diagnosis for saphenous nerve entrapment includes: medial meniscal tear, patellofemoral disorder, suprapatellar plica, pes tendinopathy, osteochondritis dessicans, nonspecific synovitis, and reflex sympathetic dystrophy.[10] Additional differentials include syndromes of the saphenous vein such as venous insufficiency and phlebitis; nerve root compression, arterial pathology, and knee or hip arthritis.[11]

Some patients complain of a "pulling" sensation during flexion and extension of the knee. Others remark that the area gives them an "unpleasant" sensation or a feeling of burning. On physical examination, the area over the infrapatellar branch of the saphenous nerve may have decreased sensation, dysesthesia, or hyperesthesia. Nonsurgical methods of treatment for saphenous nerve impingement pain and sensory disturbance should be tried prior to surgery. Acupuncture and related techniques designed to minimize nerve compression and entrapment from its origin at the femoral nerve and the femoral triangle to its destination, as well as to encourage restoration of normal function may aid in the conservative resolution of this disorder.

Vessels

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein.
- **Superior medial genicular artery:** The superior medial genicular artery participates in the formation of the genicular anastomosis – a network of vessels around the knee. It does so with the help of the other genicular arteries, including the lateral superior, medial inferior, and lateral inferior arteries and three additional contributors: the descending genicular branch of the femoral artery, the descending branch of the lateral femoral circumflex artery, and the anterior recurrent branch of the anterior tibial artery. Genicular branches of the popliteal artery also supply the knee joint capsule and the ligaments of the knee.
- **Medial superior veins of the knee:** One of several deep veins around the knee that drain into the popliteal vein.

Clinical Relevance: Articular structures such as the knee receive abundant blood supply by means of anastomotic networks. However, numerous surgical procedures and trauma put the vascular supply of the patella at risk. They may acutely alter flow through direct vascular insult (e.g., pseudoaneurysm) or, over the long term, drive sympathetic nerve stimulation, peripheral or central nervous system sensitization in chronic pain states. Acupuncture in this region may aid in restoring proper circulation by neuromodulating nervi vasorum and central nervous system pathways.

Similarly, blood flow compromise to the patellar tendon may put that structure at risk of developing patellar tendinopathy and, conceivably, rupture.[12]

Perhaps most importantly, the anterior cruciate ligament and supporting structures derives its blood supply from the genicular periarticular vascular plexus.[13] Soft tissues within the knee (i.e., the infrapatellar fat pad and synovium) mediate the blood supply to both cruciate ligaments. As such, negative impacts to these sites may impair nutrition to the cruciate ligaments and contribute to their degradation.

Varicose saphenous veins contain unmyelinated C fibers in the external portion of the media as well as the internal part of the adventitia.[14] Histiocytes and other inflammatory cells exist scattered within the media. These findings provide evidence for the existence of a neurologic medium through which nociceptive signals from the vein reach the spinal cord and brain. Mast cells and concomitant inflammatory cells may serve to activate C fibers in the vessel wall of the varicose vein. The presence of nerves and inflammatory cells suggests an avenue through which neuromodulation through acupuncture and related techniques may impart healing effects for a disturbed milieu.

Indications and Potential Point Combinations

- **Medial knee pain:** LR 8, SP 10, SP 9, KI 10.
- **Cruciate ligament injury:** LR 8, BL 40, GB 33, ST 34, ST 35, ST 36, SP 10, SP 9. Consider electrical stimulation across the joint.

Evidence-Based Applications

- Laser acupuncture significantly outperformed sham laser for the treatment of **mild to moderate depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[1]
- Laser acupuncture clinically statistically significantly reduced symptoms of **major depression** compared to placebo acupuncture. Points included LR 8, LR 14, KI 3, HT 7, and CV 14.[15] These same points increased brain activation in the frontal-limbic-striatal regions.[16]
- Electroacupuncture at 2 Hz reportedly **increased blood flow** in the spleen (but not the liver) and liver (but not the spleen) of rats when treating SP 9 and LR 8, respectively.[17]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV4, CV 6, and GV 4.[2]

References

1. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine.* 2005;23(3):103-111.
2. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
3. Grover RP and Rakhra KS. Pes anserine bursitis – an extra-articular manifestation of gout. *Bull NYU Hosp Jt Dis.* 2010;68(1):46-50.
4. Le Corroller T, Bouvier-Labit C, Sbihi A, et al. Mineralized fibroma of the tendon sheath presenting as a bursitis. *Skeletal Radiol.* 2008;37:1141-1145.
5. Helfenstein M and Kuromoto J. Anserine syndrome. *Rev Bras Reumatol.* 2010;50(3):313-327.
6. Brand RA. John Hilton, 1805-1878. *Clin Orthop Relat Res.* 2009;467:2208-2209.
7. Artico M, Stevanato G, Ionta B, et al. Venous compressions of the nerves in the lower limbs. *Br J Neurosurg.* 2012;26(3):386-391.
8. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
9. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain. *Hospital for Joint Disorders Bulletin.* 1993;52(2):31-33.
10. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back

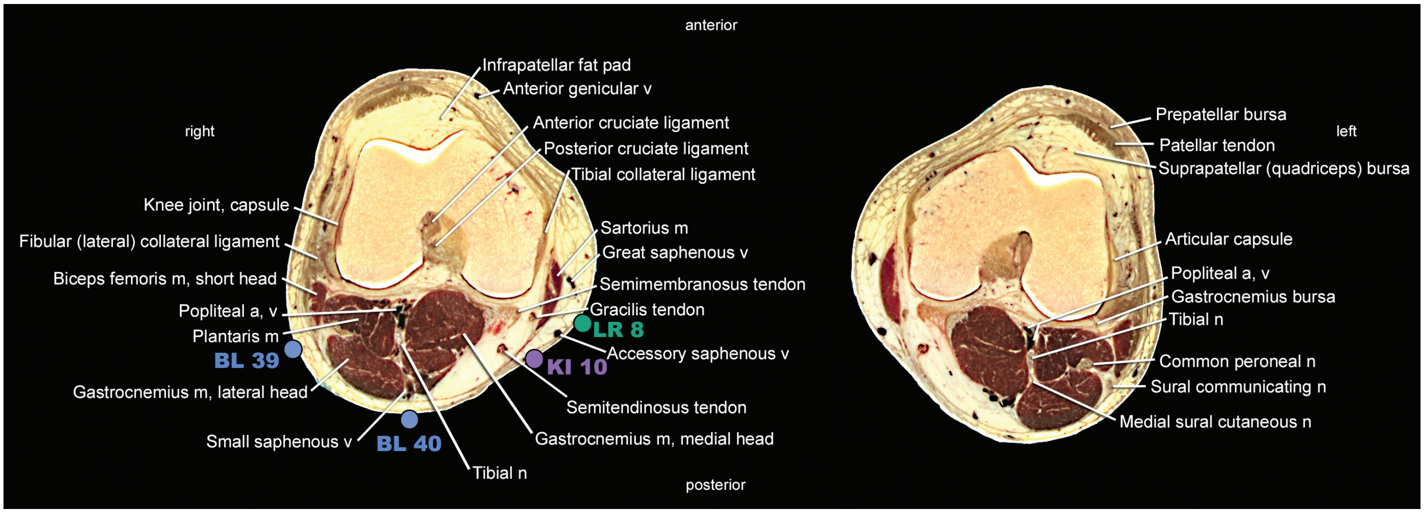

anterior
right
left
posterior
Infrapatellar fat pad
Anterior genicular v
Anterior cruciate ligament
Posterior cruciate ligament
Tibial collateral ligament
Knee joint, capsule
Fibular (lateral) collateral ligament
Biceps femoris m, short head
Popliteal a, v
Plantaris m
BL 39
Gastrocnemius m, lateral head
Small saphenous v
BL 40
Tibial n
Gastrocnemius m, medial head
Semitendinosus tendon
KI 10
Accessory saphenous v
LR 8
Gracilis tendon
Semimembranosus tendon
Great saphenous v
Sartorius m
Prepatellar bursa
Patellar tendon
Suprapatellar (quadriceps) bursa
Articular capsule
Popliteal a, v
Gastrocnemius bursa
Tibial n
Common peroneal n
Sural communicating n
Medial sural cutaneous n

Figure 12-23. This cross section illustrates several points along the popliteal crease, including LR 8, each impacting a different myotendinous element.

pain. *Journal of Brachial Plexus and Peripheral Nerve Injury*. 2010;5:2.

11. Nir-Paz R, Luder AS, Cozacov JC, et al. Saphenous nerve entrapment in adolescence. *Pediatrics*. 1999;103(1):161-163.
12. Pang J, Shen S, Pan WR, et al. The arterial supply of the patellar tendon: anatomical study with clinical implications for knee surgery. *Clinical Anatomy*. 2009;22:371-376.
13. Arnoczky SP. Blood supply to the anterior cruciate ligament and supporting structures. *Orthop Clin North Am*. 1985;16(1):15-28.
14. Vital A, Carles D, Serise J-M, et al. Evidence for unmyelinated C fibres and inflammatory cells in human varicose saphenous vein. *Int J Angiol*. 2010;19(2):e73-e77.
15. Quah-Smith I, Smith C, Crawford JD, et al. Laser acupuncture for depression: a randomized double blind controlled trial using low intensity laser intervention. *J Affect Disord*. 2013;148(2-3):179-187.
16. Quah-Smith I, Sachdev PS, Wen W, et al. The brain effects of laser acupuncture in healthy individuals: an fMRI investigation. *PLoS One*. 2010;5(9):e12619.
17. Chou WC, Liu HJ, Lin YW, et al. 2 Hz electro-acupuncture at yinlingquan (SP 9) and ququan (LR 8) acupoints induces changes in blood flow in the liver and spleen. *Am J Chin Med*. 2012;40(1):75-84.

LR 9

Yin Bao "Yin Wrapping", "Yin Wrappage", "Yin Bladder"

On the medial thigh, 4 cun proximal to the medial epicondyle of the femur and LR 8, in the cleft between the vastus medialis and sartorius muscles. (See Figure 12-24 for location.) (Alternate method: Starting at LR 8, slide a finger craniad across thebetween the vastus medialis and sartorius muscles to reach a tender spot within a depression.)

Connective Tissues

- **Vastoadductor membrane:** The vastoadductor membrane forms a subcompartment within the canal underlying the sartorius muscle, known as the "subsartorial canal".[1]

Clinical Relevance: This membrane connects the medial edge of the vastus medialis muscle to the lateral border of the adductor magnus muscle. In so doing it forms the roof of the adductor canal. (The adductor canal can be seen in cross section in Figure 12-25.)

Cutaneous branches of the saphenous and obturator nerves perforate the vastoadductor membrane. A number of vessels also course through this connective tissue, including communicating branches between the great saphenous and the deep venous system as well as muscular and cutaneous branches of the femoral artery.

Patients with spontaneous, nontraumatic, saphenous neuralgia secondary to saphenous nerve entrapment in the subsartorial canal present with medial knee and crus pain. These individuals report tenderness to palpation over the canal and sensory deficits along the saphenous nerve distribution.

Some have speculated that restless legs syndrome may result from entrapment of the saphenous nerve along its course, such as at adductor canal.

Increased stiffness and tension in the membrane may impair return of venous blood from the pelvic limb and worsen varicose veins.

Muscles and Tendons

- **Adductor magnus muscle:** Adducts the thigh. Comprises two parts – the adductor part and the hamstrings part. The adductor part flexes the thigh while the hamstrings part extends it.
- **Vastus medialis muscle:** Extends the leg at the knee joint. Extends the leg at the knee joint. Dubbed the "buckling knee muscle" by Travell and Simons, the vastus medialis harbors trigger points that not only cause pain but also inhibit muscle function, leading to unexpected failure of knee support.

Clinical Relevance: Trigger points in the adductor magnus and vastus medialis muscles refer pain along the LR and SP channels from LR 9 and SP 10 to the groin.

Nerves

- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the leg and foot.
- **Anterior femoral cutaneous nerve (from the femoral nerve, L2-L4):** Supplies the skin on the anterior and medial Aspects of

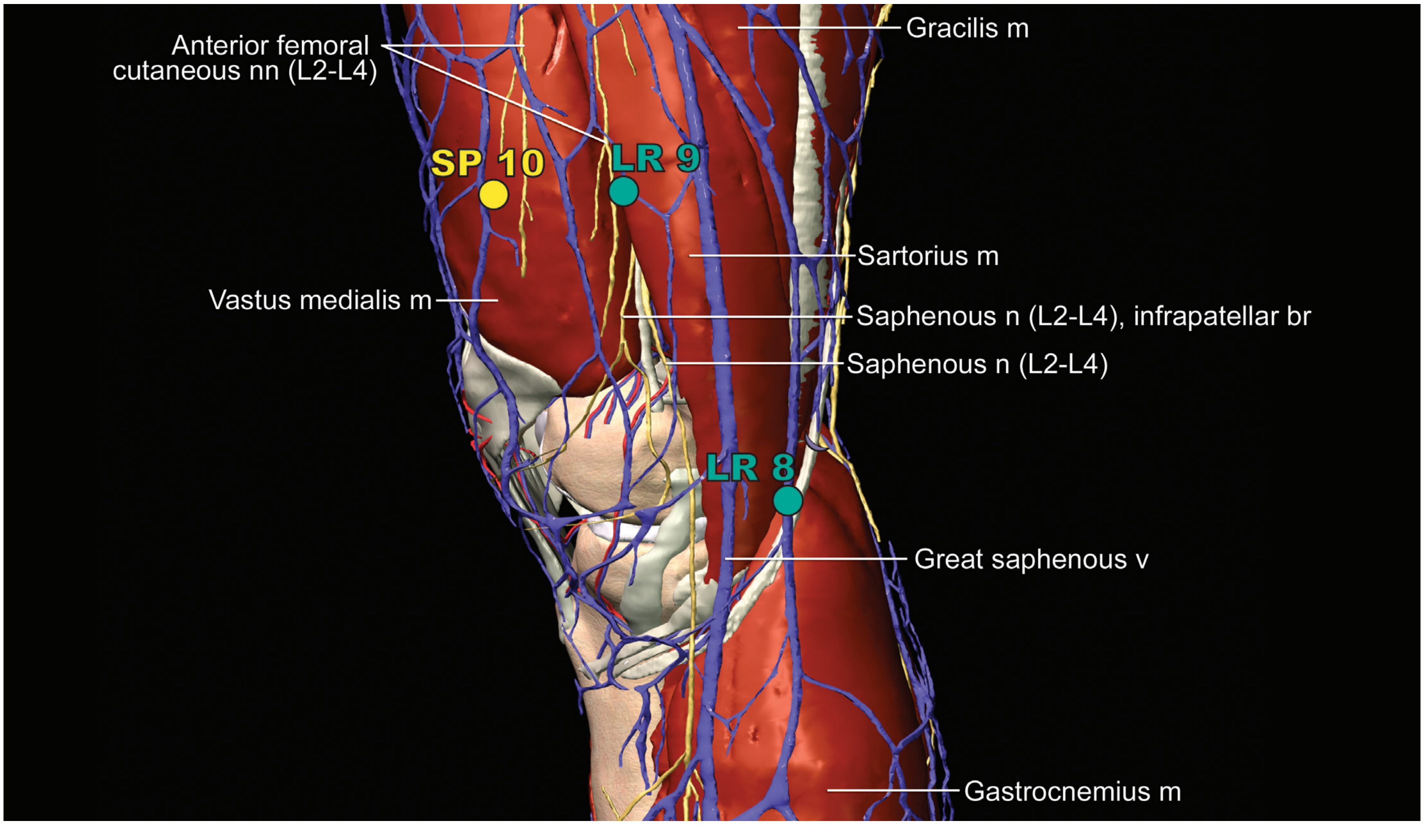


Figure 12-24. The sartorius adjacent to LR 9 resembles a fluid-filled bladder on the medial thigh that the ancient Chinese referred to as "Yin Bladder". The term "Yin Wrappage" connotes the way in which this muscle curves around the thigh on the medial ("Yin") surface.

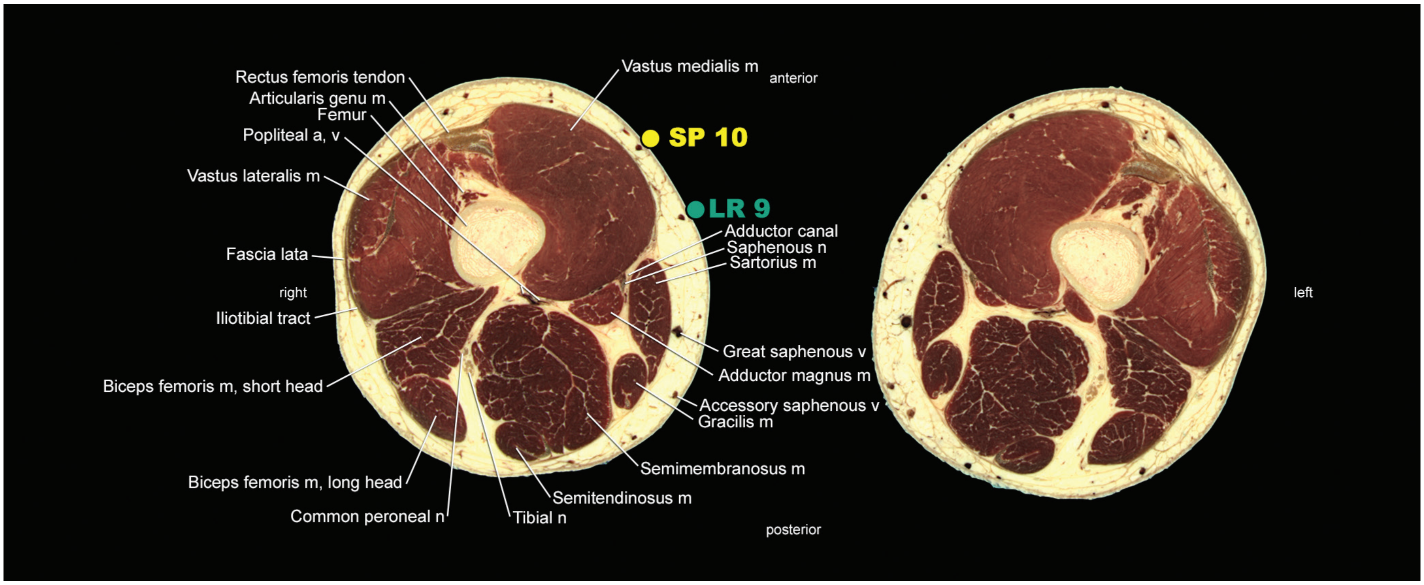

Rectus femoris tendon
Articularis genu m
Femur
Popliteal a, v
Vastus lateralis m
Fascia lata
right
Iliotibial tract
Biceps femoris m, short head
Biceps femoris m, long head
Common peroneal n
Tibial n
Semitendinosus m
Semimembranosus m
Vastus medialis m
anterior
SP 10
LR 9
Adductor canal
Saphenous n
Sartorius m
Great saphenous v
Adductor magnus m
Accessory saphenous v
Gracilis m
posterior
left

Figure 12-25. Although LR 9 and SP 10 sit side by side on the medial thigh, their clinical indications differ. Simply stated, the LR line on the thigh connects to adductor muscles while the SP channel courts the quadriceps group.

the thigh.

- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus and obturator externus muscles.
- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. Supplies the skin on the anteromedial thigh. Supplies the hip and knee joints and the anterior thigh muscles, including the sartorius muscle.

Clinical Relevance: Sites on the thigh where the saphenous nerve may become entrapped include 1) The adductor canal where the saphenous nerve splits from the femoral and courses independently along the fascial channel through the adductor canal, and 2). The locus where the nerve leaves the adductor canal to exit the fascial layer between the sartorius and gracilis muscles. Chronic irritation or compression may induce persistent, medial knee pain.[2] Palpating for myofascial restriction in the medial thigh should help localize the site of saphenous nerve compression or entrapment.

Vessels

- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.
- **Perforating veins:** Drain blood from the thigh muscles.
- **Deep vein of the thigh:** The perforating veins terminate in the deep vein of the thigh.
- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein.
- **Descending genicular artery, articular branch:** This artery arises from the femoral artery and gives rise to muscular and articular branches. It anastomoses with the superior and inferior medial genicular arteries. The descending genicular artery passes through the opening in the adductor magnus tendon to divide into saphenous and articular branches. The saphenous branch of the descending genicular artery follows the saphenous nerve along the medial aspect of the knee and the LR channel. Articular branches anastomoses with the medial superior genicular artery within the substance of the vastus medialis muscle, not far from SP 10.

Clinical Relevance: Applying acupuncture, laser therapy, or soft tissue manual therapy could aid circulation by alleviating fascial restriction and neurovascular compression.

Indications and Potential Point Combinations

- **Saphenous neuralgia or neuropathy, restless leg syndrome, altered or painful sensation along the medial thigh and leg (SP and LR channels):** Consider entrapment by the vastoadductor membrane; palpate for restrictions and tenderness along the medial thigh and needle accordingly, including LR 9.
- **Genitourinary conditions:** LR 9, SP 6, CV 4, BL 23, BL 28, BL 32.

References

1. Tubbs RS, Loukas M, Shoja MM, et al. Anatomy and potential significance of the vasto-adductor membrane. *Surg Radiol Anat*. 2007;29:569-573.
2. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain *Bull Hosp Jt Dis*. 1993;52(2):31-33.

LR 10

Zu Wu Li "Leg Five Miles", "Foot Five Li"

On the craniomedial thigh, on the lateral border of the adductor longus muscle, 2 cun from its attachment to the pubic symphysis, approximately 3 cun distal to ST 30. (See Figure 12-27 to examine the relationship between LR 10, ST 30, and the pubic symphysis.) The adductor longus tendon is often the most prominent tendon in the groin, and originates on the pubic bone. Ask the patient to adduct the thigh slightly to activate the tendon to better define its location.

Note: This point is located very close to the apex of the femoral triangle where the femoral artery exits the triangle to enter the adductor canal. (Review the anatomy of the femoral triangle in Figure 12-26.)

Connective Tissues

- **Adductor canal:** This conical or pyramidal canal contains the femoral vessels, the saphenous nerve, and a certain amount of connective tissue. Its distal extent, the narrowest point, borders the vastoadductor membraine, the sartorius muscle, the vastus medialis, and the adductor magnus and longus muscles.[1]

Clinical Relevance: Compression of the neurovascular contents in the adductor canal by tense muscles and/or facial restriction causes clinical symptoms of neuralgia and circulatory impairment. Patients with spontaneous, nontraumatic, saphenous neuralgia secondary to saphenous nerve entrapment in the adductor canal present with medial knee and crus pain. These individuals report tenderness to palpation over the canal and sensory deficits along the course of the nerve.

Restless legs syndrome may result from entrapment of the saphenous nerve along its course, such as at adductor canal.

Chronic groin pain has many etiologies due to the multiplicity of anatomical structures in this region that experience injury or disease. Muscle strain affecting the adductors or pectineus, tendonitis, bursitis, osteitis pubis, inguinal hernia, sustained stressful postures, inguinal ligament enthesopathy, and peripheral nerve entrapment (e.g., obturator or lateral femoral cutaneous nerves) constitute examples of disorders that produce chronic groin pain.[2]

Determining the course of the extrapelvic portion of the obturator nerve is challenging due to the variability of nerve, vessel, and fascia in the adductor regions. Figures 12-26 and 12-27 delineate the network of nerves, arteries and veins in the adductor corridor. They are difficult to follow even in a photo – imagine the complexity of trying to sort these out surgically!

Muscles

- **Adductor longus muscle:** Adducts the thigh.
- **Adductor brevis muscle:** Adducts the thigh. Also assists in thigh flexion.
- **Adductor magnus muscle:** Adducts the thigh. Comprises two parts – the adductor part and the hamstrings part. The adductor part flexes the thigh while the hamstrings part extends it.
- **Pectineus muscle:** Adducts the thigh. Flexes the thigh. Helps medially rotate the thigh.

Clinical Relevance: Trigger points in the adductor magnus refer pain along the medial thigh that describes the course of the LR pathway. Myofascial dysfunction in the adductor magnus and brevis send pain more predominantly down the ST and SP lines to the knee, then with just the SP channel to the ankle.

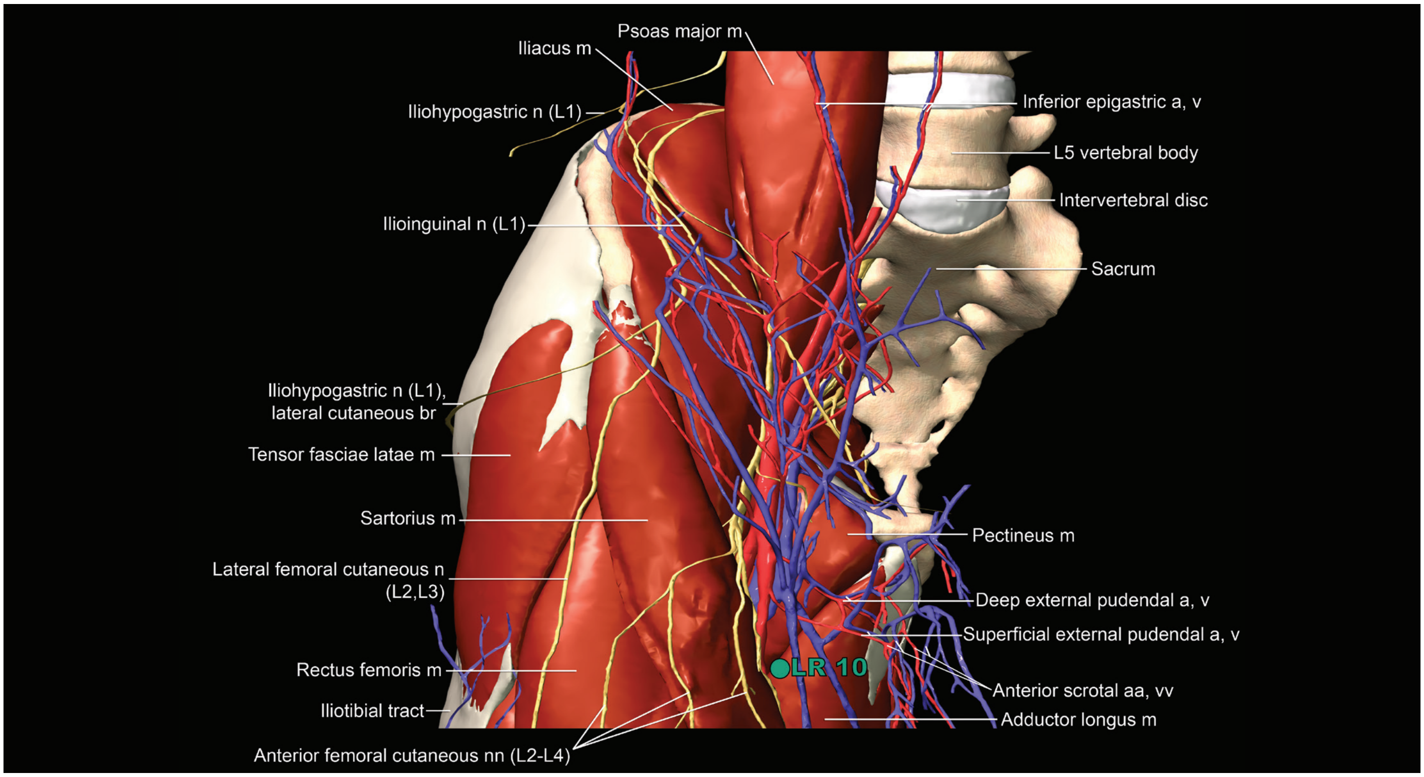

Psoas major m
Iliacus m
Iliohypogastric n (L1)
Inferior epigastric a, v
L5 vertebral body
Intervertebral disc
Ilioinguinal n (L1)
Sacrum
Iliohypogastric n (L1), lateral cutaneous br
Tensor fasciae latae m
Sartorius m
Pectineus m
Lateral femoral cutaneous n (L2,L3)
Deep external pudendal a, v
Superficial external pudendal a, v
LR 10
Rectus femoris m
Anterior scrotal aa, vv
Iliotibial tract
Adductor longus m
Anterior femoral cutaneous nn (L2-L4)

Figure 12-26. "Foot Five Li", with "Li" interpreted as the fifth position on the LR line, designates LR 10 as the fifth point from "Cycle Gate", LR 14.

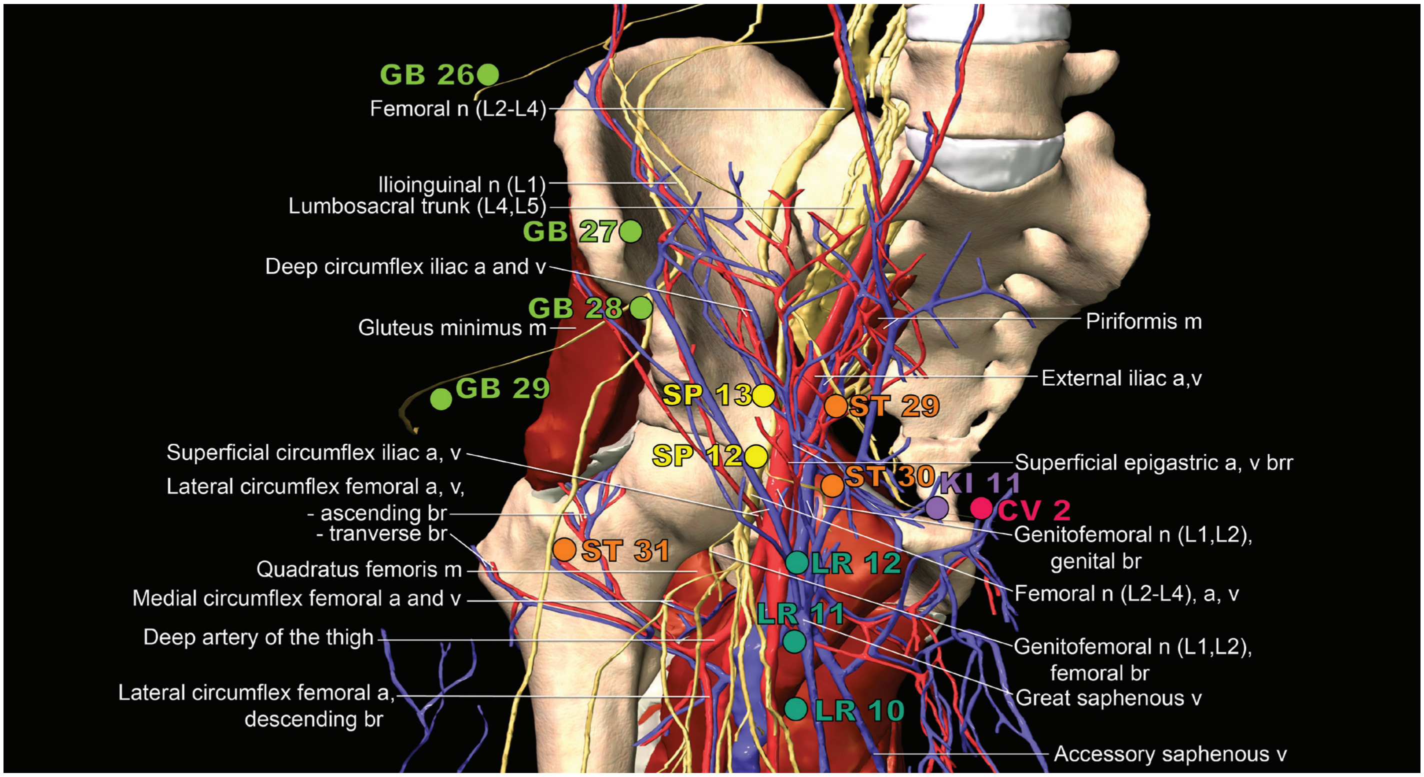

GB 26
Femoral n (L2-L4)
Ilioinguinal n (L1)
Lumbosacral trunk (L4,L5)
GB 27
Deep circumflex iliac a and v
GB 28
Gluteus minimus m
Piriformis m
External iliac a,v
GB 29
SP 13
ST 29
Superficial circumflex iliac a, v
SP 12
Superficial epigastric a, v brr
Lateral circumflex femoral a, v,
- ascending br
- tranverse br
ST 30
KI 11
CV 2
Genitofemoral n (L1,L2), genital br
ST 31
LR 12
Quadratus femoris m
Femoral n (L2-L4), a, v
Medial circumflex femoral a and v
LR 11
Deep artery of the thigh
Genitofemoral n (L1,L2), femoral br
Great saphenous v
Lateral circumflex femoral a, descending br
LR 10
Accessory saphenous v

Figure 12-27. This image of the deep muscles of the proximal pelvic limb exposes the complex neurovascular anatomy associated with LR 10, LR 11, and LR 12.

Travell and Simons call the pectineus muscle the "fourth adductor". Trigger point pathology produces pain in the local groin and proximal thigh region along the LR 10, LR 11, LR 12 corridor. Pain may refer to the lateral thigh into ST channel territory.

The posterior, or caudal, division of the obturator nerve in the proximal medial thigh both exits through the obturator externus muscle and supplies it as well. From there, the posterior branch courses cranial to the adductor magnus muscle, sending branches to that and its brevis counterpart. Terminal articular branches of the obturator nerve exit the adductor hiatus and enter the popliteal fossa whereupon they supply the articular capsule, cruciate ligaments, and synovial membrane of the knee joint. Pathology of the hip, such as slipped capital femoral epiphysis, may refer pain to the knee by dint of the innervation of both the hip and knee by the posterior division of the obturator nerve.

Nerves

- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus, adductor brevis, and obturator externus muscles.
- **Femoral nerve (L2-L4):** The femoral nerve arises from the lumbar plexus and is its largest branch. Supplies the skin on the anteromedial thigh. Supplies the hip and knee joints and the anterior thigh muscles, including the sartorius muscle.
- **Anterior femoral cutaneous nerve (L2-L4, from the femoral nerve):** Innervates the skin on the anteromedial thigh.
- **Genitofemoral nerve (L1, L2):** Divides into genital and femoral branches. The femoral branch supplies the skin overlying the femoral triangle. The genital branch supplies the labia majora in females and the scrotum in males.
- **Saphenous nerve (from the femoral nerve, L2-L4):** Innervates the skin on the medial aspects of the pelvic limb.

Clinical Relevance: Sites of compression for the anterior division of the obturator nerve occur between pectineus and obturator externus muscles as well as between the adductor longus and brevis. The obturator nerve travels medial to the femoral nerve within the pelvis. Near to where the obturator nerve exits the pelvis through the obturator foramen, it divides into anterior and posterior branches. The anterior branch courses cranial to the obturator externus muscle while the posterior branch courses through it. The anterior division supplies motor innervation to the adductor longus, adductor brevis, pectineus, and gracilis muscles. It also sends sensory supply to the hip joint and medial thigh. The posterior branch supplies the adductor brevis, the adductor magnus, and the obturator externus. It provides sensation to the knee joint as well. Causes of obturator neuropathy include pelvic and acetabular fractures, post-traumatic hematoma, pelvic tumors, obturator hernia, myositis ossificans, penetrating or surgical trauma, and nerve compression by fibrous brands secondary to chronic adductor tendinopathy with osteitis pubis, more common in athletes.

Traumatic contusion or laceration may cause a saphenous neuropathy within the adductor canal due to the nerve's superficial location. The nerve courses deep to the sartorius muscle in an oblique craniocaudal direction. The saphenous nerve is subject to compression at a variety of sites along the medial pelvic limb; the nerve originates distal to the inguinal ligament, courses through the femoral triangle, and then accompanies the femoral vessels through the adductor canal.[3] The saphenous nerve then takes a more superficial course between the sartorius and gracilis muscles after penetrating the fascia lata. From here, the saphenous nerve travels on the medial aspect of the pelvic limb in the company of the great saphenous vein. An infrapatellar branch exits the adductor canal to supply the craniomedial knee. Here, the nerve supplies both the skin and the patellar ligament. The remainder of the saphenous nerve follows the great saphenous vein to the distal limb. Two branches form on the distal medial crus, becoming the medial and lateral crural cutaneous branches. The former communicates with cutaneous branches of the femoral nerve on the craniomedial crus. The lateral crural cutaneous branch descends between the anterior tibialis tendon and the medial malleolus, lateral to the great saphenous vein. This supplies sensation to the dorsal foot, medial malleolus, and skin of the first metatarsal head, abutting that supplied by the deep peroneal (fibular) nerve between LR 2 and LR 3.

The first locus of saphenous nerve entrapment occurs distal to the adductor canal where the saphenous nerve becomes superficial. Further down the limb, the infrapatellar branch may be injured or truncated during total knee replacement or other knee surgery that entails approaching the knee through a long incision that coincides with the nerve. Scar tissue may damage remaining branches. In other cases, compression or injury of the saphenous nerve causes acute and chronic medial knee pain. More distal compression of the saphenous nerve may refer pain proximad to the infrapatellar branch, leading to diagnostic and localizing ambiguity. Varicose vein surgery is a well-known culprit of saphenous nerve damage given how closely yet irregularly the nerve and great saphenous vein interrelate along their journeys. Removal of the great saphenous vein for use in coronary artery bypass surgery is perhaps the most common cause of saphenous nerve damage in the limb.

Saphenous neuropathy can cause knee pain.[4] Obesity, genu varum, and internal tibial torsion contribute to stress on the saphenous nerve. Symptoms of saphenous neuropathy include pain and paresthesia on the medial aspect of the knee. The differential diagnosis for saphenous nerve entrapment includes: medial meniscal tear, patellofemoral disorder, suprapatellar plica, pes tendinopathy, osteochondritis dessicans, nonspecific synovitis, and reflex sympathetic dystrophy.[5] Additional differentials include syndromes of the saphenous vein such as venous insufficiency and phlebitis; nerve root compression, arterial pathology, and knee or hip arthritis.[6]

Some patients complain of a "pulling" sensation during flexion and extension of the knee from saphenous neuropathy. Others remark that the area gives them an "unpleasant" sensation or a feeling of burning. On physical examination, the area over the infrapatellar branch of the saphenous nerve may have decreased sensation, dysesthesia, or hyperesthesia. Nonsurgical methods of treatment for saphenous nerve impingement pain and sensory disturbance should be tried prior to surgery. Acupuncture and related techniques designed to minimize nerve compression and entrapment from its origin at the femoral nerve and the femoral triangle to its destination, as well as to encourage restoration of normal function may aid in the conservative resolution of this disorder.

Iatrogenic procedures in the groin, along with blunt or penetrating trauma, may damage the genitofemoral and ilioinguinal nerves, producing persistent pain and paresthesias in the inguinal region.[7] Hyperextension of the hip and physical activity typically worsen the pain from genitofemoral neuropathy, which may extend to the genitalia and proximomedial thigh over LR 10, LR 11, and LR 12.

Vessels

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein.
- **Medial circumflex femoral artery:** Supplies the majority of blood to the femoral head and neck.
- **Medial circumflex femoral vein:** Accompanies the medial circumflex femoral artery and terminates in either the femoral or deep femoral vein.
- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.

Clinical Relevance: Obturator neuropathy, i.e., focal obturator nerve entrapment, can be caused by both fascial and vascular compression.

In some individuals, the medial circumflex femoral artery and vein cross the caudal (or posterior) division of the obturator nerve as the latter descends within a fascial plane superficial to the obturator externus and proximal portion of the adductor magnus muscle.[8] Arterial anastomoses between the muscular branches of the medial circumflex artery and the anterior branch of the obturator happen here – vascular abnormalities could cause obturator nerve compression. The presence of vessels overlying the nerve as well as its "low visibility" in imaging studies creates difficulties for clinicians attempting obturator nerve blocks.

Fascial expansions such as perivascular condensations around vessels supplying the adductor musculature produce a definitive layer of connective tissue that may entrap the anterior division of the obturator nerve.[9] The vascular pedicle from the medial circumflex femoral artery that leads to the pectineus, adductor longus, and adductor brevis surrounds the obturator nerve as it courses toward the apex of the brevis, thereby diminishing space further for the nerve.

The femoral artery and vein enter the adductor canal close to LR 10, at the apex of the femoral triangle. The femoral triangle, bounded superiorly by the inguinal ligament, medially by the adductor longus, and laterally by the sartorius, rests upon a floor formed by the iliopsoas muscle and pectineus. The roof of this triangle is built by the fascia lata and cribriform fascia, along with subcutaneous tissue and skin. From lateral to medial, the contents of the femoral triangle include the femoral nerve and branches, the femoral sheath and contents, the femoral artery and branches, and the femoral vein and tributaries (e.g., the great saphenous and deep femoral veins). As such, LR 10 serves as an entryway to a high traffic zone replete with vessels and nerves of major importance.

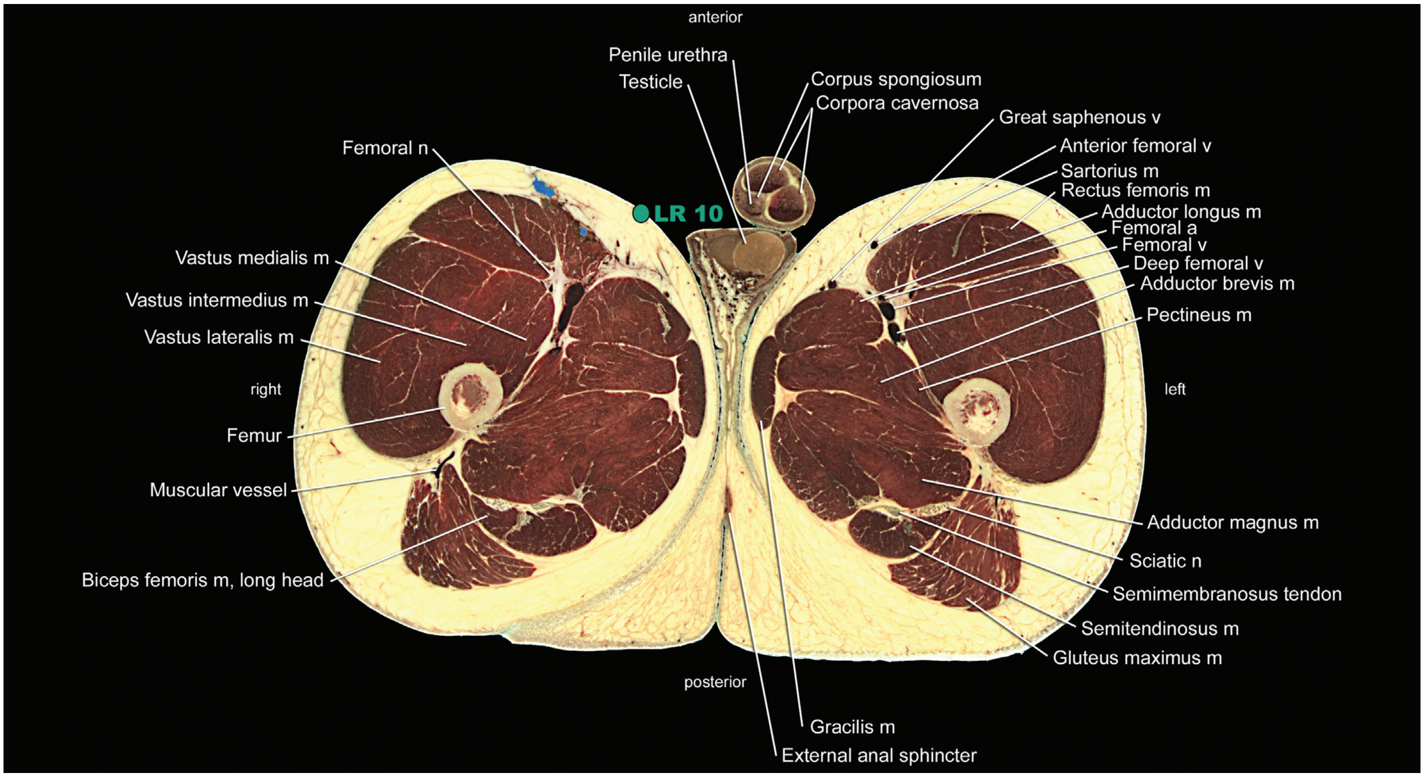

anterior
Penile urethra
Testicle
Corpus spongiosum
Corpora cavernosa
Femoral n
Great saphenous v
Anterior femoral v
Sartorius m
Rectus femoris m
LR 10
Adductor longus m
Femoral a
Femoral v
Vastus medialis m
Deep femoral v
Adductor brevis m
Vastus intermedius m
Pectineus m
Vastus lateralis m
right
left
Femur
Muscular vessel
Adductor magnus m
Sciatic n
Biceps femoris m, long head
Semimembranosus tendon
Semitendinosus m
Gluteus maximus m
posterior
Gracilis m
External anal sphincter

Figure 12-28. A needle injudiciously inserted deeply into LR 10 could readily injure major vessels within the adductor canal. This, could cause adductor canal outlet syndrome, a condition in which mechanical trauma of the femoral artery tears the intimal layer, forming a localized thrombosis.[11]

Indications and Potential Point Combinations

- **Groin pain:** LR 10, ST 32; palpate the pectineus muscle for trigger points.
- **Knee pain and/or hip pain referred from the adductor longus and brevis muscles:** LR 10, GB 29, ST 31, ST 34, SP 10.

Evidence-Based Application

- Electroacupuncture at LR 10, LR 11, ST 31, and GB 29 more effectively alleviated pain from **hip osteoarthritis** and benefited joint function over diclofenac sodium.[10]

References

1. De Oliveira F, de Vasconcellos Fontes RB, da Silva Baptista J, et al. The connective tissue of the adductor canal – a morphological study in fetal and adult specimens. J Anat. 2009;214:388-395.
2. Kumka M. Critical sites of entrapment of the posterior division of the obturator nerve: anatomical considerations. *JCCA.* 2010;54(1):33-42.
3. Flanigan RM and DiGiovanni BF. Peripheral nerve entrapments of the lower leg, ankle, and foot. *Foot Ankle Clin N Am.* 2011;16:255-274.
4. Lippitt AB. Neuropathy of the saphenous nerve as a cause of knee pain. *Hospital for Joint Disorders Bulletin.* 1993;52(2):31-33.
5. Ahadi T, Raissi GR, Togha M, et al. Saphenous neuropathy in a patient with low back pain. *Journal of Brachial Plexus and Peripheral Nerve Injury.* 2010;5:2.
6. Nir-Paz R, Luder AS, Cozacov JC, et al. Saphenous nerve entrapment in adolescence. *Pediatrics.* 1999;103(1):161-163.
7. Benito-Leon J, Picardo A, Garrido A, et al. Gabapentin therapy for genitofemoral and ilioinguinal neuralgia. *J Neurol.* 2001;248(10):907-908.
8. Kumka M. Critical sites of entrapment of the posterior division of the obturator nerve: anatomical considerations. *JCCA.* 2010;54(1):33-42.
9. Harvey G and Bell S. Obturator neuropathy. *Clinical Orthopaedics and Related Research.* 1999;363;203-211.
10. Sheng XP and Fan TY. Comparative observation on hip osteoarthritis treated with electroacupuncture and medication. *Zhongguo Zhen Jiu.* 2010;30(12):982-984.
11. Balaji MR and DeWeese JA. Adductor canal outlet syndrome. *JAMA.* 1981;245(2):167-170.

LR 11

Yin Lian "Yin Corner"

On the craniomedial thigh on the lateral margin of the adductor longus muscle or tendon, 1 cun from its attachment near the pubic symphysis, approximately 2 cun distal to ST 30. The adductor longus tendon is often the most prominent tendon in the groin, and originates on the pubic bone.

Muscles

- **Adductor longus muscle:** Adducts the thigh.
- **Adductor brevis muscle:** Adducts the thigh. Also assists in thigh flexion.
- **Pectineus muscle:** Adducts the thigh. Flexes the thigh. Helps medially rotate the thigh.

Clinical Relevance: Trigger points in the adductor magnus refer pain along the medial thigh that describes the course of the LR pathway. Myofascial dysfunction in the adductor magnus and brevis send pain more predominantly down the ST and SP lines to the knee, then with just the SP channel to the ankle.

Travell and Simons call the pectineus muscle the "fourth adductor". Trigger point pathology produces pain in the local groin and proximal thigh region along the LR 10, LR 11, LR 12 corridor. Pain may refer to the lateral thigh into ST channel territory. Patients may complain of hip pain but indicate the region immediately distal to the inguinal ligament; i.e., the pectineus muscle. The deep-seated groin pain caused by pectineus trigger points worsens with weight bearing and activities that require thigh abduction. This myofascial pathology often accompanies trigger points in the iliopsoas and the adductors.

The posterior, or caudal, division of the obturator nerve in the proximal medial thigh both exits through the obturator externus muscle and supplies it as well. From there, the posterior branch courses cranial to the adductor magnus muscle, sending branches to that and its brevis counterpart. Terminal articular branches of the obturator nerve exit the adductor hiatus and enter the popliteal fossa whereupon they supply the articular capsule, cruciate ligaments, and synovial membrane of the knee joint. Pathology of the hip, such as slipped capital femoral epiphysis, may refer pain to the knee by dint of the innervation of both the hip and knee by the posterior division of the obturator nerve.

Nerves

- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus and obturator externus muscles.
- **Genitofemoral nerve (L1, L2):** Divides into genital and femoral branches. The femoral branch supplies the skin overlying the femoral triangle. The genital branch supplies the labia majora in females and the scrotum in males.

Clinical Relevance: Sites of compression for the anterior division of the obturator nerve occur between pectineus and obturator externus muscles as well as between the adductor longus and brevis. The obturator nerve travels medial to the femoral nerve within the pelvis. Near to where the obturator nerve exits the pelvis through the obturator foramen, it divides into anterior and posterior branches. The anterior branch courses cranial to the obturator externus muscle while the posterior branch courses through it. The anterior division supplies motor innervation to the adductor longus, adductor brevis, pectineus, and

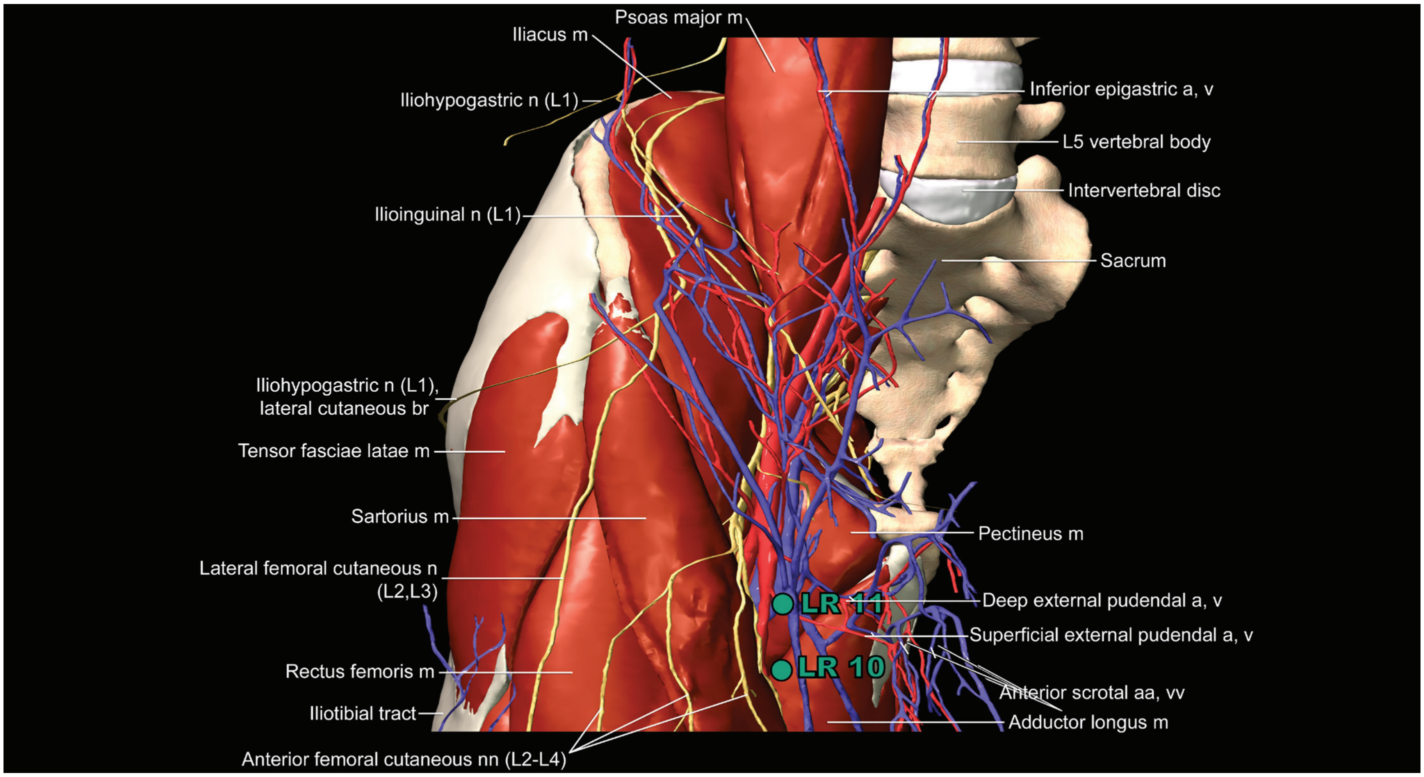

Psoas major m
Iliacus m
Iliohypogastric n (L1)
Inferior epigastric a, v
L5 vertebral body
Intervertebral disc
Ilioinguinal n (L1)
Sacrum
Iliohypogastric n (L1), lateral cutaneous br
Tensor fasciae latae m
Sartorius m
Pectineus m
Lateral femoral cutaneous n (L2,L3)
LR 11
Deep external pudendal a, v
Superficial external pudendal a, v
LR 10
Rectus femoris m
Anterior scrotal aa, vv
Iliotibial tract
Adductor longus m
Anterior femoral cutaneous nn (L2-L4)

Figure 12-29. Myofascial trigger points in the pectineus muscle at or near LR 11 produce groin pain that patients describe as a deep ache.

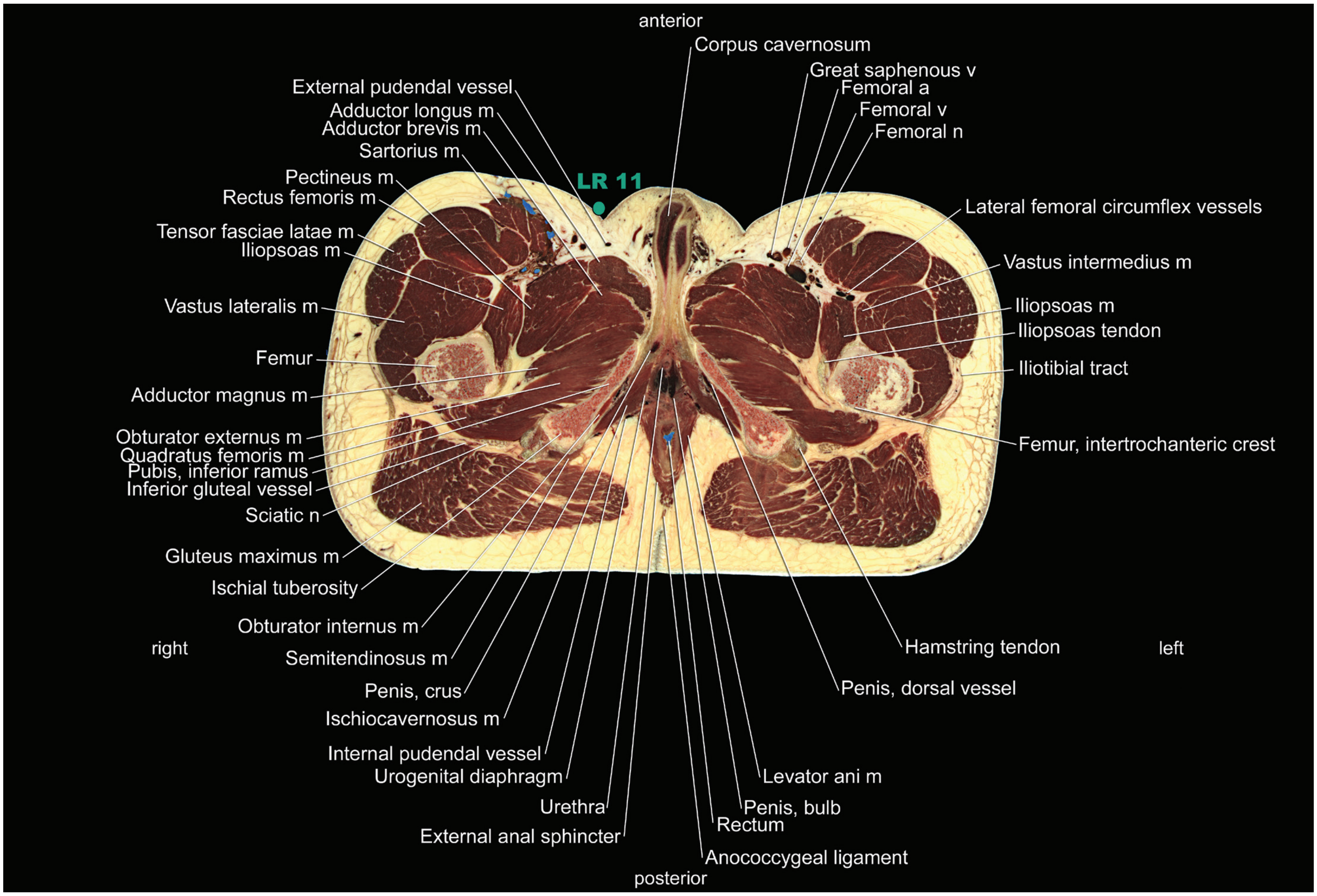

anterior
Corpus cavernosum
Great saphenous v
Femoral a
Femoral v
Femoral n
External pudendal vessel
Adductor longus m
Adductor brevis m
Sartorius m
LR 11
Pectineus m
Rectus femoris m
Lateral femoral circumflex vessels
Tensor fasciae latae m
Iliopsoas m
Vastus intermedius m
Vastus lateralis m
Iliopsoas m
Iliopsoas tendon
Femur
Iliotibial tract
Adductor magnus m
Obturator externus m
Quadratus femoris m
Pubis, inferior ramus
Inferior gluteal vessel
Femur, intertrochanteric crest
Sciatic n
Gluteus maximus m
Ischial tuberosity
Obturator internus m
right
Semitendinosus m
Hamstring tendon
left
Penis, crus
Penis, dorsal vessel
Ischiocavernosus m
Internal pudendal vessel
Urogenital diaphragm
Levator ani m
Urethra
Penis, bulb
Rectum
External anal sphincter
Anococcygeal ligament
posterior

Figure 12-30. Reaching the pectineus through the femoral triangle requires careful localization and avoidance of the triangle's neurovascular contents. LR 11 nestles in the "Yin Corner", at the medial thigh where the leg meets the groin.

gracilis muscles. It also sends sensory supply to the hip joint and medial thigh. The posterior branch supplies the adductor brevis, the adductor magnus, and the obturator externus. It provides sensation to the knee joint as well. Causes of obturator neuropathy include pelvic and acetabular fractures, post-traumatic hematoma, pelvic tumors, obturator hernia, myositis ossificans, penetrating or surgical trauma, and nerve compression by fibrous brands secondary to chronic adductor tendinopathy with osteitis pubis, more common in athletes.

Iatrogenic procedures in the groin, along with blunt or penetrating trauma, may damage the genitofemoral and ilioinguinal nerves, producing persistent pain and paresthesias in the inguinal region.[1] Hyperextension of the hip and physical activity typically worsen the pain from genitofemoral neuropathy, which may extend to the genitalia and proximomedial thigh over LR 10, LR 11, and LR 12.

Vessels

- **Great saphenous vein:** This superficial, large vein courses along the medial aspect of the leg and thigh, begins as the union of the dorsal vein of the great toe and the pedal dorsal venous arch, and anastomoses with the small saphenous vein and empties into the femoral vein.
- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.
- **Medial circumflex femoral artery:** Supplies the majority of blood to the femoral head and neck.
- **Medial circumflex femoral vein:** Accompanies the medial circumflex femoral artery and terminates in either the femoral or deep femoral vein.

Clinical Relevance: Obturator neuropathy, i.e., focal obturator nerve entrapment, can be caused by both fascial and vascular compression.

In some individuals, the medial circumflex femoral artery and vein cross the caudal (or posterior) division of the obturator nerve as the latter descends within a fascial plane superficial to the obturator externus and proximal portion of the adductor magnus muscle.[2] Arterial anastomoses between the muscular branches of the medial circumflex artery and the anterior branch of the obturator happen here – vascular abnormalities could cause obturator nerve compression. The presence of vessels overlying the nerve as well as its "low visibility" in imaging studies creates difficulties for clinicians attempting obturator nerve blocks.

Fascial expansions such as perivascular condensations around vessels supplying the adductor musculature produce a definitive layer of connective tissue that may entrap the anterior division of the obturator nerve.[3] The vascular pedicle from the medial circumflex femoral artery that leads to the pectineus, adductor longus, and adductor brevis surrounds the obturator nerve as it courses toward the apex of the brevis, thereby diminishing space further for the nerve.

The femoral artery and vein enter the adductor canal close to LR 10, at the apex of the femoral triangle. The femoral triangle, bounded superiorly by the inguinal ligament (not shown here), medially by the adductor longus, and laterally by the sartorius, rests upon a floor formed by the iliopsoas muscle and pectineus. The roof of this triangle is built by the fascia lata and cribriform fascia, along with subcutaneous tissue and skin. From lateral to medial, the contents of the femoral triangle include the femoral nerve and branches, the femoral sheath and contents, the femoral artery and branches, and the femoral vein and tributaries (e.g., the great saphenous and deep femoral veins). As such, LR 10 and LR 11 serve as entryways to a high traffic zone replete with vessels and nerves of major importance.

Indications and Potential Point Combinations

- **Thigh or groin pain related to pectineus trigger points:** LR 11; consider adding GB 26, GB 27, and GB 28 for concomitant iliopsoas restriction and local trigger points in the adductors to address their contribution to perceived hip or groin pain distal to the inguinal ligament.
- **Vulvodynia, scrotal pain:** LR 11, SP 12, ST 30, CV 2, GV 3, BL 23.

Evidence-Based Application

- Electroacupuncture at LR 10, LR 11, ST 31, and GB 29 more effectively alleviated pain from **hip osteoarthritis** and benefited joint function over diclofenac sodium.[4]

References

1. Benito-Leon J, Picardo A, Garrido A, et al. Gabapentin therapy for genitofemoral and ilioinguinal neuralgia. *J Neurol.* 2001;248(10):907-908.

2. Kumka M. Critical sites of entrapment of the posterior division of the obturator nerve: anatomical considerations. *JCCA.* 2010;54(1):33-42.

3. Harvey G and Bell S. Obturator neuropathy. *Clinical Orthopaedics and Related Research.* 1999;363;203-211.

4. Sheng XP and Fan TY. Comparative observation on hip osteoarthritis treated with electroacupuncture and medication. *Zhongguo Zhen Jiu.* 2010;30(12):982-984.

LR 12

Ji Mai "Urgent Pulse"

On the base of the femoral triangle, distal to the inguinal Ligament and medial to the pulsation of the femoral artery.

Approximately 1 cun distal to and 2.5 cun lateral to the midline and CV 2.

Although some sources have described an alternate location for LR 12 cranial to the inguinal ligament and lateral to ST 30, treating that site would target different muscles, nerves, and vessels, thereby changing its clinical relevance and expected physiologic outcomes.

Note in Figure 12-33 the presence of the spermatic cord and large vessels within reach of a needling entering LR 12. Needle with caution in this region.

Muscles

- **Pectineus muscle:** Adducts the thigh. Flexes the thigh. Assists in rotating the thigh mediad.
- **Obturator externus muscle:** Adducts the thigh. Rotates the thigh laterad.
- **Obturator internus muscle:** Adducts the thigh when the hip flexes. Rotates the thigh laterad.

Clinical Relevance: Based on the cross section shown in Firgure 12-33, the pectineus muscle is the straight-on myofascial target of LR 12. Travell and Simons call the pectineus muscle the "fourth adductor". Trigger point pathology in the pectineus produces pain in the local groin and proximal thigh region along the LR 10, LR 11, LR 12 corridor. Pain may refer to the lateral thigh; i.e., ST channel territory. Patients may complain of hip pain but indicate the region immediately distal to the inguinal ligament; i.e., the pectineus muscle. The deep-seated groin pain caused by pectineus trigger points worsens with weight bearing and activities that require thigh abduction. This myofascial pathology often accompanies trigger points in the iliopsoas and the adductors.

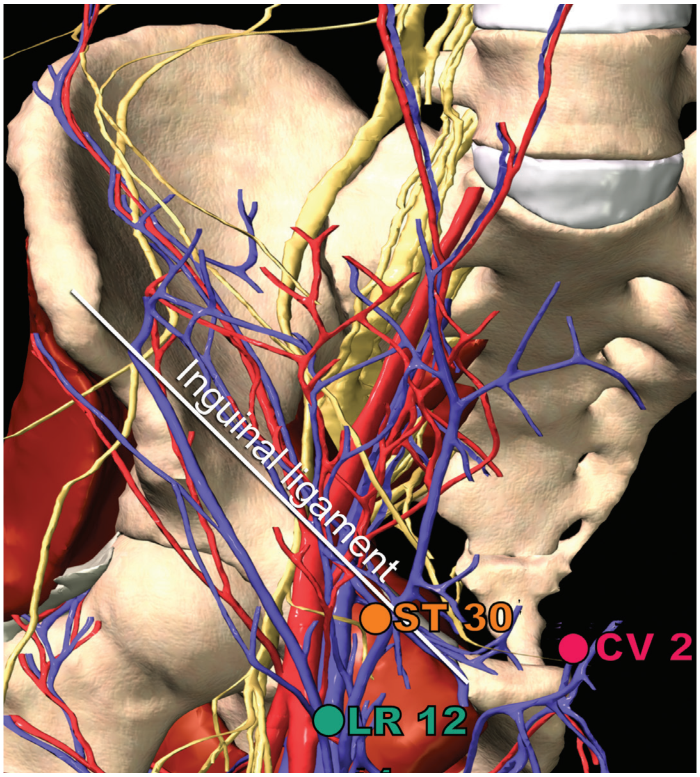


Figure 12-31. The "Urgent Pulse", i.e., the sensation appreciated when palpating the femoral artery, illustrates the ancient association between blood vessels and acupuncture channels. As seen in this image, LR 12 sits immediately adjacent to the femoral artery, between the "urgent pulse" and the femoral vein.

The posterior, or caudal, division of the obturator nerve in the proximal medial thigh both exits through the obturator externus muscle and supplies it as well. From there, the posterior branch courses cranial to the adductor magnus muscle, sending branches to that and its brevis counterpart. Terminal articular branches of the obturator nerve exit the adductor hiatus and enter the popliteal fossa whereupon they supply the articular capsule, cruciate ligaments, and synovial membrane of the knee joint. Pathology affecting the hip, such as slipped capital femoral epiphysis, may refer pain to the knee by dint of the innervation of both the hip and knee by the posterior division of the obturator nerve.

A trigger point in the obturator externus muscle can cause right lower abdominal wall pain near the inguinal ligament. Pain may radiate to the groin and proximal medial thigh. A burning sensation may accompany the pain. Discomfort can worsen when the patient drives or crosses the pelvic limbs.

The obturator internus muscle, along with its compatriots that create the pelvic diaphragm (i.e., bulbospongiosus, ischiocavernosus, transversus perinei, sphincter ani, levator ani, and the coccygeus) produce what Travell and Simons call a "pain in the rear". That is, they refer pain to the intergluteal cleft and perianal area. Trigger point pathology in the obturator internus may refer pain along the caudal thigh overlying sciatic nerve terrain.

While both obturator muscles fall in line with LR 12, treatment of their trigger points may be more safely instituted with manual trigger point release and stretching of the trunk, hip, and pelvic myofascial elements, rather than the extremely deep needling that it would require at LR 12, jeopardizing safety.

Nerves

- **Obturator nerve (L2-L4):** The obturator nerve branches into anterior and posterior branches. The anterior branch supplies adductor muscles, including the adductor longus and brevis muscles, the gracilis, and the pectineus muscles. The posterior branch supplies the adductor magnus and obturator externus muscles.
- **Genitofemoral nerve (L1, L2):** Divides into genital and femoral branches. The femoral branch supplies the skin overlying the femoral triangle. The genital branch supplies the labia majora in females and the scrotum in males.
- **Ilioinguinal nerve (L1, occasionally with T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with

the genitofemoral nerve (L1,L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females.

Clinical Relevance: Neural compression by space-occupying lesions, enlarged vessels, or overgrown connective tissue in the inguinal region can cause pain or tingling in the groin. External compression by tight clothing can produce similar symptoms. For example, restrictive garments compressing the genitofemoral nerve against the inguinal ligament entraps the nerve, leading to pain and/or numbness on the anterior thigh immediately below the midsection of the ligament.

Obturator hernia, a rare type of abdominal hernia also known as "little old lady's hernia", entraps the obturator nerve with pain and/or tingling and/or paresthesias along the medial thigh, down to the knee. Alternately, the patient with obturator hernia may present with vague symptoms suggestive of bowel obstruction, as when a loop of small intestine becomes lodged within the obturator canal. Patients with this condition may report a dull, cramping abdominal pain accompanied by nausea, and vomiting.[2]

Sites of compression for the anterior division of the obturator nerve occur between pectineus and obturator externus muscles as well as between the adductor longus and brevis. The obturator nerve travels medial to the femoral nerve within the pelvis. Near to where the obturator nerve exits the pelvis through the obturator foramen, it divides into anterior and posterior branches. The anterior branch courses cranial to the obturator externus muscle while the posterior branch courses through it. The anterior division supplies motor innervation to the adductor longus, adductor brevis, pectineus, and gracilis muscles. It also sends sensory supply to the hip joint and medial thigh. The posterior branch supplies the adductor brevis, the adductor magnus, and the obturator externus. It provides sensation to the knee joint as well. Causes of obturator neuropathy include pelvic and acetabular fractures, post-traumatic hematoma, pelvic tumors, obturator hernia, myositis ossificans, penetrating or surgical trauma, and nerve compression by fibrous brands secondary to chronic adductor tendinopathy with osteitis pubis, more common in athletes.

Iatrogenic procedures in the groin, along with blunt or penetrating trauma, may damage the genitofemoral and ilioinguinal nerves, producing persistent pain and paresthesias in the inguinal region.[3] Hyperextension of the hip and physical activity typically worsen the pain from genitofemoral neuropathy, which may extend to the genitalia and proximomedial thigh over LR 10, LR 11, and LR 12.

Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[4] Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery may respond to neuromodulation.

The variability in spinal nerve origin for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy. Conversely, issues related to pain or dysfunction of somatic or visceral tissues served by the T12-L2 spinal segments may benefit from neuromodulation applied to ST 29, KI 12, and CV 3.

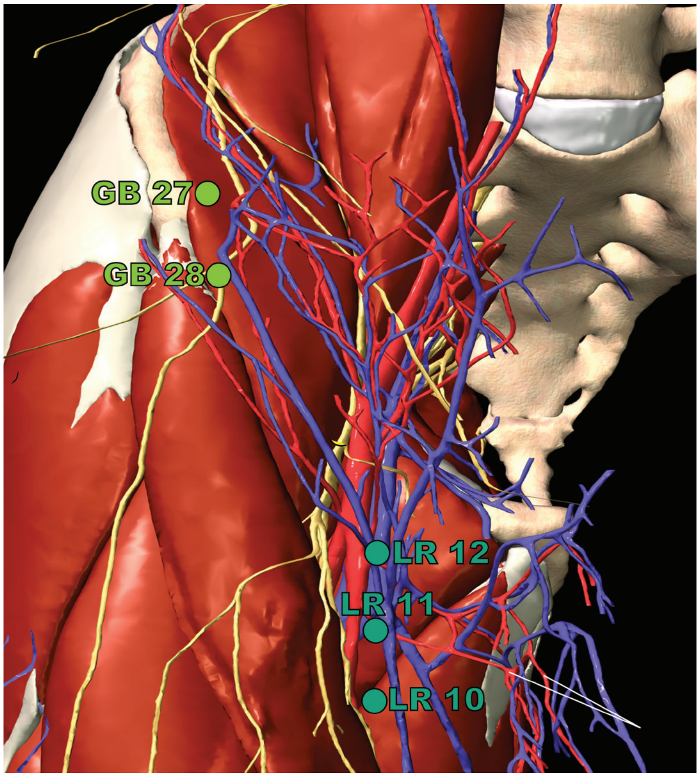


Figure 12-32. This view of the groin-region LR points illustrates the ways in which treatment at each point, i.e., LR 10, LR 11, and LR 12, might impact the pectineus muscle.

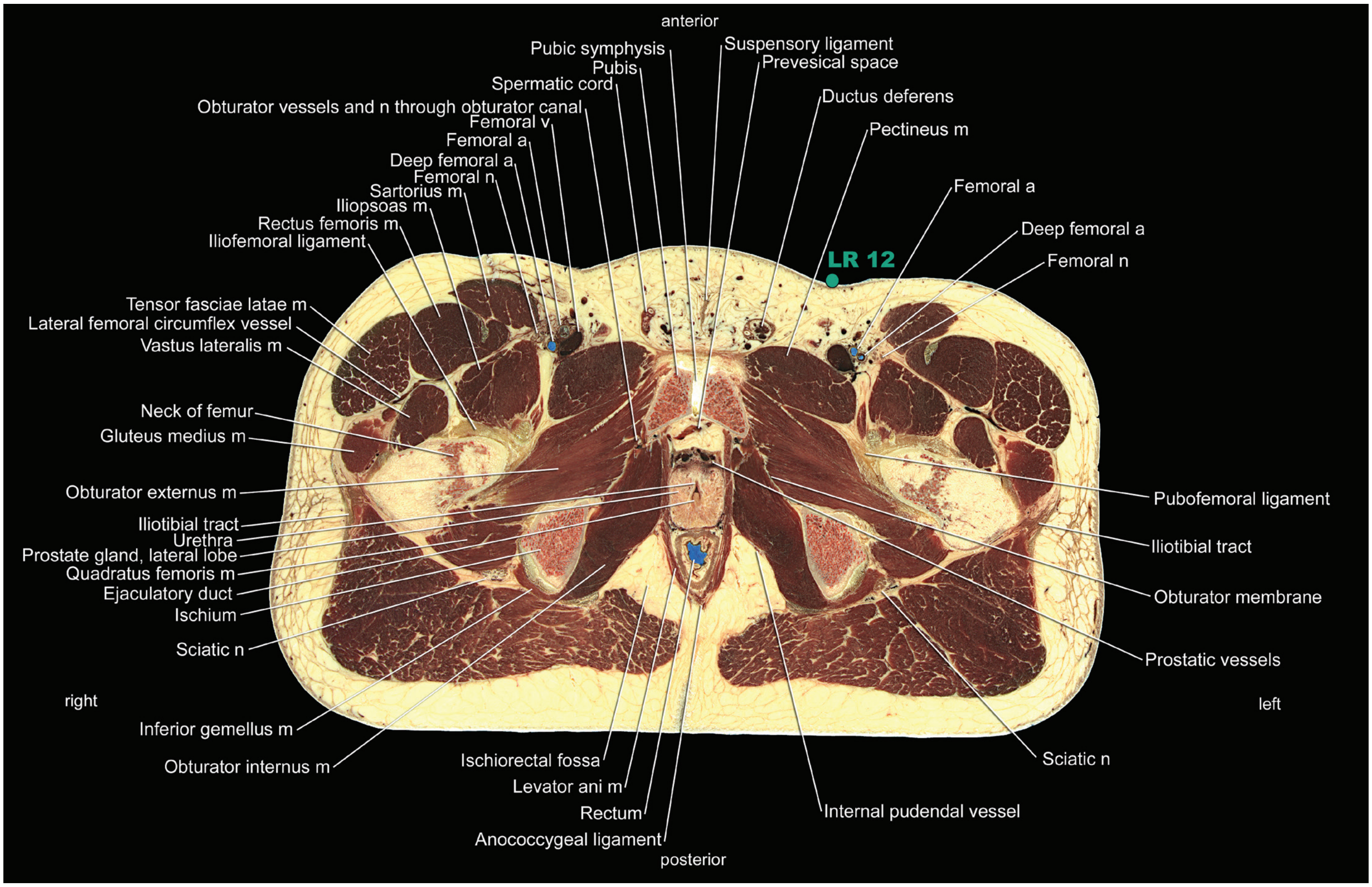
Vessels

- **Femoral artery:** Supplies the anteromedial surface of the thigh as well as the anterior surface.
- **Femoral vein:** The femoral vein arises from the popliteal vein.
- **Medial circumflex femoral artery:** Supplies the majority of blood to the femoral head and neck.
- **Medial circumflex femoral vein:** Accompanies the medial circumflex femoral artery and terminates in either the femoral or deep femoral vein.

Clinical Relevance: Obturator neuropathy, i.e., focal obturator nerve entrapment, can be caused by both fascial and vascular compression.

In some individuals, the medial circumflex femoral artery and vein cross the caudal (or posterior) division of the obturator nerve as the latter descends within a fascial plane superficial to the obturator externus and proximal portion of the adductor magnus muscle.[5] Arterial anastomoses between the muscular branches of the medial circumflex artery and the anterior branch of the obturator happen here – vascular abnormalities could cause obturator nerve compression. The presence of vessels overlying the nerve as well as its "low visibility" in imaging studies creates difficulties for clinicians attempting obturator nerve blocks.

Fascial expansions such as perivascular condensations around vessels supplying the adductor musculature produce a definitive layer of connective tissue that may entrap the anterior division of the obturator nerve.[6] The vascular pedicle from the medial circumflex femoral artery that leads to the pectineus, adductor longus, and adductor brevis surrounds the obturator nerve as it courses toward the apex of the brevis, thereby diminishing



anterior
Pubic symphysis
Pubis
Spermatic cord
Obturator vessels and n through obturator canal
Femoral v
Femoral a
Deep femoral a
Femoral n
Sartorius m
Iliopsoas m
Rectus femoris m
Iliofemoral ligament
Suspensory ligament
Prevesical space
Ductus deferens
Pectineus m
Femoral a
Deep femoral a
Femoral n
LR 12
Tensor fasciae latae m
Lateral femoral circumflex vessel
Vastus lateralis m
Neck of femur
Gluteus medius m
Obturator externus m
Iliotibial tract
Urethra
Prostate gland, lateral lobe
Quadratus femoris m
Ejaculatory duct
Ischium
Sciatic n
Pubofemoral ligament
Iliotibial tract
Obturator membrane
Prostatic vessels
right
left
Inferior gemellus m
Obturator internus m
Ischiorectal fossa
Levator ani m
Rectum
Anococcygeal ligament
Sciatic n
Internal pudendal vessel
posterior

Figure 12-33. Neurovascular structures in the vicinity of LR 12 may suffer compression from a wide array of maladies, including intrapsoas hematoma or abscess, retroperitoneal hematoma, enlarged lymph nodes, and obturator hernia.

space further for the nerve.

The femoral artery and vein enter the adductor canal close to LR 10, at the apex of the femoral triangle. The femoral triangle, bounded superiorly by the inguinal ligament (not shown here), medially by the adductor longus, and laterally by the sartorius, rests upon a floor formed by the iliopsoas muscle and pectineus. The roof of this triangle is built by the fascia lata and cribriform fascia, along with subcutaneous tissue and skin. From lateral to medial, the contents of the femoral triangle include the femoral nerve and branches, the femoral sheath and contents, the femoral artery and branches, and the femoral vein and tributaries (e.g., the great saphenous and deep femoral veins). As such, LR 10 and LR 11 serve as entryways to a high traffic zone replete with vessels and nerves of major importance.

Indications and Potential Point Combinations

- **Genital or pelvic pain:** LR 12; examine for trigger points, taut bands, and other local constrictions that may be compressing peripheral nerves.
- **Postoperative abdominal pain:** Apply pressure to LR 12.[1]
- **Hernia:** LR 12, ST 29, SP 13, GB 27; take care not to puncture intestinal contents involved with the hernia.
- **Thigh pain:** Identify, to the degree possible, whether the pain stems from myofascial dysfunction, nerve entrapment, or both.

LR 12 and LR 11 target the pectineus trigger points, though other points in the area will be required to address other myofascial components and fascial restriction.

References

1. He Y. Enterospasm treated by pressure on jimai acupoint. *J Tradit Chin Med.* 1990;10(1):19.
2. Mantoo SK, Mak K, and Tan TJ. Obturator hernia: diagnosis and treatment in the modern era. *Singapore Med J.* 2009;50(9):866-870.
3. Benito-Leon J, Picardo A, Garrido A, et al. Gabapentin therapy for genitofemoral and ilioinguinal neuralgia. *J Neurol.* 2001;248(10):907-908.
4. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
5. Kumka M. Critical sites of entrapment of the posterior division of the obturator nerve: anatomical considerations. *JCCA.* 2010;54(1):33-42.
6. Harvey G and Bell S. Obturator neuropathy. *Clinical Orthopaedics and Related Research.* 1999;363;203-211.

LR 13

Zhang Men "Completion Gate", "Camphorwood Gate", "Screen Gate"

"Camphorwood Gate", "Screen Gate" Slightly distal and ventral to the tip of the 11th rib.

Also found where the tip of the patient's elbow touches the lateral thorax.

Muscles

- **External oblique muscle:** Flexes and rotates the trunk; supports and compresses internal organs.
- **Internal oblique muscle:** Flexes and rotates the trunk; supports and compresses internal organs.
- **Transversus abdominis muscle:** Compresses and supports the internal organs; acts as an antagonist of the diaphragm to facilitate exhalation.

Clinical Relevance: Referred pain from trigger points in the abdominal oblique and transversus muscles can upset digestion. Or, referred pain may course in across the abdominal wall, extending toward the ipsilateral or even the contralateral subcostal margin, the umbilicus, the groin, and/or the genitalia. Needless to say, this leads to a variety of diagnostic dilemmas.

Enthesopathy where the internal oblique attaches to the costal margin can produce severe pain during coughing. View this attachment site in Figure 12-38.

Nerves

- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin superior to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin inferior to the umbilicus.
- **10th intercostal nerve:** Supplies the skin in this region.
- **11th intercostal nerve:** Supplies the skin in this region.

Clinical Relevance: Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may ensue.[2] Entrapment of the thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[3] The nerves become entrapped as they travel a fibrous tunnel or where soft tissues compress them. Scar tissue worsens nerve entrapment.

Acupuncture and related techniques address these problems by releasing tissue tension, improving circulation, and fostering repair.

Front Mu points such as LR 13 (the Spleen Front Mu) and their Back Shu partners such as BL 20 (the Spleen Back Shu) influence viscera through communication between somatic and visceral neurons.

LR 13 resides within the T11 dermatome; the spleen organ derives its sympathetic innervation from T8 to T11 spinal cord segments.[4] As such, T11 provides the overlapping spinal

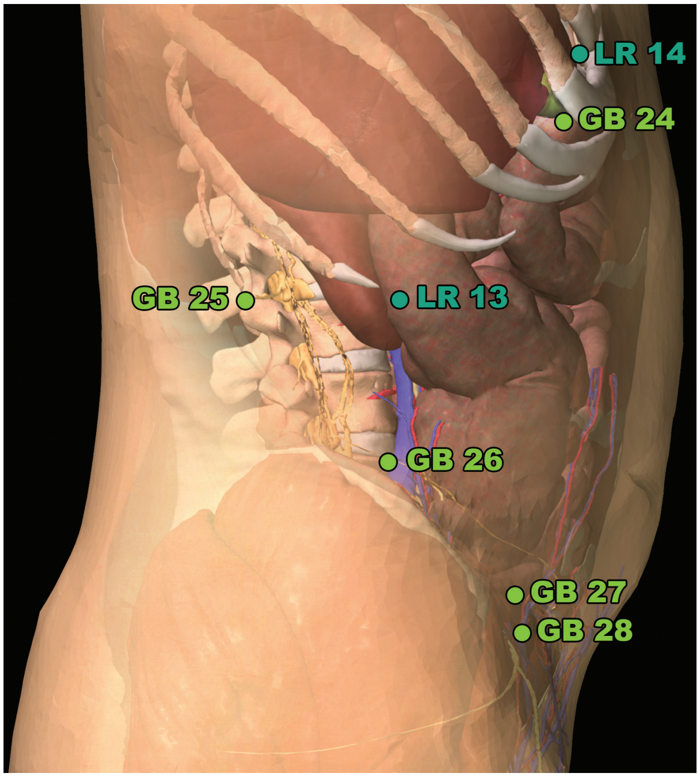


Figure 12-34. LR 13, LR 14, GB 24, and GB 25 all carry special significance as "Front Mu" or "Alarm" points. Tenderness to palpation at a Front Mu or Back Shu point may indicate dysfunction in its associated organ. The related organs for the Front Mu points appearing here are, respectively, spleen, liver, gallbladder, and kidney.

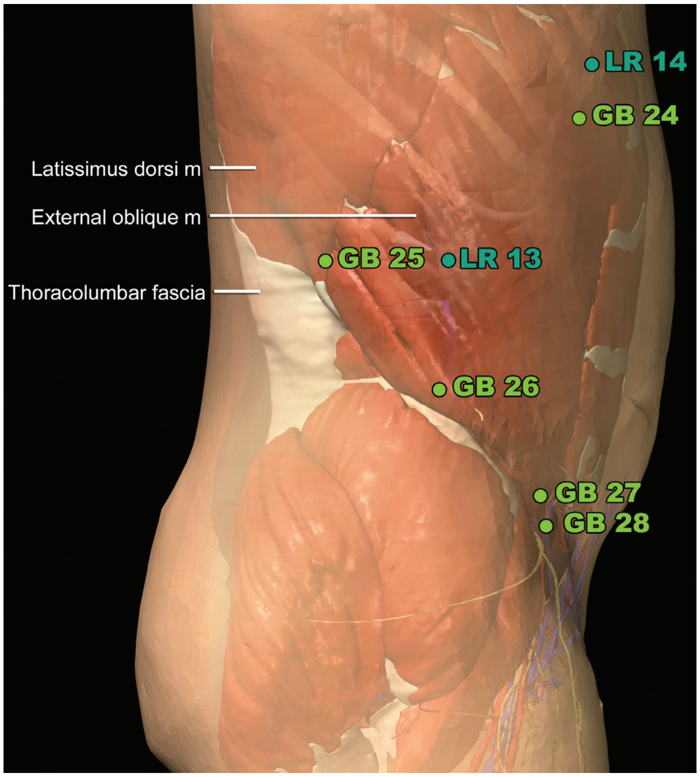


Figure 12-35. Visceral disease may trigger pain in abdominal wall musculature. Thus, tenderness to palpation at LR 13 can reflect internal organ dysfunction or abdominal wall pathology such as nerve entrapment or myofascial strain.

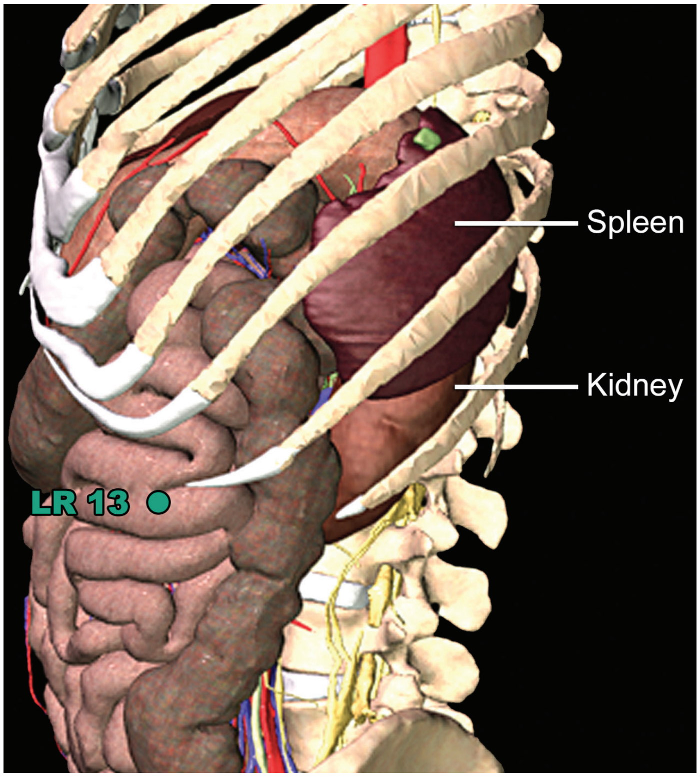


Figure 12-36. This left hemithorax illustrates the relationship between LR 13 and the spleen organ. Both appear along the same intercostal level, implicating spinal segmental overlap. The descriptive term for LR 13, "Screen Gate", connotes the way in which the ribcage resembles a screen. The term "Completion Gate" suggests that LR 13 serves as the gateway to LR 14, where the course of the twelve, paired channels becomes complete.

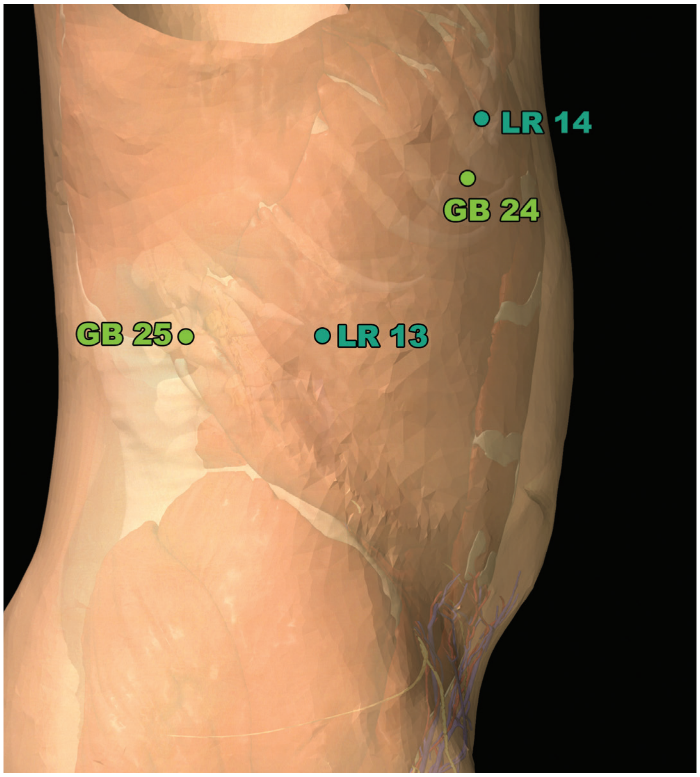


Figure 12-37. GB 25, LR 13, GB 24, and LR 14 fall along a crescent that follows the costal margin.

cord segment between somatic and organ supply. That said, nociceptive input from the body wall travels to several segments of spinal cord, not just one, introducing numerous possibilities for information exchange.

Vessels

- **Anterior and collateral branches of the 11th posterior intercostal arteries:** Supply the skin and muscles of this region.
- **Anterior and collateral branches of the 11th posterior intercostal veins:** Drain the skin and muscles of this region.
- **Anterior branches of the subcostal artery:** Supplies the skin and muscles of this region.
- **Anterior branches of the subcostal vein:** Drain the skin and muscles of this region.

Clinical Relevance: Improving circulation to the local tissues through acupuncture, massage, and laser therapy assists in resolving myofascial dysfunction and promoting tissue recovery.

Indications and Potential Point Combinations

- **Pain in the lateral thorax:** LR 13, GB 22, GB 25, tender trigger points.
- **Pleuritis:** LR 13, local trigger points as found. LU 1, LU 7, BL 13, BL 23.
- **Low back pain, with a feeling of cold in the low back or abdomen:** LR 13, GB 25, GB 26, GB 41, TH 5, BL 23, BL 52. Add massage and laser therapy; consider heat application.

Evidence-Based Applications

- Electroacupuncture at LR 13, GV 2, and GV 14 encouraged improved **survival of skin flaps** in rats compared to sham points.[1]

References

1. Uema D, Orlandi D, Freitas RR, et al. Effect of electroacupuncture on DU-14 (Dazhui), DU-2 (Yaoshu), and Liv-13 (Zhangmen) on the survival of Wistar rats' dorsal flaps. *J Burn Care Res.* 2008;29(2):353-357.

2. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.

3. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.

4. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy.* 2009;8:32-35.

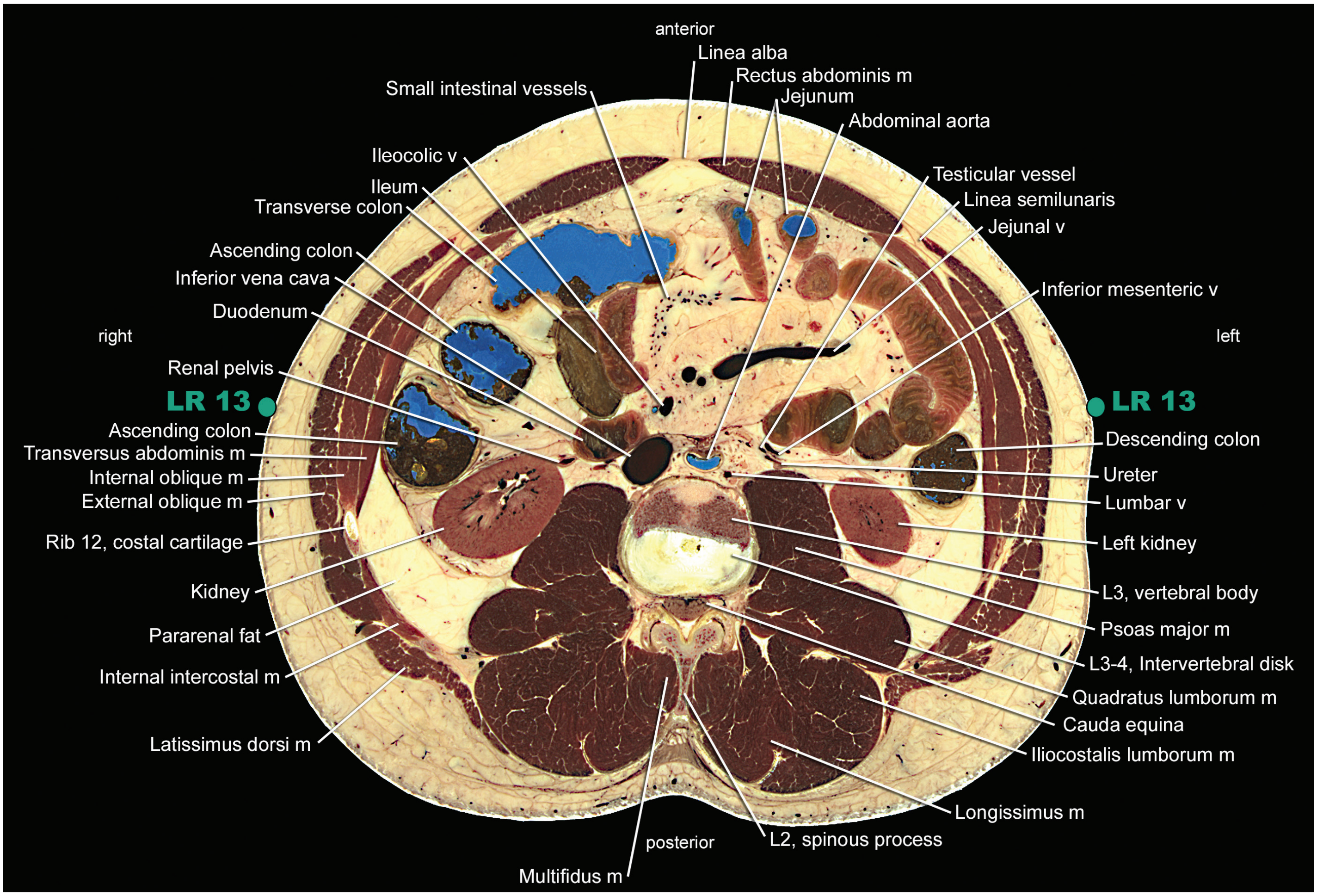

anterior
Linea alba
Rectus abdominis m
Small intestinal vessels
Jejunum
Abdominal aorta
Ileocolic v
Testicular vessel
Ileum
Linea semilunaris
Transverse colon
Jejunal v
Ascending colon
Inferior vena cava
Inferior mesenteric v
Duodenum
right
left
Renal pelvis
LR 13
LR 13
Ascending colon
Descending colon
Transversus abdominis m
Ureter
Internal oblique m
External oblique m
Lumbar v
Rib 12, costal cartilage
Left kidney
Kidney
L3, vertebral body
Pararenal fat
Psoas major m
L3-4, Intervertebral disk
Internal intercostal m
Quadratus lumborum m
Cauda equina
Latissimus dorsi m
Iliocostalis lumborum m
Longissimus m
posterior
L2, spinous process
Multifidus m

Figure 12-38. This cross section illustrates the locus of connection where, in this case, the right internal oblique muscle attaches to the costal cartilage of the twelfth rib. Myofascial pathology here can cause intense pain when the abdomen suddenly and forcefully contracts, as when coughing. The transversus abdominis muscle may serve as an accomplice.

LR 14

Qi Men "Cycle Gate"

In the 6th intercostal space, on the midclavicular line, approximately 4 cun lateral to the anterior midline.

Some authors suggest placing LR 14 in the first full intercostal space palpable above the costal arch, which in this case would displace or coincide with GB 24, as shown in Figure 12-39. Considering that sympathetic fibers from T8-T11[3] supply both the liver and gallbladder, moving both LR 14 and GB 24 one interspace caudad from their traditional locations seems justified neuroanatomically.

Muscles

- **External intercostal muscle:** Elevates the ribs.
- **Internal intercostal muscle:** Depresses the ribs.

Clinical Relevance: Trigger points in the intercostal muscles at LR 14, when the point is treated either in the 6th or 7th intercostal space, incite mainly local pain. Severe myofascial dysfunction may cause pain to travel toward the sternum. Or, patients complain of having a "stitch in the side", although diaphragmatic trigger points may also cause this sensation.

The external intercostal muscles contain more muscle spindles than do the internal intercostal muscles. Intercostal muscles inhabiting the most cranial seven intercostal spaces exhibit a greater density of muscle spindles than do those in the lower thorax. As such, physical medicine interventions in the cranial thorax might deliver a more robust response. At any location over the thorax, however, acupuncture of the intercostal muscles risks causing internal organ damage, illustrated by the cross-section of Figure 12-41. Therefore, acupressure, medical massage, soft tissue manipulation, and laser therapy should substitute for acupuncture for intercostal trigger points. Stretching or yoga may also help, along with corrective deep breathing exercises.

Nerves

- **6th intercostal nerve:** Supplies the skin and muscles of the 6th intercostal space.
- **Thoracoabdominal nerves (i.e., the ventral rami of the inferior six thoracic nerves):** Innervate the anterior abdominal muscles, overlying skin, and the periphery of the diaphragm. T7-T9 provide sensation to the skin cranial to the umbilicus; T10 innervates the periumbilical skin; T11 and the subcostal (T12), iliohypogastric (L1) and ilioinguinal (L1) nerves supply the skin caudal to the umbilicus.

Clinical Relevance: Intercostal neuralgia produces pain of a burning, electrical, or stabbing type.[4,5] Trigger point and general myofascial release may aid in the reduction of neuropathic pain.

Vessels

- **Superficial thoracoepigastric vein:** Provides a collateral pathway by which the femoral vein can communicate with the axillary vein in the event of inferior vena caval obstruction.
- **Anterior intercostal arteries:** Derived from the musculophrenic arteries (branches of the internal thoracic arteries), the 6th and 7th anterior intercostal arteries supply the 6th and 7th intercostal muscles, respectively, along with the pectoral muscles, the breasts, and the skin.
- **Anterior intercostal veins:** Tributaries of the internal thoracic veins and accompany the intercostal arteries to drain venous blood from the 6th and 7th intercostal spaces.

Clinical Relevance: Reduced blood supply from muscle tension and connective tissue fibrosis reduces arterial blood supply and venous and lymphatic drainage.

The venous connection made by the thoracoepigastric vein serves as the vascular basis for the cycle completion between LR 14 and LU 1.

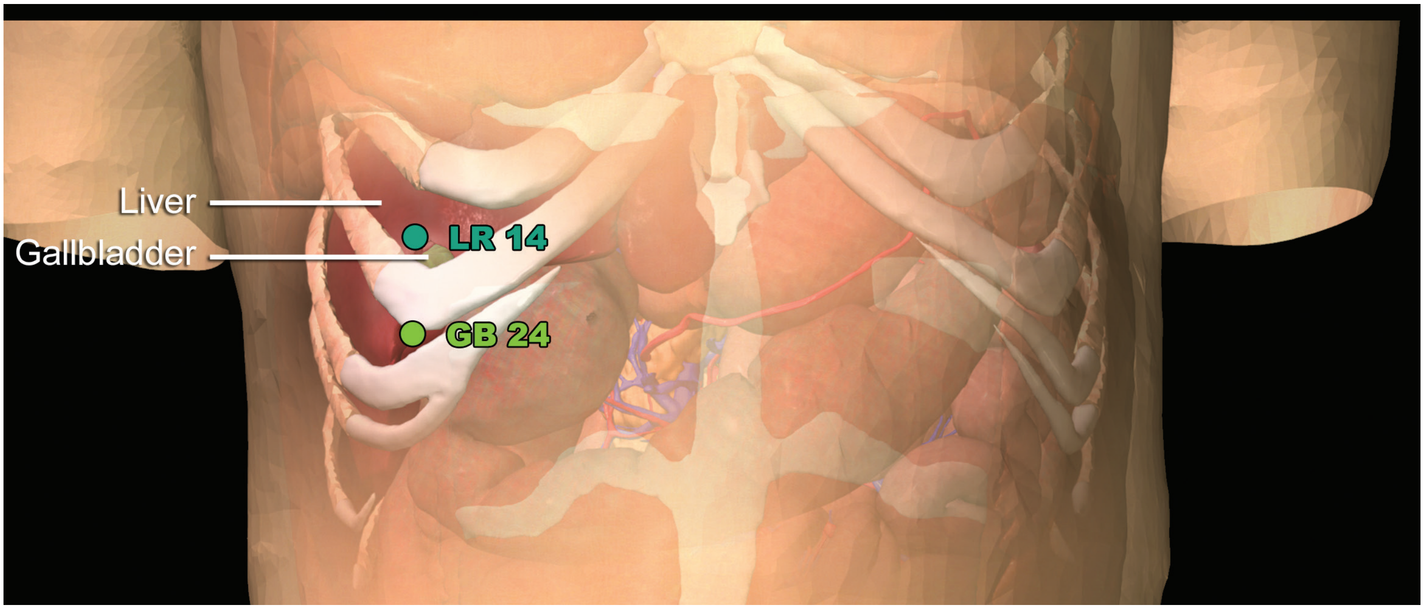


Figure 12-39. At their conventional locations, the right-sided LR 14 and GB 24 land close to the liver and gallbladder. On the left side in either location, they lie superficial to digestive structures; i.e., the stomach and transverse colon, respectively.

Indications and Potential Point Combinations

- **Pain in the chest, diaphragm, or lateral costal region:** LR 14, LR 13, BL 20, BL 21, CV 15.
- **Hepatitis, other hepatobiliary problems:** LR 14, GB 24, BL 18, BL 19, ST 36.
- **Vomiting:** LR 14, PC 6, ST 36.
- **Hiccoughs:** LR 14, CV 22.
- **Intercostal neuralgia:** LR 14, related trigger points.

Evidence-Based Applications

- **Laser acupuncture significantly outperformed sham laser for the treatment of mild to moderate depression with the following points:** LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[1]
- Laser acupuncture at LR 14, CV 14, LR 8, HT 7, and KI 3 provided a statistically and significantly significant benefit in the treatment of **major depression.**[6] These same points increased brain activation in the frontal-limbic-striatal regions in healthy individuals.[7]
- Acupuncture at LR 14, LR 3, CV 6, CV 12, BL 17, BL 18, BL 23, SP 6, and SP 10 may have contributed to resolving **amenorrhea** in an athlete (case report).[8]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6 plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[2]

References

1. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine*. 2005;23(3):103-111.
2. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology*. 2003;5:345-348.
3. Cabioglu MT, Kaya Y, and Surucu HS. Neurophysiologic basis of Front-Mu points. *Neuroanatomy*. 2009;8:32-35.
4. Dorsi MJ, Lambrinos G, Dellon AL, et al. Dorsal rhizotomy for treatment of bilateral intercostal neuralgia following augmentation mammoplasty: case report and review of the literature. *Microsurgery*. 2011;31:41-44.
5. Williams EH, Williams CG, Rosson GD, et al. Neurectomy for treatment of intercostal neuralgia. *Ann Thor Surg.* 2008;85:1766-1770.
6. Quah-Smith I, Smith C, Crawford JD, et al. Laser acupuncture for depression: a randomized double blind controlled trial using low intensity laser intervention. *J Affect Disord.* 2013;Jan 18. S0165-0327(12)–825-7.
7. Quah-Smith I, Sachdev PS, Wen W, et al. The brain effects of laser acupuncture in healthy individuals: an fMRI investigation. *PLoS One.* 2010;5(9):e12619.
8. Donoyama N, Hotoge S, and Ohkoshi N. Acupuncture might have contributed to improving amenorrhoea in a top athlete. *Acupunct Med.* 2011;29(4):304-306.
9. Schuenke M, Schulte E, and Schumacher U. *Thieme Atlas of Anatomy. Neck and Internal Organs.* Stuttgart: Thieme., 2005. P. 292.

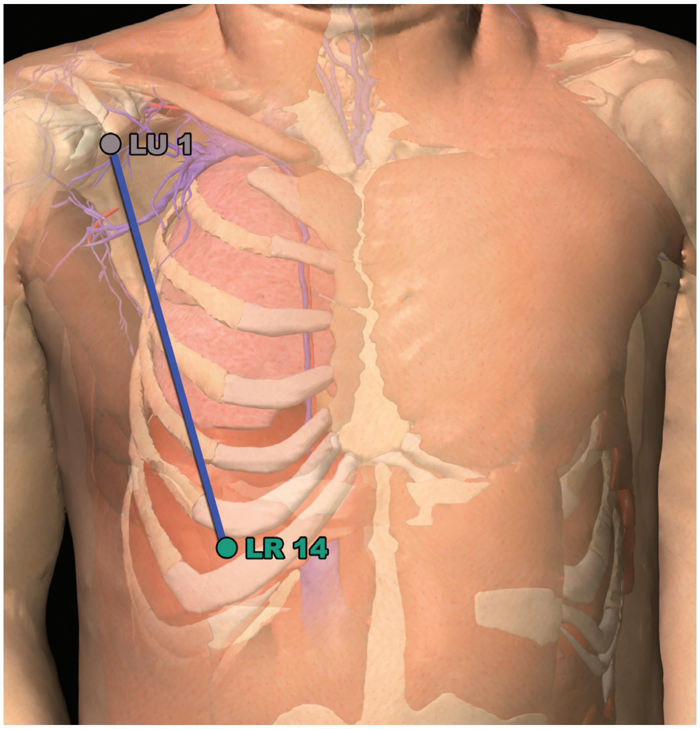


Figure 12-40. LR 14, "Cycle Gate", completes the tour, or cycle, of the twelve paired channels over the ventral, lateral, and dorsal surfaces of the body. The thoracoepigastric vein serves as the "gate" that completes the cycle. When needed, as in the case of inferior vena caval obstruction, the thoracoepigastric vein (represented here as a straight blue line) drains blood from the region around LR 14 to LU 1. The entire collateral communication route spans from the inferior vena cava distal to the obstruction, to the common iliac vein, external iliac vein, femoral vein, superficial epigastric/superficial circumflex iliac veins, thoracoepigastric/lateral thoracic veins, axillary vein, subclavian vein, brachiocephalic vein, and finally back into the superior vena cava.[9]

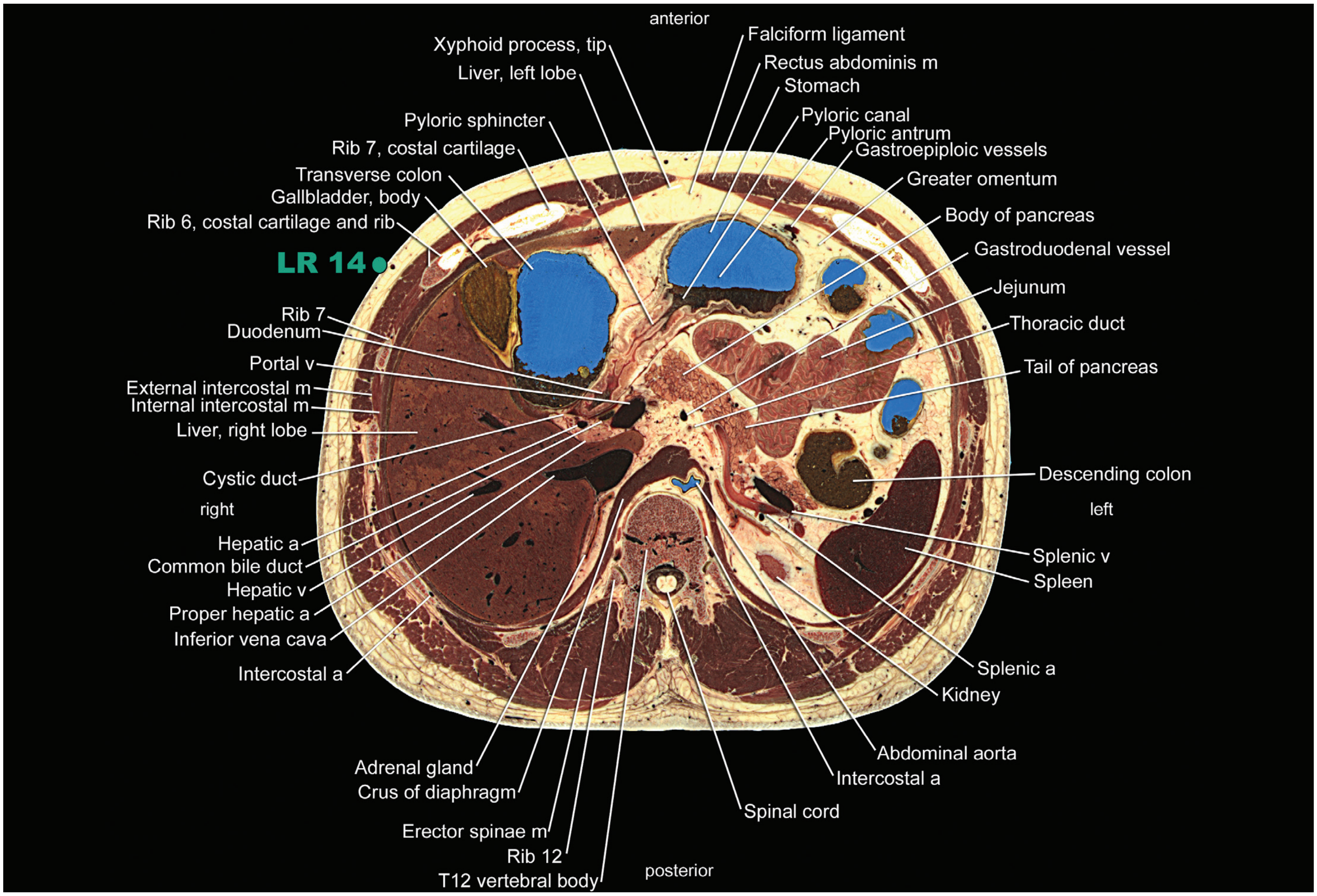

anterior
Xyphoid process, tip
Liver, left lobe
Pyloric sphincter
Rib 7, costal cartilage
Transverse colon
Gallbladder, body
Rib 6, costal cartilage and rib
LR 14
Rib 7
Duodenum
Portal v
External intercostal m
Internal intercostal m
Liver, right lobe
Cystic duct
right
Hepatic a
Common bile duct
Hepatic v
Proper hepatic a
Inferior vena cava
Intercostal a
Adrenal gland
Crus of diaphragm
Erector spinae m
Rib 12
T12 vertebral body
posterior
Spinal cord
Intercostal a
Abdominal aorta
Kidney
Splenic a
Spleen
Splenic v
left
Descending colon
Tail of pancreas
Thoracic duct
Jejunum
Gastroduodenal vessel
Body of pancreas
Greater omentum
Gastroepiploic vessels
Pyloric antrum
Pyloric canal
Stomach
Rectus abdominis m
Falciform ligament

Figure 12-41. Both the liver and gallbladder appear near the right-sided LR 14 in this cross section, not too far from the surface, emphasizing the need for caution while needling. Note the proximity of the intercostal muscles to the right lobe of the liver.

Section 4::

The Eight “Singular Vessels,” “Extraordinary Vessels,” or “Curious Meridians”

The Eight Singular Vessels

Also called “Extraordinary Channels” and “Curious Meridians”

Singular Vessels – Channels and the Vessels They Represent:

- **Governor Vessel = Venous plexuses of the spine and drainage pathways of the CNS and back**
- **Conception Vessel = Venae Cavae**
- **Chong Mai = Aorta**
- **Dai Mai = Subcostal vessels and sympathetic, thoracolumbar nerves**
- **Yang Wei Mai, Yin Wei Mai, Yang Qiao Mai, and Yin Qiao Mai = superficial venous networks on the pelvic limbs**
- **Yang Wei Mai, Yin Wei Mai, Yang Qiao Mai, and Yin Qiao Mai = superficial venous networks on the pelvic limbs**

Section 3 presented the points and trajectories of the twelve paired acupuncture channels. Now, Section 4 adds the two midline channels. These two belong to a set of eight channels that correspond to singular, or unitary vessel systems. In contrast to the singular vessels, the previously described paired channels comprises a right and left trajectory. Each of the eight singular, vessels demonstrates a uniqueness in some manner, whether unpaired as in the case of the vena cava and aorta, or set apart from its anatomical associates functionally, as in the case of the subcostal veins, arteries, and nerves.

The ventral and dorsal midlines channels, i.e., the Conception Vessel (CV) and Governor Vessel (GV) respectively, begin in the distal pelvis and end near the mouth. CV and GV are the only two from the eight singular channel system that have their own points and pathways. The other six lack linear avenues and classical surface locations assigned to them alone.

While fanciful ideas abound about their true nature, they in fact describe real anatomical entities. Unfortunately, erroneous translations incorporating descriptors such as “marvelous”, “curious”, or “extraordinary” have contributed to notions that these structures ferry spiritual, metaphysical energies through intangible, mystical pathways. Some insist that only the adept acupuncturist should attempt to influence the singular vessels with acupuncture, intimating that their “curious” contents are far too sophisticated and otherworldly for amateurs to engage or manipulate.

The reason that the material basis of these channels has eluded most Western acupuncture practitioners harkens back to translation errors from George Soulié de Morant.[1] Although he came close to recognizing their true nature by calling them “vessels”, Soulié de Morant still clung to hopes that acupuncture worked through unseen energies. Fortunately, Kendall exposed their tangible bases, coining the term “singular distribution vessels” instead of “marvelous meridians”. In his groundbreaking book, *The Dao of Chinese Medicine,* he explained:[2]

> “The singular distribution vessels consist of three major deep vessels of the body, including one arterial vessel and two venous vessels, in addition to five pairs of superficial distribution veins. Called *jimai* in Chinese, these vessels are considered singular because they are not assigned to any particular internal organ. Here, the character *ji* means singular, but is also identical in form to the character *qi*, typically used to mean strange. This character *qi* can also be interpreted as extraordinary, which is commonly contracted to mean extra, resulting in the singular distribution vessels being referred to as the ‘eight extra vessels.’ Being a critical part of the circulatory network, the singular vessels have regulatory functions over particular main distribution (jing) vessels (i.e., the twelve main channels: LU, LI, ST, SP, etc.) Certain nodes (i.e., acupuncture points) on those regulated distribution vessels represent confluent locations (called master and couple nodes) that are applied in the treatment of particular clinical indications.”

Whereas Soulié de Morant likened the eight vessels to canals or drains “for the excess of floods”, Kendall recognized the venous structures as capacitance vessels. To illustrate this disparity, in de Morant’s translation of the *Zhen Jiu Yi Xue”, Easy Studies in Needles and Moxa* by Li Shouxian in 1798, he wrote:

> “The meridians are twelve; the secondary vessels, fifteen. Energy and blood continue their course in them like water in large rivers… But when the rain of the sky is too abundant, all the large rivers suddenly swell and overflow, filling canals and drains. That is what one wishes to express when saying that the illness penetrates and fills the marvellous (sic) vessels. If one treats these conditions using the twelve meridians and there is no response, one must use the master points of the eight marvellous vessels. This causes the so-called canals and drains to circulate.”[3]

In contrast, Kendall brought actual anatomy and physiology into the picture in this translation of a passage from the ancient Nanjing:[4]

> “By analogy, the eight singular vessels are like a plan drawn up by the Sage of irrigation ditches and canals. When these irrigation ditches and canals are filled to overflow capacity, they pour into deep lakes. Therefore, using the Sage’s analogy, when there is an inability to constrain the distribution of blood and vital substances, the vessels in the human body will swell and bulge to excess. Blood then flows into the eight singular vessels so as not to circulate throughout the periphery and therefore relieve the twelve main distribution vessels when they cannot constrain the flow.” (Nanjing, Difficulty 28: the Eight Singular Distribution Vessels)

Kendall provides further insight by approaching the conceptual basis of the eight singular vessel system from a structure-function perspective:[5]

> “The study of therapeutic bloodletting led to early investigation of the vascular system. Much effort went into understanding vessel pathways, branching, and organization. All significant blood vessels of the body were identified, and many are named in relation to the anatomical region they serve, as well as to an associated internal organ. Twelve pairs of matched longitudinal arteries and veins (six pairs on each half of the body) comprise the organ-related main distribution vessels (jingmai). The collateral branches (luomai) of these main vessels supply tissues in the superficial and deep areas of the body. Collateral vessels divide further into fine vessels (sunmai), which comprise arterioles, capillaries, and venules. Fine vessels communicate between the outflowing arteries and

the return flow venous supply, thus ensuring continuous blood circulation. Vessels, along with associated nerves, provide the anatomical means of communication between the internal and external body, a factor that is essential to health, disease processes, and treatment mechanisms.

"Because there are more veins than arteries, the ancient Chinese identified five pairs of superficial venous networks that are not associated with internal organs. These veins, plus two deep major veins, are classified as singular vessels (jimai). About 70% of blood is now known to be in the slow-flowing veins, 11 to 12% is found in the fast-moving systemic arteries, and 5 to 6% is contained in the systemic capillaries. The remainder is in the lungs (8%) and heart (5%). Normally, the volumetric rate of flow in the veins and arteries is equal, even through the veins hold six times more blood than the arteries. The Chinese understood that veins are capacitance vessels, noting that they have additional capacity to control the relative blood volume between the arteries and veins."

By acknowledging and investigating the structure-function relationships between the vascular pathways, associated neural connections, and acupuncture points, one better understands how and why stimulating points creates the physiologic changes the Chinese noted with acupuncture. For example, analyzing the role of the venous network accompanying the brain and spinal cord provides insight and context about ways in which points stimulated on the GV channel help to lower brain and spinal cord temperature and impact the health of the nervous system in order to benefit patients with epilepsy, stroke, back pain, and headaches.

The Three Deep Singular Vessels: GV, CV, and the Chong Mai

The eight singular vessels in acupuncture fall into two groups. Three of the eight relate to three deep, large vessels. Five channels correlate with five superficial structures or networks. The three deep channels include:

1) GV (Du Mai), which represents vertebral and epidural venous networks attached to the azygous system that drains the back,

2) CV (Ren Mai), pertaining to the superior and inferior vena caval system and their tributaries, and

3) Chong Mai, the Penetrating Vessel or Thoroughfare Vessel, which accounts for the aorta. This is the only arterial pathway among the eight singular vessels.

Of the five superficial venous networks, only the **Dai Mai** (Belt Vessel or Girdle Vessel) offers a distinctly traceable trajectory, one that encircles the waist like a sloping belt.

The remaining four superficial venous networks offer less distinct courses comprised of tributaries that ultimately empty into larger passageways.

Yang and Yin in GV and CV

GV and CV form a complementary pair referred to as the "Sea of **Yang**" and the "Sea of **Yin**", respectively. As the "Sea of **Yang**", the venous system of the GV drains the back, spinal cord, and brain. Conversely, the "Sea of **Yin**", i.e., the vena caval system, receives blood from the Yin, or more caudal and ventral portions of the body including the pelvic limbs, pelvis, abdomen, neck, and face.

The actual veins represented by GV and CV meet in several places. The *Li Shi Zhen* referred to CV and GV as "branches from the same source, one in the front of the body and the other in the back. Just as the human body has the Directing [meaning the CV] and Governing Vessels, nature has midnight and midday: these two vessels are separate but also joined."[6] It continues, "The Governing and Directing Vessels may be seen as a closed circuit, one channel with two branches: one part Yang, the other Yin." And, "Indeed, the Governing and Directing Vessels intersect with each other and form as it were two circles which join up in the Interior."

More recently, Herlihy stated, "The vertebral vein system (GV) is a provision of Nature to equalize pressure, to redistribute blood, and in pathologic conditions of either of the two venae cavae (CV), to act as an alternative path for the continuation of the circulation… we must regard the venous system as being composed of five strata, of which the main two are the caval and vertebral systems…I wish to draw special attention to the pool of blood in the vertebral veins…In and out of this plexus blood runs, not unlike the earliest conceptions of an 'ebb and flow'."[7]

Anatomy and Physiology (Structure and Function) of the Veins Comprising the GV (Du Mai)

The GV begins "in front of the lowest part of the perineum and from this area, travels side-by-side up the interior part of the back (azygous and hemiazygous, and the ascending lumbar veins) to enter the node (i.e., acupuncture point) Fengfu (DU 16 (GV 16)), where it connects with the brain."[8]

The veins forming the GV network create a dynamic reflux-regulating system that operates through the epidural and radicular venous interconnections surrounding the spinal cord.[9,10] This network responds to venous pressure changes by adjusting intravascular resistance. For example, the radicular veins alter their diameter in cases of venous "hyperpression", in order to protect the spinal cord from potentially damaging pressure waves. In addition, venous reflux through the radicular veins offers selective cooling of the spinal cord, just as the dural sinuses help to cool the brain, draining excessively warm blood from sensitive neural tissue.[11,12]

Conjoined with the azygous system, the vertebral venous plexus participates as an alternate route of venous return in cases of caval blockade.[13] At times, however, the capacity of the radicular veins to modulate venous pressure may become overwhelmed. In certain circumstances, such as thrombosis in the inferior vena cava (IVC), epidural veins may dilate due to the increased blood flow through the vertebral venous plexus, resulting in neurologic compression or cauda equina syndrome.[14]

Chronic back pain and radiculopathy may also result from

The Metaphorical Attributes and Vascular Relationships of the Governor Vessel

Metaphorical Attributes	Anatomic Correlate
Warms the Lower Burner and the Bladder Harmonizes sexual function Tonifies Kidney *Yang*	The GV channel arises from the various venous plexuses (i.e. the rectal, vesical, prostatic, uterine, and vaginal plexuses) that drain the pelvis and its contents.
Strengthens the back Nourishes the Marrow	A network of intercommunicating veins empties into both the internal iliac veins and internal vertebral venous plexus. The internal vertebral venous plexus courses along the interior of the spinal column and enters the brain.
Strengthens the mind Lifts the *Qi* Nourishes the brain	Where the GV "enters the brain", at GV 16, the internal vertebral venous plexus connects with the occipital sinus, terminating at the confluence of sinuses, which is the dilated caudal extremity of the superior sagittal sinus. The superior sagittal sinus and the GV channel continue in a rostral direction, in line with the mid-sagittal cranial suture.
Extinguishes Interior Wind	Like the GV channel that "descends along the midline of the head to the bridge of the nose", the superior sagittal sinus links to a nasal emissary vein that emerges through the foramen cecum, an opening near the anterior end of the crista galli. This establishes a connection between the intracranial superior sagittal venous sinus and the extracranial veins of the nasal cavity, although it is not always present in an adult.

epidural and radicular venous congestion.[15] The ability of blood flow to reverse through the relatively valveless vertebral venous plexus explains the spread of certain metastatic lesions, such as the dissemination of prostate cancer cells to the spine.[16] Elevated intra-abdominal pressure causes blood draining the prostate to flow into the vertebral veins.[17] With these anatomical correlates in mind, the metaphorical attributes assigned to the GV by TCM texts no longer need remain elusive when instead explained as the vascular conduits and corresponding neural networks they actually are.

See the Table above for more details.

Anatomy and Physiology of the CV (Ren Mai))

The CV channel (vena cava) "starts below the node‡ Zhongji (RN 3) (CV-3) and travels up through the border of the pubic hair to follow along the interior aspect of the abdomen [medial branches of the superior and inferior epigastric veins], past Guanyuan (RN 4) (CV-4) and up to the throat. It then continues up the cheek, following along the face, to enter the eyes (Chengqi, ST 1)". In the ancient work, the *Ling Shu* (Divine Pivot section of the *Huang Di Nei Jing*), Qibo describes the upper extent of the CV as venous tributaries feeding into the superior vena cava (SVC). These include the internal jugular vein draining the brain and a portion of the face, the external jugular vein draining the head and face and the vertebral veins, draining the brain and neck.[18]

Both CV and GV began at the anoperineal region in the pelvis. At their conclusion, they rejoin on the face. The angular vein as an offshoot of CV communicates with the superior ophthalmic vein of GV via the nasofrontal vein, establishing an anastomosis between the anterior facial vein (CV territory) and the cavernous sinus (a GV structure).

The Ren Mai "controls the internal vessels" and supplies reserve blood to the 12 main channels (paired vascular pathways) by means of adjusting resistance in the large venous passageways, or capacitance vessels. Low-pressure baroreceptors in the walls of the great veins and atria (as opposed to high-pressure baroreceptors in the carotid sinus and aortic arch) send messages to the central nervous system, prompting it to modify blood volume distribution and pressure.

As with GV, dispelling the murky metaphors of TCM clarifies the anatomic and physiologic foundations of the CV channel. The Table on the following page compares the metaphorical attributes with their anatomic correlates in detail

Anatomy and Physiology of the Chong Mai (Thoroughfare Vessel)

Chong Mai energy-based descriptions contend that this "marvelous vessel" connects Pre-Heaven and Post-Heaven Qi. It supposedly accomplishes this by connecting the Kidneys (keepers of the Pre-Heaven Qi; i.e., inherited "Jing Qi" or spiritual-energetic gifts conferred by the mother) to the Stomach (bearer of Post-Heaven Qi or the end-products of digestion absorbed as nutrients). Maciocia comes close to acknowledging a vascular foundation for the Chong Mai in his statement that concerning this "Sea of the 12 channels". He states claims that the Chong Mai "branches out in many small capillary-like vessels" and, as the "Sea of Blood", "controls movement of Blood in the Uterus and controls, too, all the Deep Blood Connecting channels".[19] In the end, though, the discussion resorts to the energy-meridian myth.

In reality, the actual vessel responsible for these activities is the aorta, characterized as "always having a pulse beat". Similarly, in the Ling Shu (Divine Pivot), Qibo refers to the pulsation of the posterior tibial artery, a branch of the Chong Mai.[20] The Chong Mai (aorta) ferries oxygenated blood (carrying nutrients, blood

---

‡ The term "node" is Donald E. Kendall's term for acupuncture point.

The Metaphorical Attributes and Vascular Relationships of the Conception Vessel

Metaphorical Attributes	Anatomic Correlate
Nourishes Blood and *Yin* Regulates the uterus Moves *Qi* in the Lower Burner *(Jiao)* and uterus Affects male reproductive system	The inferior vena cava ultimately receives blood from the entire pelvis.
Activates the Triple Heater to control the transportation and penetration of *Qi* throughout the body	On its way to the inferior vena cava via the hepatic veins, blood draining from the viscera first circulates through the portal system, carrying nutrient-laden fluid (or, metaphorically, Nutritional *Qi*) into the liver for its dispersal throughout the body.
Controls Water Passages and the transformation, transportation, and excretion of fluids Strengthens the Kidneys	About one quarter of an individual's total blood volume circulates through the kidneys per minute, which clears waste from the blood and helps regulate fluid and electrolyte balance. Blood leaves the kidney through the renal vein, which drains into the inferior vena cava.
Controls fat tissue and membranes that anchor, connect, and envelop the organs	This function most likely describes the peritoneum, mesentery, and omentum, which performs the jobs to which the TCM description alludes. The inferior and superior mesenteric veins and their tributaries accomplish the mission of draining these structures.
Regulates the life cycle	Hypothalamic-pituitary-adrenal axis
Promotes the descending of Lung *Qi*	The superior vena cava receives blood from structures cranial to the diaphragm. Blocking superior vena cava blood flow results in a medical emergency known as superior vena cava syndrome (SVCS), which increases venous pressures in the head, neck, thoracic limbs, and cranial thorax, a notable obstruction to the descent of metaphorical *Qi*.

products, immune cells, dissolved gases, neurohormonal and humoral substances, etc.) from the left ventricle through the vessels and organs associated with the twelve main channels.

The "Sea of Blood" or Chong Mai issues branches to the thorax, abdomen, back and pelvic limbs. Its internal pathway extends to the perineum at CV 1. Its abdominal branches migrate to the surface, its head and spinal branches supply the nervous system, and its descending offshoots accompany the Kidney and Liver channels to the foot.[21]

Anatomy and Physiology of the Dai Mai (Belt Vessel)

The Dai Mai, the only horizontal acupuncture channel, corresponds to subcostal arteries and veins as well as nerves that supply sensation and sympathetic support to the mid-truncal, gluteal, and genital regions. The subcostal veins originate from the Du Mai (GV)'s ascending lumbar veins. The Dai Mai's circumferential nature brings it into contact with portions of the paired channels that cross the waist or belt territory. One point on the Gallbladder channel, GB 26, bears the same name ("Dai Mai") as this channel because of its coincidence along the Dai Mai singular vessel.

The functions of both the Dai Mai point (i.e., GB 26) and the Dai Mai singular vessel, or channel, overlap in their structure-function connections. That is, both impact thoracoabdominal nerves, the iliohypogastric nerve, the ilioinguinal nerve, the subcostal (12th intercostal) nerve, and affiliated vessels.

TCM texts assert that the Dai Mai channel harmonizes digestive activities, promotes communication and circulation between the upper and lower halves of the body, and resolves dampness in the lower burner (lower Jiao) or pelvis. A medical acupuncture interpretation translates these activities into physiologic responses culminating from neuromodulation of sympathetic supply to the pelvis from T12/L1. That is, tissues in the Dai Mai region are supplied by subcostal neurovascular structures that influence digestion in the lower intestinal tract as well as circulation to pelvic organs.

The Remaining Four Superficial Singular Vessels

The Yang Wei Mai (Yang Linking Vessel), the Yin Wei Mai (Yin Linking Vessel), the Yang Qiao Mai (Yang Heel Vessel) and the Yin Qiao Mai (Yin Heel Vessel) constitute the four remaining superficial singular vessels. In reality, these pathways consist of long, interlacing venous channels from pelvic limbs to the head.

One might ask why none of the singular vessels extends to the thoracic limbs. The answer can be found in the fact that the venous networks of the pelvic limbs possess different vasodilator characteristics than the thoracic limbs. Humans' upright posture and bipedal locomotion pose hemodynamic challenges; i.e., standing encourages blood to sink to the feet. The hydrostatic pressure gradient induced by gravity raises vascular pressure in the pelvic limbs to about 65 mm Hg higher than in the thoracic limbs.[22] The superficial pelvic limb veins, fed by the four superficial singular vessels, support blood redistribution to other parts of the body in accordance with the moment to moment shifts in regional volume. In this way, the superficial networks may play a capacitance role that assists the larger, deeper capacitance vessels of the pelvic limb.

Summary

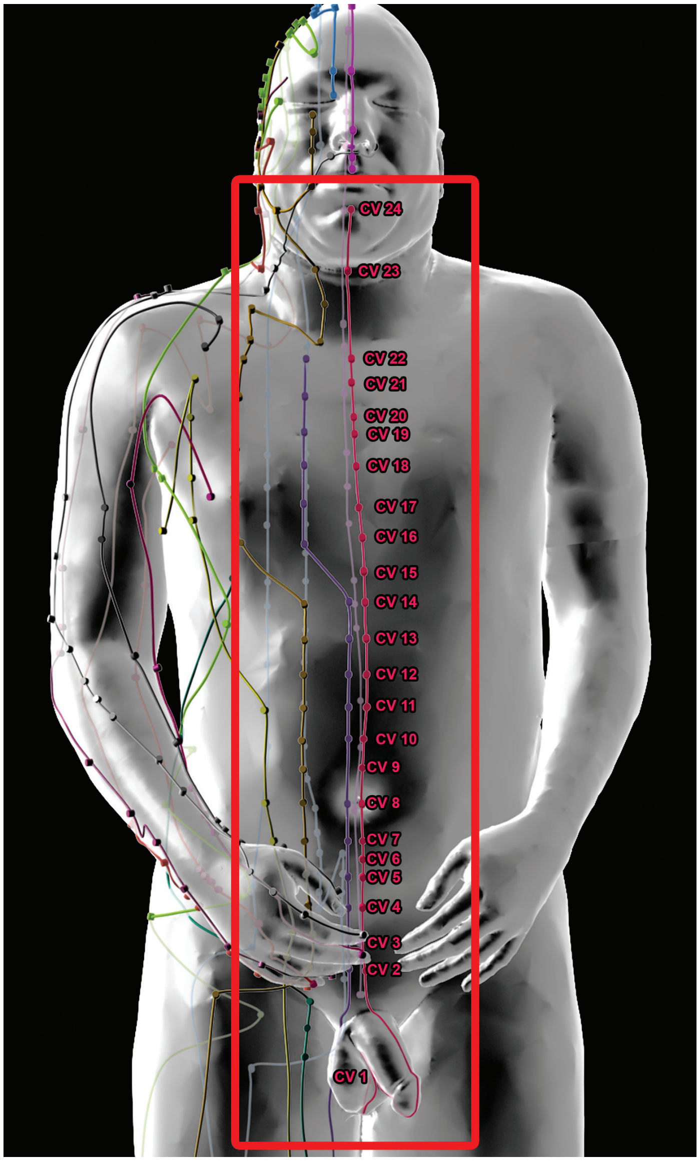
Finding the form behind the function of the eight singular vessels releases acupuncturists from relying on myth and belief systems to explain their course and function. The following two chapters delve into the anatomic detail concerning points of the CV and GV venous routes.

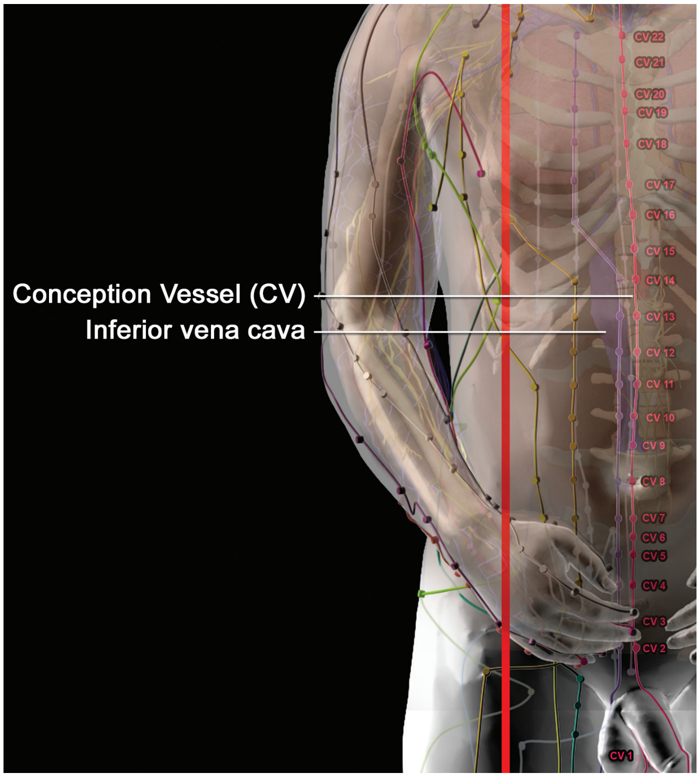
References

1. Soulié de Morant G. *Chinese Acupuncture*. Brookline: Paradigm Publications, 1994. P. 148.
2. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. Pp. 149-158.
3. Soulié de Morant G. *Chinese Acupuncture*. Brookline: Paradigm Publications, 1994. P. 146.
4. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. Pp. 152.
5. Kendall DE. *Dao of Chinese Medicine. Understanding an Ancient Healing Art*. Hong Kong: Oxford University Press, 2002. Pp. 144.
6. Maciocia G. The Channels of Acupuncture. Clinical Use of the Secondary Channels and Eight Extraordinary Vessels. Philadelphia: Churchill Livingstone/Elsevier, 2006. Pp. 389, 417, 415-416, 418, 464.
7. Herlihy WF. Revision of the venous system: the role of the vertebral veins. *Med J Aust*. 1947;1:661-672. Cited in Tobinick E. The cerebrospinal venous system: anatomy, physiology, and clinical implications. Obtained at http://cme.medscape.com/viewarticle/522597_print on 8-7-09.
8. Kendall, DE. *Dao of Chinese Medicine*. New York: Oxford University Press, 2002. Pp. 149-158.
9. Van der Kuip M, Hoogland PVJM, Groen RJM. Human radicular veins: regulation of venous reflux in the absence of valves. The Anatomical Record. 1999; 254:173-180.
10. Parke WW. Role of epidural and radicular veins in chronic back pain and radiculopathy. *Arthroscopic and Endoscopic Spinal Surgery*, Second Edition Text and Atlas. Humana Press, 2005. Pp. 151-165.
11. Ghoshal NG, Zguigal H. Dural sinuses in the pig and their extracranial venous connections. Am J Vet Res. 1986; 47:1165-1169.
12. Zguigal H and Ghoshal NG. Dural sinuses in the camel and their extracranial venous connections. Anat Histol Embryol. 1991; 20:253-260.
13. Groen RJM, Groenewegen HJ, van Alphen HAM, and Hoogland PVJM. Morphology of the human internal vertebral venous plexus: a cadaver study after intravenous araldite CY 221 injection. The Anatomical Record. 1997; 249:285-294.
14. De Kruijk J, Korten A, Boiten J, Wilmink J. Acute cauda equina syndrome caused by thrombosis of the inferior vena cava. J Neurol Neurosurg Psychiatry. 1999; 67:827-828.
15. Parke WW. Role of epidural and radicular veins in chronic back pain and radiculopathy. *Arthroscopic and Endoscopic Spinal Surgery*, Second Edition Text and Atlas. Humana Press, 2005. Pp. 151-165.
16. Geldof AA. Models for cancer skeletal metastasis: a reappraisal of Batson's plexus. Anticancer Research. 1997; 17:1535-1540.
17. Suzuki T, Kurokawa K, Okabe K, Ito K, and Yamanaka H. Correlation between the prostatic vein and vertebral venous system under various conditions. The Prostate. 1992; 21:153-165.
18. Kendall, DE. *Dao of Chinese Medicine.* New York: Oxford University Press, 2002. Pp. 149-158.
19. Maciocia G. The Channels of Acupuncture. Clinical Use of the Secondary Channels and Eight Extraordinary Vessels. Philadelphia: Churchill Livingstone/Elsevier, 2006.
20. Kendall, DE. *Dao of Chinese Medicine*. New York: Oxford University Press, 2002. Pp. 149-158.
21. Kendall, DE. *Dao of Chinese Medicine.* New York: Oxford University Press, 2002. Pp. 149-158.
22. Newcomer SC, Leuenberger UA, Hogeman CS, et al. Different vasodilator responses of human arms and legs. J Physiol. 2004; 556:1001-1011.

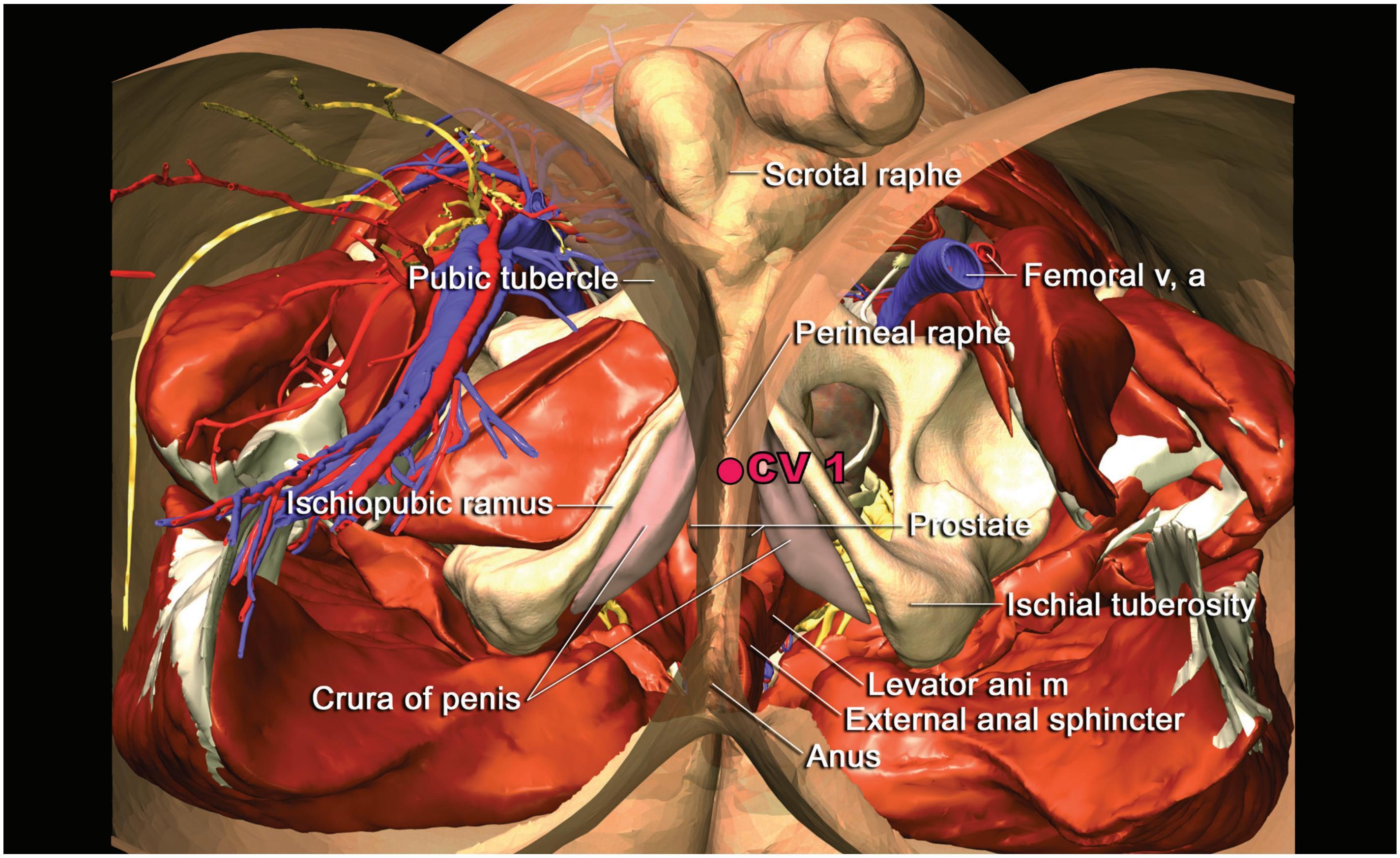
Channel 13:: The Conception Vessel (CV)

The Conception Vessel traverses the ventral midline from perineum to chin. Its central location provides neuromodulatory access to nerve fibers from the right and left sides of the body. The singular vessel it represents comprises the deep and inaccessible venae cavae.[1]

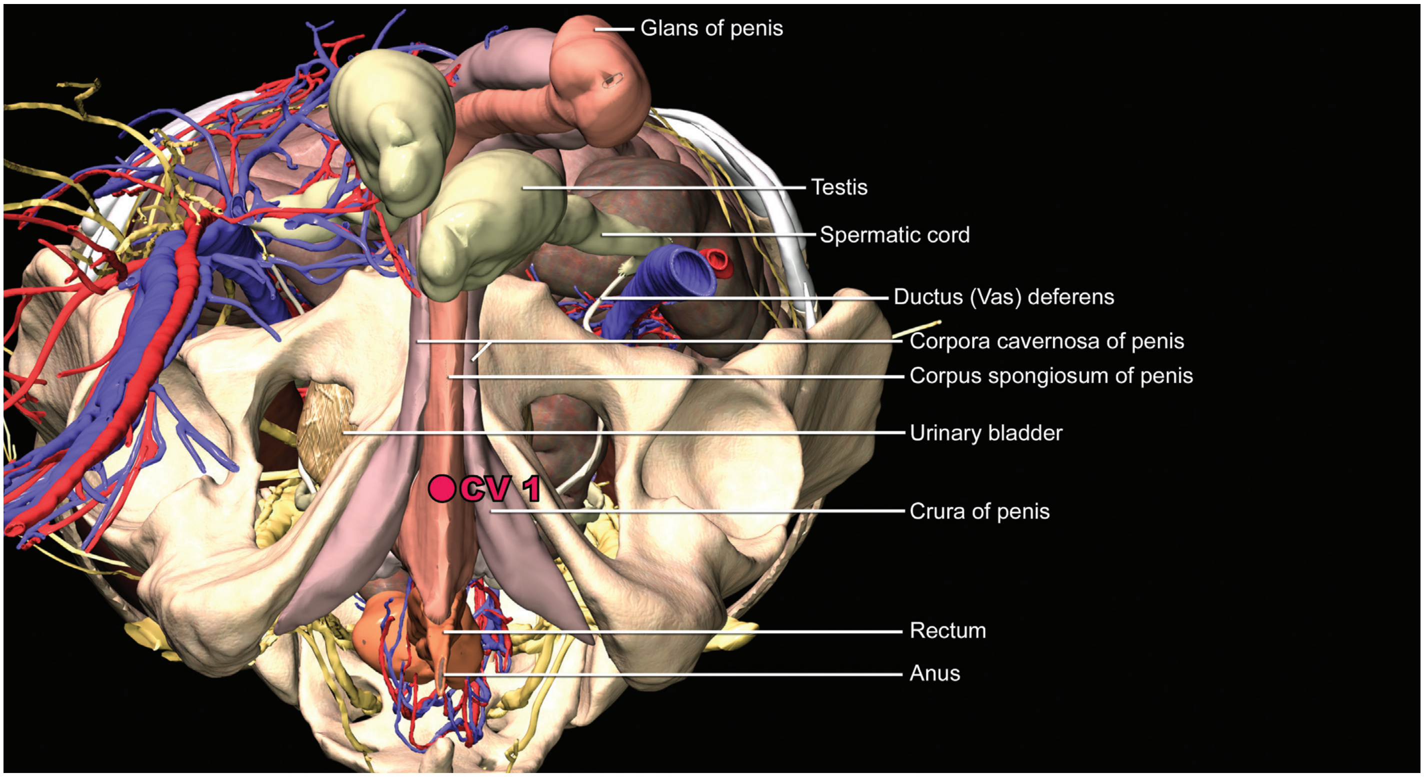

CV 24
CV 23
CV 22
CV 21
CV 20
CV 19
CV 18
CV 17
CV 16
CV 15
CV 14
CV 13
CV 12
CV 11
CV 10
CV 9
CV 8
CV 7
CV 6
CV 5
CV 4
CV 3
CV 2
CV 1


Conception Vessel (CV)
Inferior vena cava
CV 22
CV 21
CV 20
CV 19
CV 18
CV 17
CV 16
CV 15
CV 14
CV 13
CV 12
CV 11
CV 10
CV 9
CV 8
CV 7
CV 6
CV 5
CV 4
CV 3
CV 2
CV 1

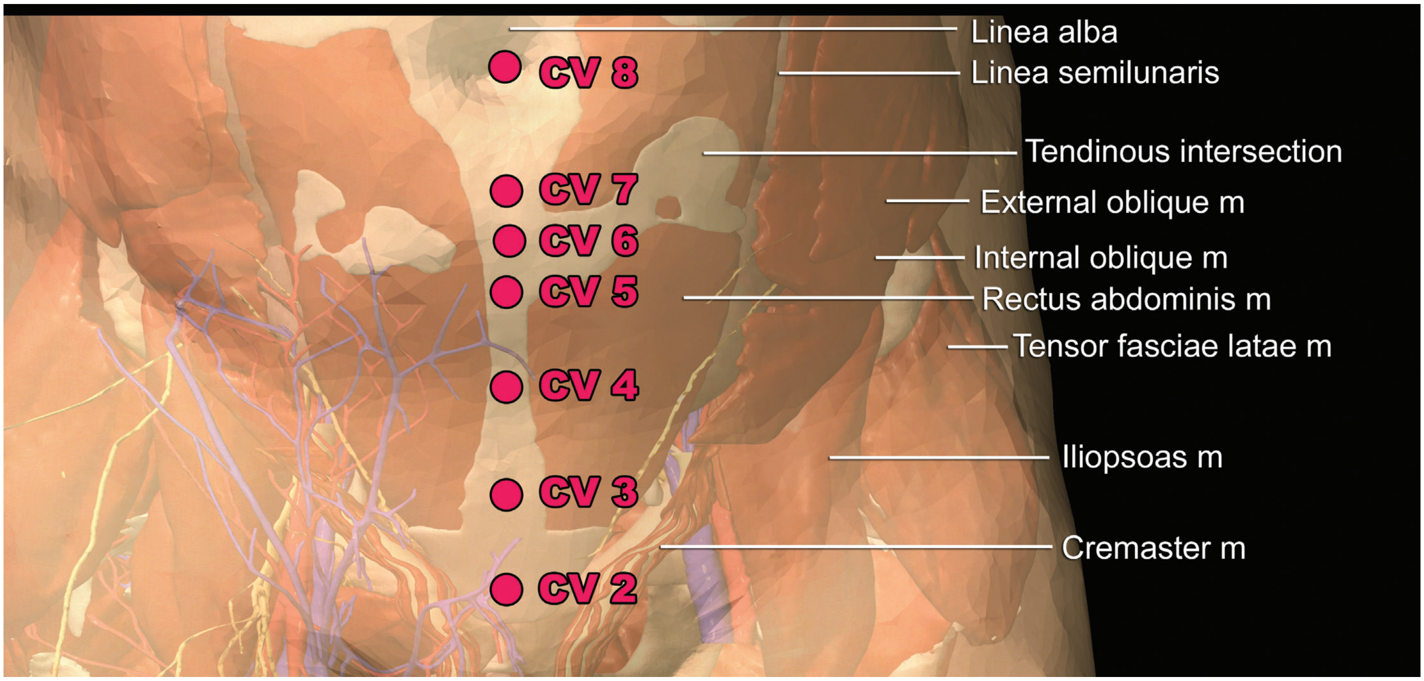
This overlay exposes the overlapping CV channel and vena cava (VC).


Scrotal raphe
Pubic tubercle
Femoral v, a
Perineal raphe
CV 1
Ischiopubic ramus
Prostate
Ischial tuberosity
Crura of penis
Levator ani m
External anal sphincter
Anus

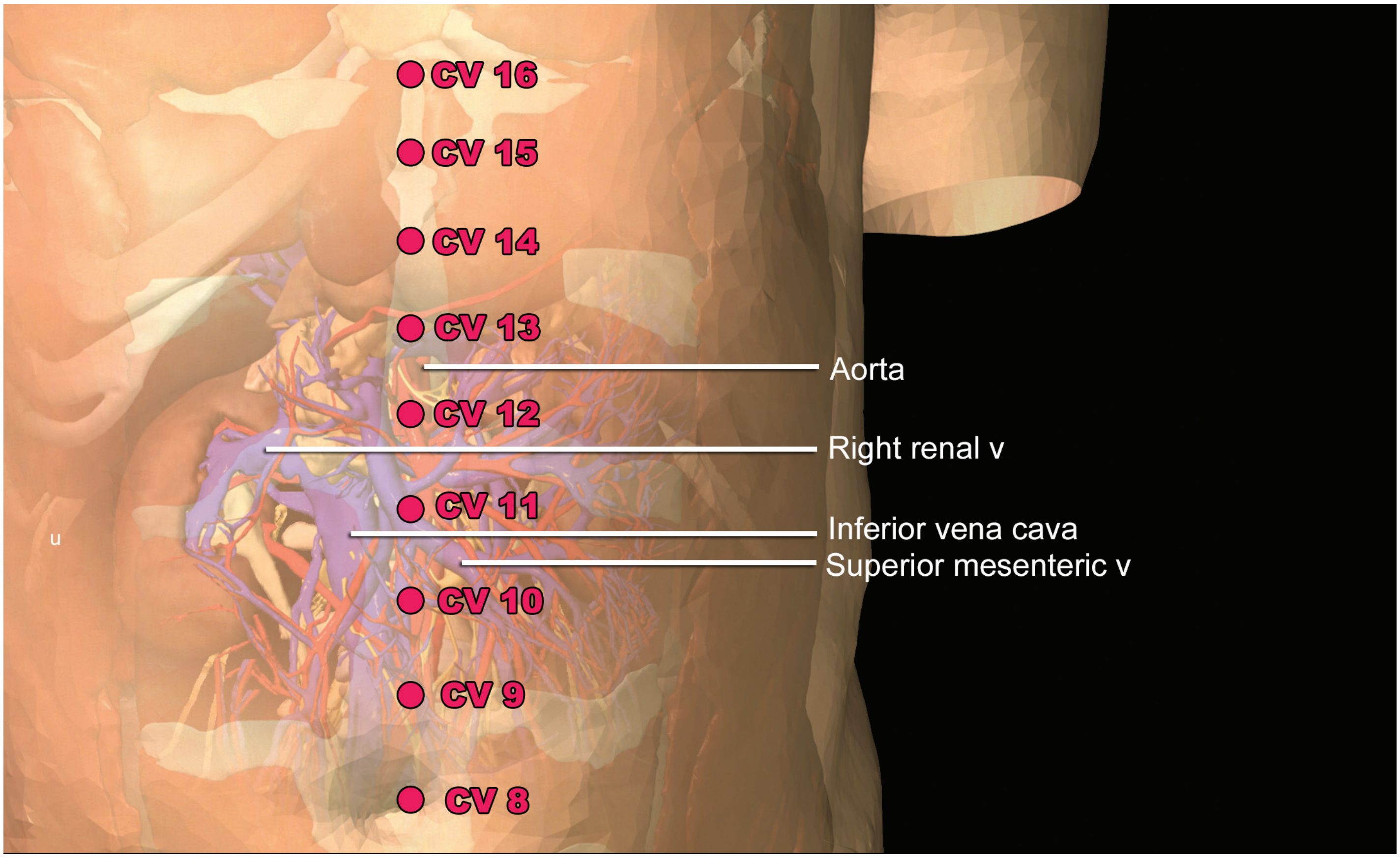
This view of the perineum shows how CV 1 lands within a needle's reach of several key nerves and vessels pertaining to genitourinary activity and anal retention. This image also illustrates the proximity of the prostate to CV 1. Surgery of the prostate may cause iatrogenic damage to nerves supplying the trigone, striated sphincter, bladder neck, and caudal urethra. Such injury risks inducing urinary incontinence. Should this occur, neuromodulation at CV 1 may lessens the symptoms of voiding dysfunction. In women, pelvic organ prolapse and stress incontinence may arise from myofascial dysfunction of the pelvic floor (also called the pelvic diaphragm). Acupuncture and related techniques applied to CV 1 may stimulate recovery of proper pelvic diaphragm biomechanics.


Glans of penis
Testis
Spermatic cord
Ductus (Vas) deferens
Corpora cavernosa of penis
Corpus spongiosum of penis
Urinary bladder
CV 1
Crura of penis
Rectum
Anus

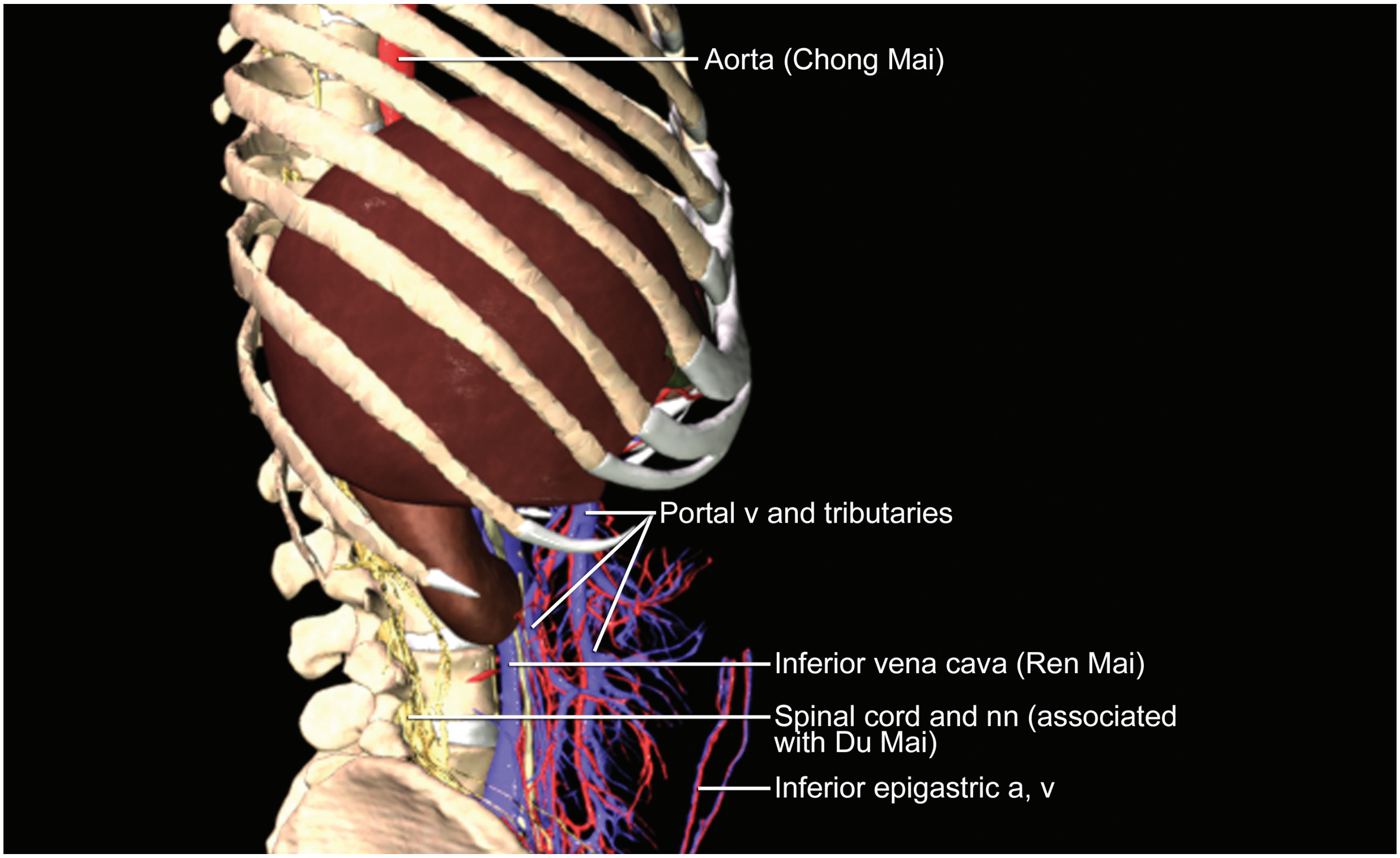
This view of the perineum provides a window into the pelvis. It exhibits the ventral rami of the sacral nerves as they exit the ventral sacral foramina. The pudendal nerve arises from the ventral rami of S2, S3, and S4. Superficial and deep branches of the pudendal nerve supply CV 1. The pudendal nerve divides into inferior rectal nerves, the perineal nerve, and the dorsal nerve of the penis or clitoris. In addition to supplying the external genitalia, the pudendal nerve courses to the urethral and anal sphincters, the scrotum, and both the bulbospongiosus and ischiocavernosus muscles. Contractions of these muscles participate in ejaculation and feelings of orgasm. Pudendal nerve damage after difficult childbirth or extensive bicycling can cause a temporary loss of function or persistent and painful neuralgia. Neuropathic, burning perineal pain may arise from compressed inferior cluneal nerves that course close to the perineum following the departure (branching off) of the posterior femoral cutaneous nerve.


Linea alba
CV 8
Linea semilunaris
Tendinous intersection
CV 7
External oblique m
CV 6
Internal oblique m
CV 5
Rectus abdominis m
Tensor fasciae latae m
CV 4
Iliopsoas m
CV 3
Cremaster m
CV 2

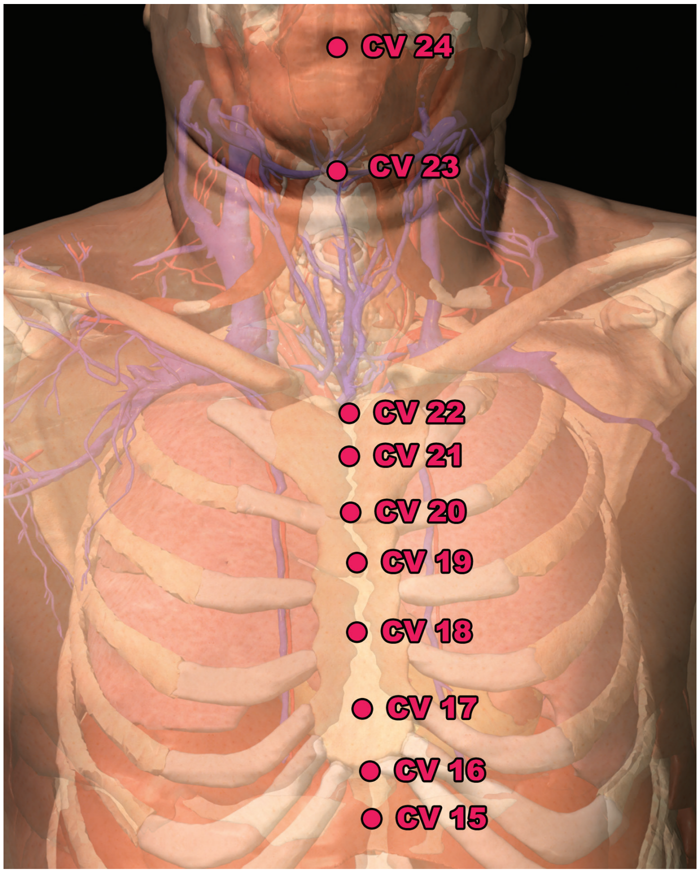
CV ascends the abdomen directly atop the linea alba on the muscle layer and sundry internal organs that deep needling may injure. There is no standard depth at which one places an acupuncture needles. Safe needling depths range from a few millimeters to several centimeters, depending on age, size, and adiposity of individuals.[2]



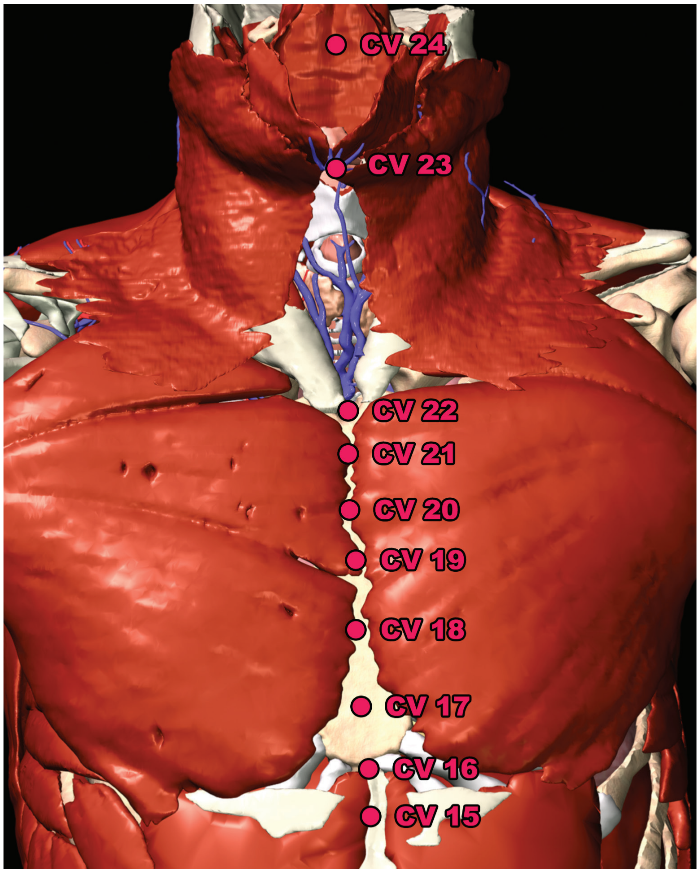
The inferior vena cava (IVC) and hepatic portal vein lie side by side in the abdomen. The hepatic portal vein arises from the confluence of the superior mesenteric vein (labeled in this image) and splenic veins. The portal vein of the liver collects poorly oxygenated and nutrient-dense venous blood from the abdominal gastrointestinal tract that includes the spleen, pancreas, and gallbladder. It empties this blood into the liver for processing. Following filtration and metabolic activities, the liver sends the blood onward and into the IVC via the hepatic veins. In contrast, the IVC, a "systemic" vein. carries deoxygenated blood from the caudal, non-digestive portions of the body into the right atrium of the heart. In cases of portal occlusion, portal hypertension, and cirrhosis, sites of venous juncture between the IVC and portal circulation may become engorged and exhibit varicosities. Varicosities develop in several sites, including the esophagus, rectum, paraumbilical region, and colon. Connections between systemic and portal systems at the esophagus involve the esophageal vein from the azygous (systemic) circulation where it links with the left gastric vein (portal). Hemorrhoids form where rectal veins dilate as the inferior and middle rectal veins (IVC-systemic) intersect with the superior rectal vein on its way to the inferior mesenteric vein (part of the portal venous system). The "caput medusa" develops in the paraumbilical region where anastomosing veins enlarge and radiate away from the umbilicus (CV 8) as the ligamentum teres (the obliterated umbilical vein) and median umbilical ligament join the superficial, superior, and inferior epigastric system (systemic). Finally, venous twigs draining the colon (portal) mingle with systemic retroperitoneal veins. Acquired obstruction of the IVC from cancer or thrombosis prompts the opening of one or more collateral venous circulation pathways. Four major routes offer alternative avenues through which blood from the pelvic limbs and pelvis returns to the heart. A deep pathway leads through the ascending lumbar veins and azygous system, including the intravertebral, paraspinal, and extravertebral plexuses. Another pathway takes blood through the periuretic plexus and left gonadal vein to the left renal vein, with the left side predominating because blood fails to flow as fluidly through the right side. The right gonadal vein empties into the infrarenal IVC which might be blocked by a thrombus. One superficial collateral route connects the external iliac veins with the superior epigastric and internal mammary veins. Blood drains into the subclavian veins and finally the superior vena cava. Another superficial path brings blood from the circumflex iliac veins to the superficial epigastric veins, anastomosing with the lateral thoracic veins and axillary veins through the thoracoepigastric vessels. Finally, venous blood from the pelvic limbs may take a retrograde course through the internal iliac veins and into the hemorrhoidal plexus. From there, it ascends into the inferior mesenteric vein, the splenic vein, and into the portal vein.[3]


Aorta (Chong Mai)
Portal v and tributaries
Inferior vena cava (Ren Mai)
Spinal cord and nn (associated with Du Mai)
Inferior epigastric a, v

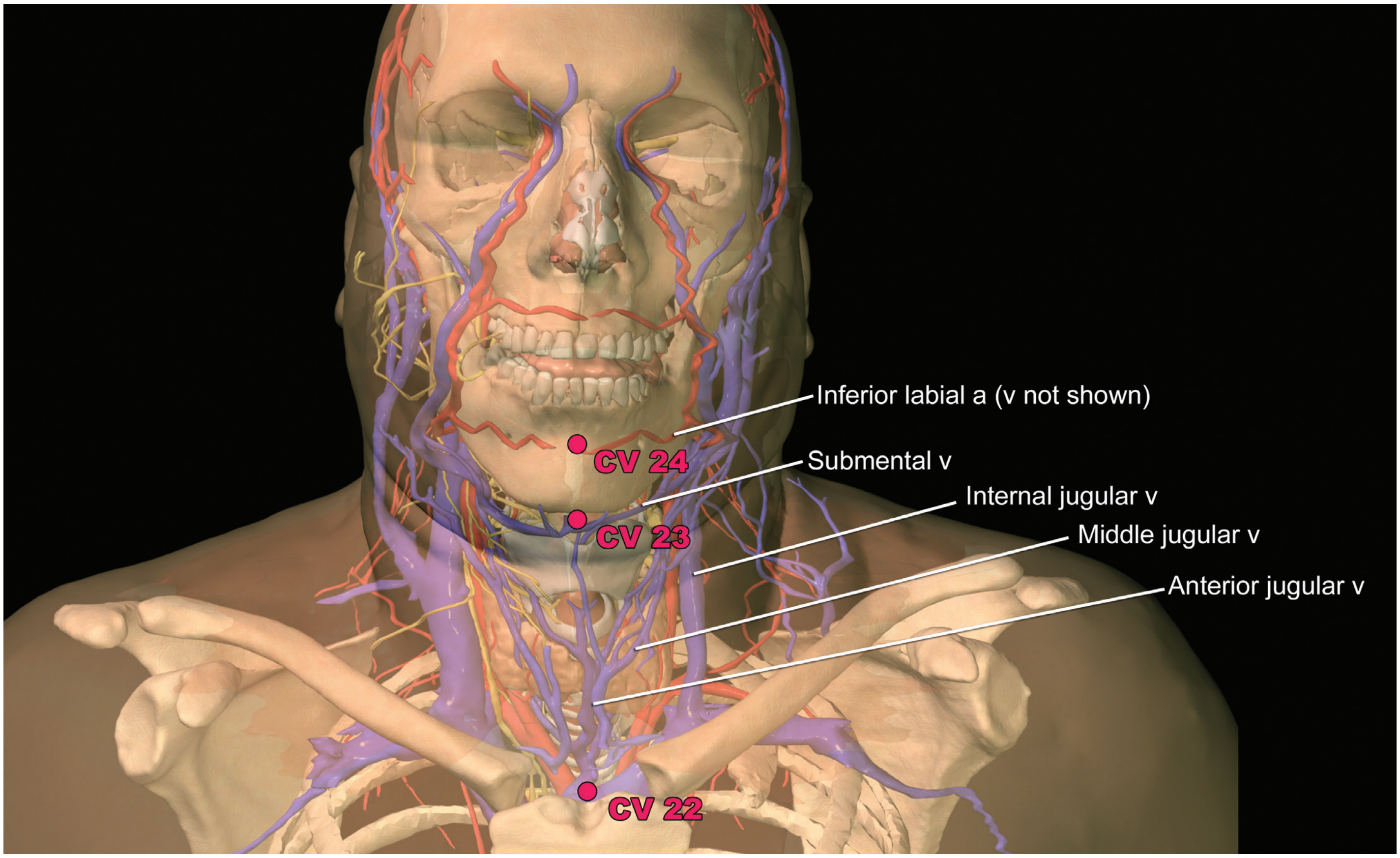
The IVC travels next to the spine and anastomoses with the azygous venous system and epidural venous plexuses. As such, CV and GV, or the caval and azygous/epidural venous systems respectively, communicate and allow blood to redirect its course back to the heart if the usual avenues are blocked. When caval obstruction occurs, due to acquired or congenital (anomalous) blockade, the azygous system then must accommodate the massive blood volume that the IVC would ordinarily have accomodated. This additional avenue of collateral circulation comprises the retroperitoneal and vertebral plexuses, the ascending lumbar veins, and the paravertebral veins which then drain into the azygous and hemiazygous system. On occasion, the testicular and ovarian veins participate in providing parallel pathways.[4] This image illustrates the aorta (Chong Mai), vena cava (CV), and spinal nerves that relate indirectly to the epidural venous plexus (GV).



Veins traversing the anterior chest and abdominal wall contain valves that impel blood toward the midline and the anastomotic venous network interlacing over the sternum.[5] From CV 15 to CV 22, the suprasternal venous network adjoins with the internal thoracic (formerly, mammary) veins and, through those conduits, the brachiocephalic veins.



Pectoral fascia overlying the sternum connects the right and left pectoralis major muscles. This view illustrates the way in which septae of the pectoralis major muscle insert onto the sternum. From a functional perspective, separation of the muscle fibers into individual insertions sets the stage for zonal activation of certain septae. In other words, depending on the movement required, differential activation of portions of the muscle allows for finer motor control along with more precise movements.[6]



The superior vena cava receives venous drainage from the face and neck by means of the internal and external jugular veins. The CV channel ends below the lip at the inferior labial vein (only the artery appears in this image).

References

1. 1. Kendall DE. *Dao of Chinese Medicine*. Hong Kong: Oxford University Press, 2002. Pp. 154-155.
2. Chen H-N et al. The therapeutic depth of abdominal acupuncture points approaches the safe depth in overweight and in older children. *Journal of Alternative and Complementary Medicine*. 2009;15(9):1033-1037.
3. Sonin AH, Mazer MJ, and Powers TA. Obstruction of the inferior vena cava: a multiple-modality demonstration of causes, manifestations, and collateral pathways. *Radiographics*. 1992;12:309-322.
4. Jones VS and Shun A. Is the inferior vena cava dispensable? *Pediatr Surg Int*. 2007;23:885-888.
5. Taylor GI, Caddy CM, Watterson PA, and Crock JG. The venous territories (venosomes) of the human body: experimental study and clinical implications. *Plastic and Reconstructive Surgery*. 1990;86(2):185-213.
6. Stecco A, Macchi V, Masiero S, et al. Pectoral and femoral fasciae: common aspects and regional specializations. *Surg Radiol Anat*. 2009;31:35-42.

CV 1

Hui Yin "Meeting of Yin"

In the center of the perineum, midway between the anus and the caudal border of the scrotum in males, or between the anus and the caudal labial commissure in females.

Caution: Deep needling at CV 1 may injure portions of the penis in males.

Fascial Entity

- **Perineal body:** A pyramid-shaped, fibromuscular mass that contains collagenous fibers and elastic fibers, nerve endings, and both smooth and skeletal muscle. Provides an attachment site for the perineal muscles, including the bulbospongiosus muscle, the external anal sphincter, and the superficial and deep transverse perineal muscles. The rectum also attaches to the perineal body, as do vaginal slips from the pubococcygeus and the anal sphincter.

Clinical Relevance: The perineal body is a vital component of the pelvic floor.[1] Weakening of the perineal body predisposes women to rectocele and enterocele.

Muscles

- **Bulbospongiosus muscle:** Supports the perineal body. In males, it assists erection by compressing outflow veins and pushing blood into the penis. It also compresses the bulb of the penis after ejaculation to expel the final drops of urine or semen. In females, it supplies the sphincter of the vagina and assists in clitoral erection.
- **Superficial and deep transverse perineal muscles:** Help support the abdominopelvic organs and assist them in resisting increased intra-abdominal pressure. Supports the perineal body or pelvic floor.

Clinical Relevance: In women, pelvic organ prolapse and stress incontinence may result from myofascial dysfunction and weakness of the pelvic floor (also called the pelvic diaphragm). Acupuncture and related techniques applied to CV 1 along with appropriate exercises may improve pelvic diaphragm biomechanics.

In men, contraction of the bulbospongiosus and ischiocavernosus muscles contributes to ejaculation and sensations associated with orgasm.

Nerves

- **Perineal nerve:** A branch of the pudendal nerve. Supplies the bulbospongiosus, ischiocavernosus, superficial and deep transverse perineal muscles, and the external urethral sphincter muscles.
- **Pudendal nerve (S2-S4):** The main nerve of the perineum, the pudendal nerve supplies its skin and muscles; as such, it supplies sensation to the lower vagina, vulva, and perineum as well as motor innervation to the perineal muscles. It is also the main sensory nerve of the external genitalia in males.

Parasympathetic and sympathetic nerve fibers proceed to the

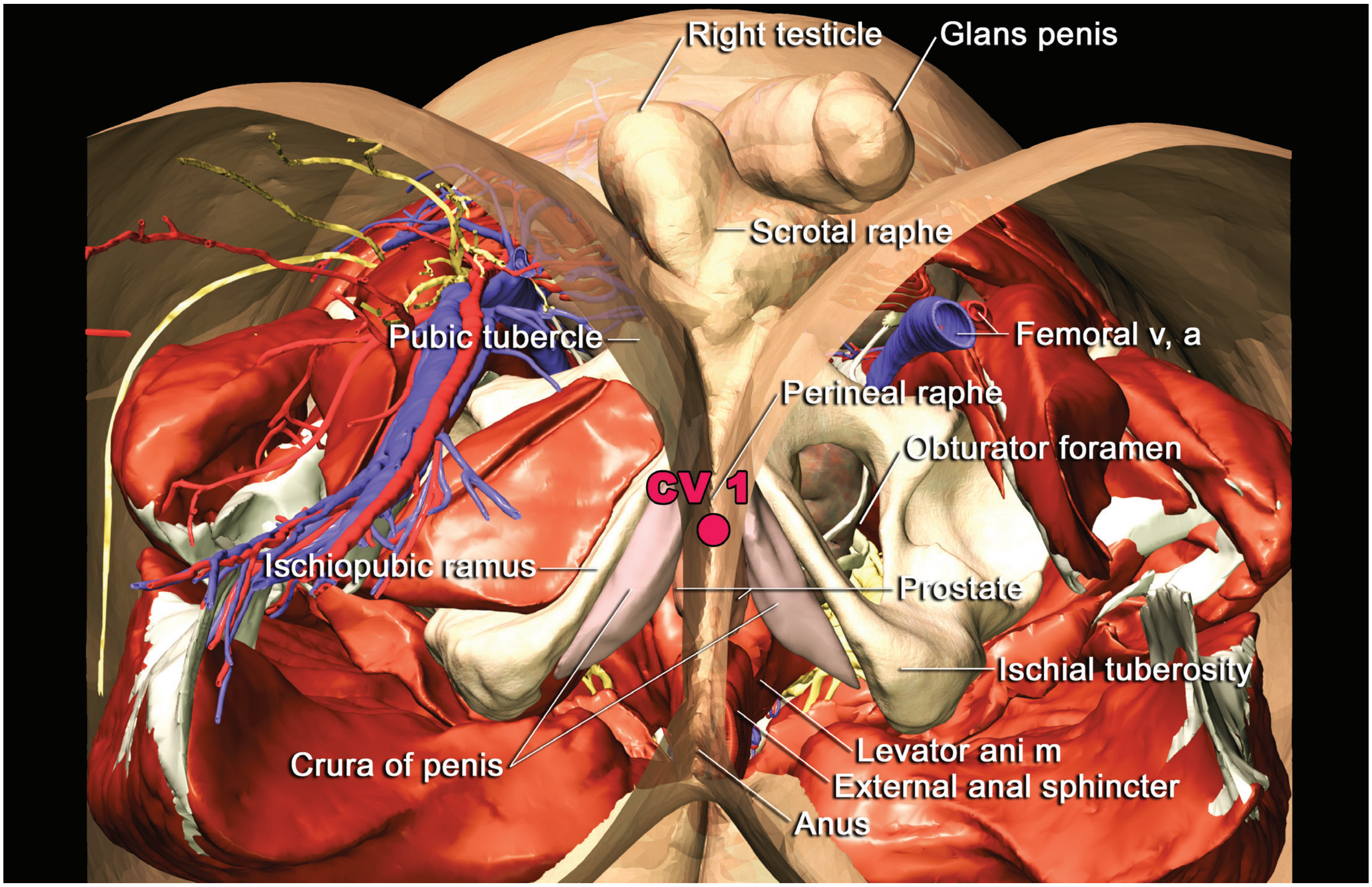


Figure 13-1. CV 1, in males, overlies a portion of the penis in males. Deep needling can traumatize the urethra as suggested by this perineal perspective.

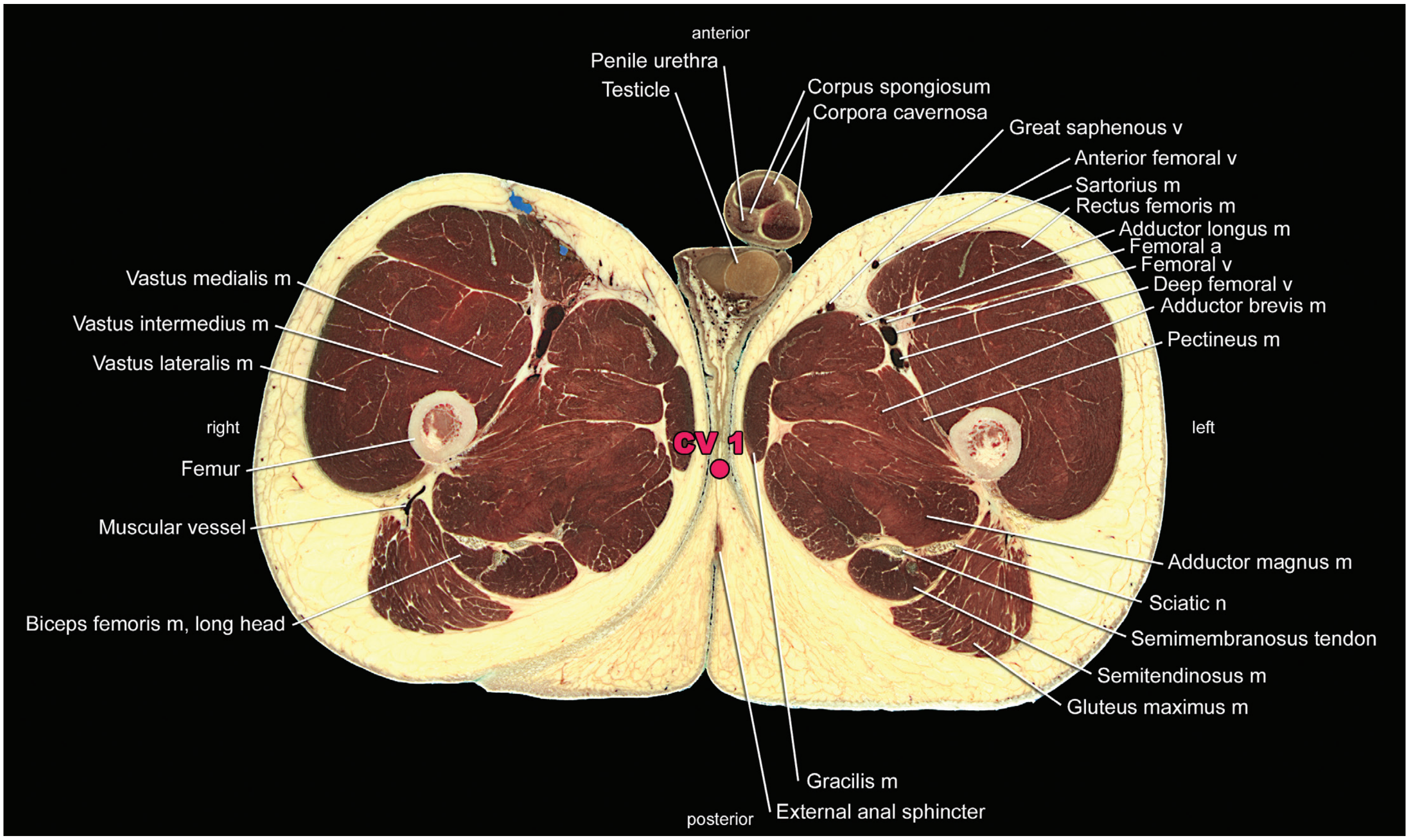

anterior
Penile urethra
Testicle
Corpus spongiosum
Corpora cavernosa
Great saphenous v
Anterior femoral v
Sartorius m
Rectus femoris m
Adductor longus m
Femoral a
Femoral v
Deep femoral v
Adductor brevis m
Pectineus m
Vastus medialis m
Vastus intermedius m
Vastus lateralis m
right
left
CV 1
Femur
Muscular vessel
Biceps femoris m, long head
Adductor magnus m
Sciatic n
Semimembranosus tendon
Semitendinosus m
Gluteus maximus m
Gracilis m
External anal sphincter
posterior

Figure 13-2. CV 1, the "Meeting of Yin", lands at the intersection of the singular vessels, CV, GV, and Chong Mai. At CV 1, conduits associated with these channels involve, for CV, the internal iliac vein; for GV, the vertebral venous plexus, and for Chong Mai, the aorta. Connections to the aorta at CV 1 include the internal iliac, internal pudendal, and inferior rectal arteries. This cross section indicates the position of CV 1 on the perineum, the most "yin" or caudal point on the pelvis and entire trunk.

erectile tissue, glands, and blood vessels of this region, coursing alongside the blood vessels and pudendal nerve branches on their way to the perineum.

- **Genitofemoral nerve (L1,L2):** Supplies motor innervation to the cremaster muscle as well as sensation to the posterolateral scrotum in the male or posterolateral labia majora in the female.
- **Perineal ramus or medial inferior cluneal branch of the posterior femoral cutaneous nerve (S1-S3):**[3] Provides cutaneous sensation to the proximal medial thigh. Communicates with the caudal anal nerves and dorsal scrotal nerves.

Clinical Relevance: Superficial and deep branches of the pudendal nerve supply CV 1. The pudendal nerve divides into inferior rectal nerves, the perineal nerve, and the dorsal nerve of the penis or clitoris. In addition to supplying the external genitalia, the pudendal nerve innervates the urethral and anal sphincters, the scrotum, along with the bulbospongiosus and ischiocavernosus muscles. These muscles contract during ejaculation/orgasm. Pudendal nerve damage after difficult childbirth, reconstructive surgery or extended bicycling (e.g., spin class)[11] can cause a temporary loss of function or persistent and painful neuralgia. Pudendal neuropathy produces a sensation of heaviness or burning along the route it traverses. It may cause the patient to feels as though the vagina or rectum contains foreign bodies; sitting worsens the condition.[2]

Neuropathy of the perineal ramus or medial inferior cluneal branch of the posterior femoral cutaneous nerve causes a burning type of perineal pain of the scrotum or labiae majorae, lateral aspect of the anal margin, caudal portion of the buttock, and proximodorsal portions of the thigh. Clunalgia worsens when sitting on a hard surface when the nerve becomes compressed between the ischial bone and the hamstring group of muscles. In contrast, pudendalgia only involves the perineum (penis, anus, and clitoris) and worsens when a bicycle seat or similar structure compresses soft tissues of the perineum.

Surgery of the prostate may cause iatrogenic damage to nerves supplying the trigone, striated sphincter, bladder neck, and caudal urethra. Urinary incontinence may result; if so, neuromodulation at CV 1 may lessen symptoms of voiding dysfunction.

Vessels

- **Perineal artery:** Distributes to the superficial perineal muscles and the scrotum.
- **Perineal vein:** Drains blood from the external genitalia.

Clinical Relevance: Iatrogenic injury of the perineal vessels may follow procedures such as penile implantation.[12]

Indications and Potential Point Combinations

- **Prostate problems:** CV 1, GV 1, BL 34, SP 6.
- **Uterine prolapse:** CV 1, CV 4, GV 20, BL 32.
- **Hemorrhoids:** CV 1, GV 1, BL 35, BL 54, and BL 57.[4,5]

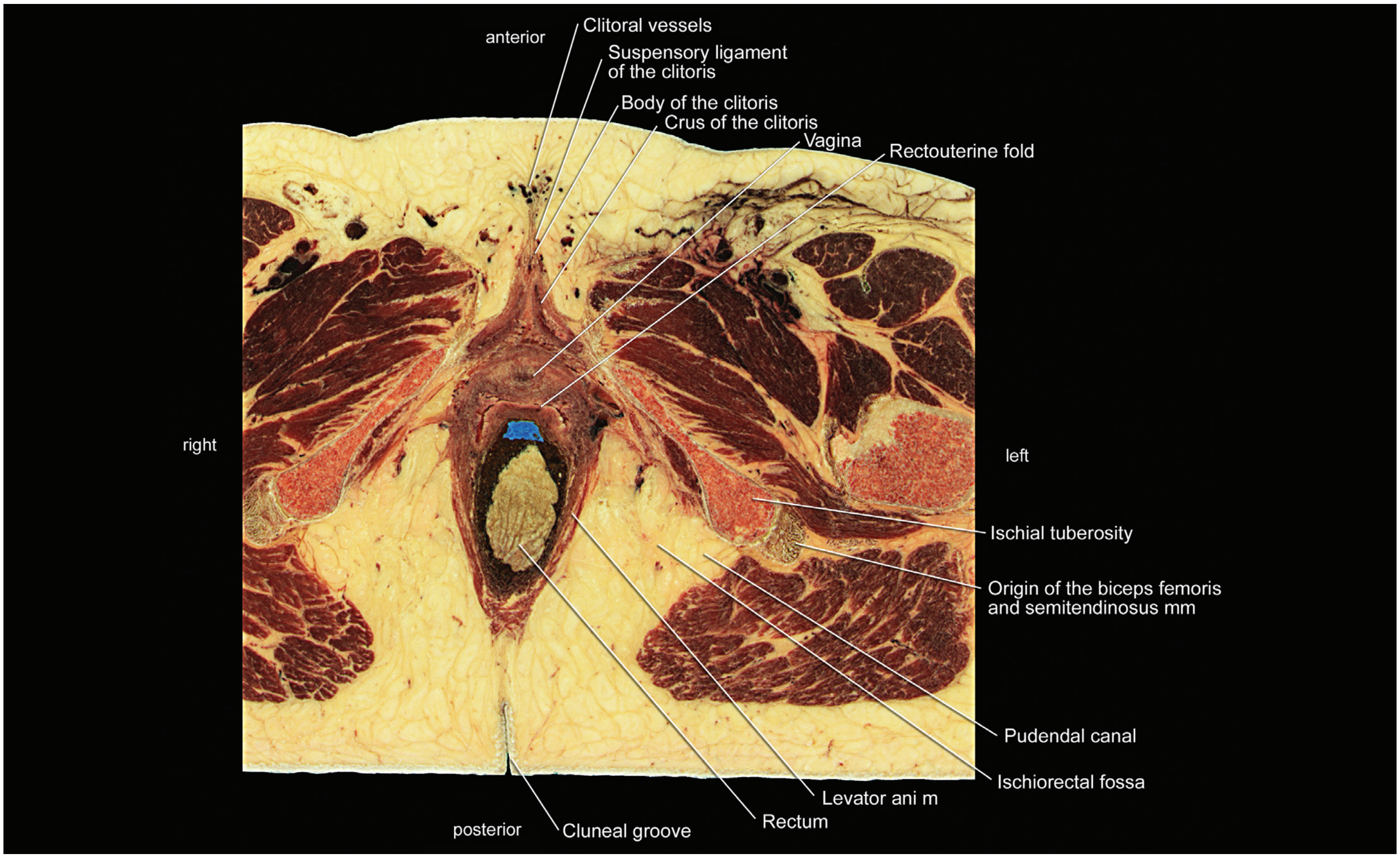


Figure 13-3. CV 1 resides between the rectum and vagina in the female. This cross section depicts the structures located just cranial, or superior, to CV 1.

- **Anal pruritus:** CV 1, GV 1, GV 2, BL 35, BL 57.
- **Scrotal, anal, or penile pain:** CV 1, GV 1, BL 35, BL 36, BL 57. Consider trigger points in the sphincter ani muscle, as they refer a poorly localized, aching pain around the anal region and produce pain upon defecation.
- **Erectile dysfunction due to trigger points in the sphincter ani muscle:** CV 1, GV 1.
- **Dyspareunia during entry in women:** CV 1, GV 1.
- **Genital herpes:** CV 1, LR 9.
- **Enuresis, urinary retention or incontinence:** CV 1, CV 3, CV 4, KI 3, SP 6, BL 23, BL 32.
- **Loss of consciousness:** CV 1, HT 9, GV 20, Yintang.

Evidence-Based Applications

- Neuroanatomically, CV 1 likely benefits **sexual muscle function** by its proximity to the perineal nerve.[6]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with persistent **sensory urgency** after **transurethral resection of the prostate.**[7]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[8]
- Chinese drug injection at CV 1, CV 4, and LR 10 led to improvements in functional and arterial low-level blood supply **erectile dysfunction** in a Chinese research trial.[9]
- Points affecting **ovarian function** in rats with experimentally induced inflammation of the ovary included CV 4, Zigong (EX-CA 1, lateral to SP 13), BL 23, GV 4, GV 1, CV 1, SP 6, ST 36, CV 12, BL 18, and GV 4.[10] Of these, CV 4, Zigong (EX-CA 1), BL 23, and GV 4 delivered the most impact.

References

1. Herschorn S. Female pelvic floor anatomy: the pelvic floor, supporting structures, and pelvic organs. *Rev Urol.* 2004; 6(suppl 5):S2-S10.
neuralgia with pulsed radiofrequency. *Pain Physician.* 2009;12:633-638.
3. Darnis B, Robert R, Labat JJ, et al. Perineal pain and inferior cluneal nerves: anatomy and surgery. *Surg Radiol Anat.* 2008;30:177-183.
4. Zhang Y. The needling technique and clinical application of point Zhibian. *J Tradit Chin Med.* 2004;24(3):182-184.
5. Zhao K and Zhao F. Clinical application of Chengshan (UB 57) acupoint. *J Tradit Chin Med.* 1991;11(1):11-13.
6. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
7. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.
8. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
9. Cui Y, Feng Y, Chen L, et al. (Chinese) Randomized and controlled research of Chinese drug acupoint injection therapy for erectile dysfunction. *Zhongguo Zhen Jiu.* 2007;27(12):881-885.
10. Wang SJ and Zhu B. (Chinese) Study on relation of ovary-body surface correlativity with acupoints. *Zhongguo Zhen Jiu.* 2007;27(10):761-765.
11. Romanzi L. Techniques of pudendal nerve block. *J Sex Med.* 2010;7:1716-1719.
12. Hsu G-L, Hsieh C-H, Wen H-S, et al. Outpatient penile implantation with the patient under a novel method of crural block. *International Journal of Andrology.* 2004;27:147-151.

CV 2

Qu Gu "Curved Bone"

On the anterior midline, just above the pubic symphysis, 5 cun below the umbilicus.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois.

Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

- **Rectus sheath:** A bilaminar fibrous aponeurotic extension of the three transverse abdominal muscles (external oblique, internal oblique, and transversus abdominis), the rectus sheath encases the rectus abdominis muscle on both sides, from ribs to pelvis. It fuses in the midline to become the linea alba along which the CV channel courses.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may cause acute abdominal pain in older children. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[11] Congenital anomalies that impair obliteration of the conduit include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus likely require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

Nerves

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[12]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region. Supplies the skin of the hypogastric region and iliac crest. Also supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve is the first nerve of the lumbar plexus.[13] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or caudal to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.
- **Ilioinguinal nerve (L1, occasionally with T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus, depending on the gender of the individual. The ilioinguinal nerve is involved in the afferent limb of the cremasteric reflex, along with the genitofemoral nerve (L1, L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[14]
- **Thoracoabdominal nerves (T7-T12), ventral rami:** In the paravertebral region, the thoracic mixed autonomic, sensory, and motor nerves divide into a large ventral ramus and a smaller dorsal ramus in the paravertebral spaces.

Clinical Relevance: Neuroanatomically, CV 2 supports circulation and neural input to the external genitalia presumably via its association with the iliohypogastric and ilioinguinal nerves from L1.[6] Further, preganglionic sympathetic neurons supplying the reproductive organs arise from the spinal cord segments T11-L2, demonstrating central nervous system overlap of nerve origins.[7] Sympathetic axons from lumbar spinal segments travel to the pelvic plexus by way of the inferior mesenteric plexus and

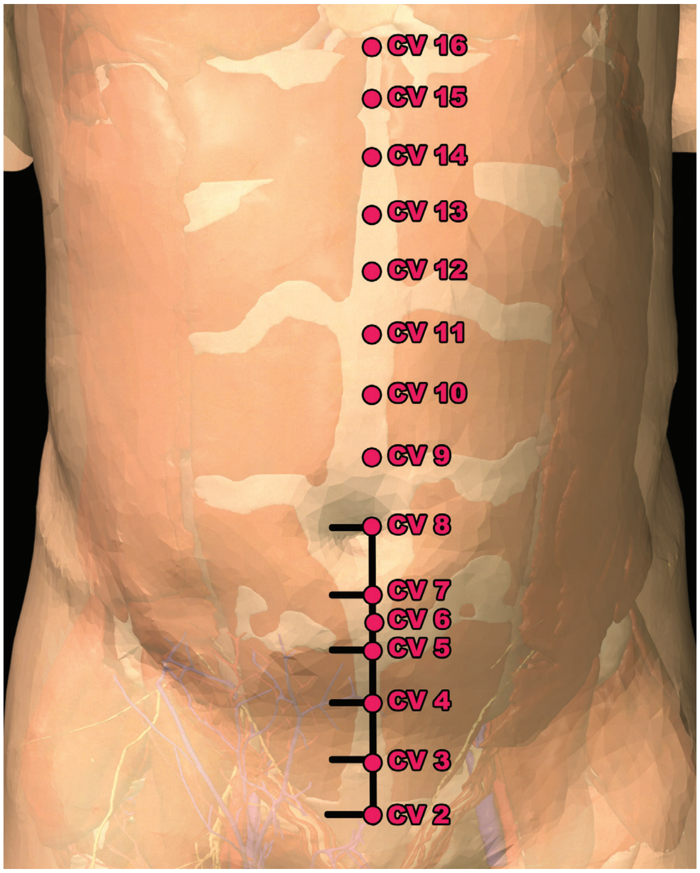


Figure 13-4. One demarcates the location of CV points on the abdomen by means of proportional measurements, as this area lacks distinct topographical features. CV 2, just cranial to the "Curved Bone" or pubic symphysis, begins a line that measures 5 cun to the umbilicus, indicated here.

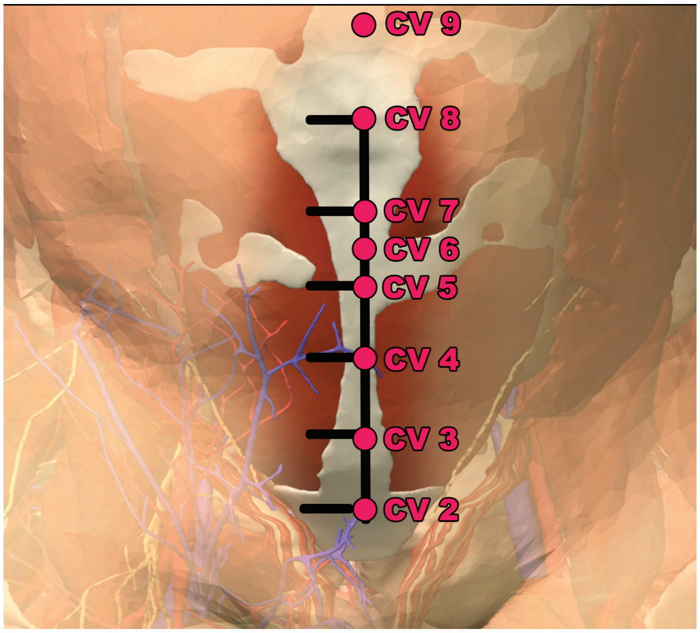


Figure 13-5. The CV line follows the linea alba, shown here as the "white line" beneath the points, from pubis to xiphoid process. This segment, between CV 2 and CV 8, overlies the median urachal ligament, a vestigial remnant of the embryonic urachus.

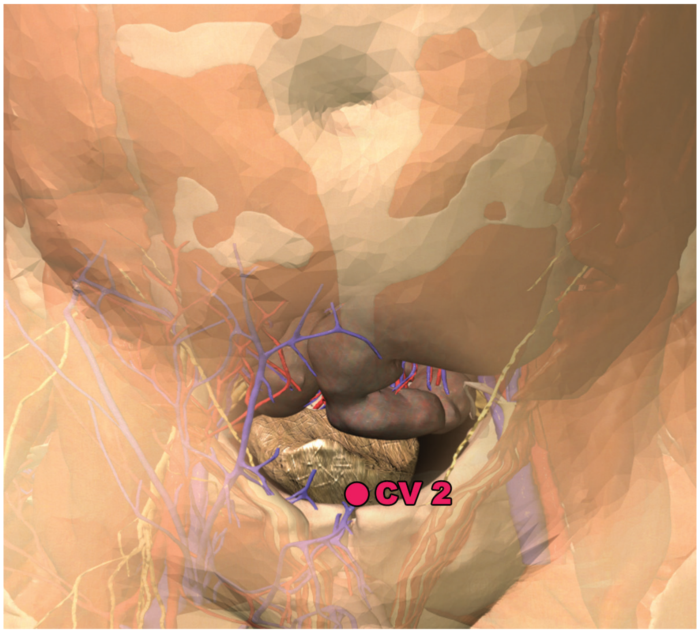


Figure 13-6. Trigger points in the vicinity of CV 2 may provoke symptoms of a urinary tract infection. Conversely, urinary disorders can cause discomfort in the caudal abdomen, from about CV 2 to CV 5. Note the bladder's location deep to CV2, appearing as a fibrous-looking structure, just cranial to the "Curved Bone" (CV 2's descriptive title) of the pelvic rim. Figure 13-7 shows the relationship of the urinary bladder to the pubic symphysis in cross section.

hypogastric nerves. In the pelvic plexus, they synapse on postganglionic sympathetic neurons that project to the genitalia. Axons of preganglionic sympathetic neurons destined for the genitalia originate in lower thoracic spinal cord segments and travel caudad within the sympathetic chain to become postganglionic after synapsing in the S2 through S4 sacral ganglia. Postganglionic axons join the pudendal nerve to supply the genitalia.

Entrapment of the ilioinguinal and iliohypogastric nerves can cause chronic, lower abdominal pain. Injection of local anesthetic relieves the pain, suggesting that acupuncture and related techniques could provide relief as well.

The iliohypogastric nerve communicates extensively with the subcostal and ilioinguinal nerves. The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[15] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

Nerves of the ventromedial abdominal wall form extensive communications within the transversus abdominis muscle plane, between the internal oblique muscle and the transverse abdominis muscle.[16] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from the plexuses run in a cranio-caudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively. The variability in spinal nerve origins for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy.

Crosstalk among nerves of the abdominal wall impacts anesthetic procedures such as nerve blocks and neuromodulatory approaches, including acupuncture and related techniques. For example, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually neuromodulate several spinal cord segments rather than only one level, thereby extending the treatment's impact more broadly.

Incisions often occur along the linea alba; i.e., the CV line. Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[17] Entrapment of thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[18] Nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction compress their turning points. Entrapment of an anterior branch of a spinal nerve within the rectus abdominis muscle or sheath produces pain in the lower abdomen and pelvis that sometimes simulates gynecologic disease in female patients. In men, entrapped cutaneous abdominal nerves can provoke penile pain. Scars increase the risk of nerve entrapment. Acupuncture may benefit these patients by releasing tension in the tissues and freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[19] Paresis of the abdominal wall can lead to mechanical complaints as well. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation unless the nerves were severed completely. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also be addressed with neuromodulation, in addition to adjunctive abdominal support and multimodal analgesia.

Vessels

- **Superficial (inferior) epigastric artery:** Supplies the subcutaneous tissue and skin in the area superior to the pubis.
- **Inferior (deep) epigastric artery:** Supplies the rectus abdominis muscle and the medial portion of the anterolateral abdominal wall. A branch of the external iliac artery. Anastomoses with the superior epigastric artery within the rectus sheath near the umbilicus.
- **Superficial (inferior) epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior (deep) epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. Collateral venous connections provide alternate routes for venous return from the lower extremities, by bypassing an obstructed or ligated inferior vena cava. Venous blood instead drains into the internal thoracic, subclavian and brachiocephalic veins and, from there, into the superior vena cava.
- **Superficial external pudendal artery:** A branch of the femoral artery, the superficial external pudendal artery crosses the spermatic cord and supplies the skin on the lower abdomen, the penis, and scrotum. The superficial external pudendal artery anastomoses with branches of the internal pudendal artery. The deep external pudendal artery also arises from the femoral artery, but in contrast to its superficial counterpart, passes across the pectineus and adductor longus muscles to supply the skin of the scrotum and perineum. The deep external pudendal artery anastomoses with scrotal branches of the perineal artery.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[20] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[21]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation., the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava.

Circulation to CV 2 increased with acupressure to SP 6 in college students with dysmenorrhea.[22] This suggests that tibial and saphenous nerve activation at SP 6 improves blood flow in the pelvis and that both neuromodulation and circulatory changes confer the benefits expected by treatment of SP 6.

Indications and Potential Point Combinations

- **Genitourinary or gynecologic problems:** CV 2, CV 3, CV 4, SP 6, BL 32, BL 34, BL 23 plus others as necessary to address specific neural pathways.
- **Distended abdomen:** CV 2, CV 12, ST 25, ST 36, BL 25.
- **Chronic lower abdominal pain:** Consider abdominal cutaneous nerve entrapment, iatrogenic peripheral nerve injury, or myofascial pain syndrome in addition to intraabdominal pathology.[1]
- **Osteitis pubis:** CV 2, KI 11.[2]
- **Penile pain:** Consider rectus abdominis and puborectalis/pubococcygeus trigger points and target accordingly, including CV 2.[3]

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[4]
- Acupuncture reportedly benefited patients with **urinary retention** in a Chinese clinical trial with the following points: CV 2, CV 3, CV 4, SP 6, SP 9, BL 23, BL 28, BL 32, and BL 39.[5]
- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with persistent **sensory urgency after transurethral resection of the prostate**.[8]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[9]
- Acupuncture at CV 2, CV 3, EX-CA 1 (lateral to SP 13), ST 25, and ST 28 benefited women with **uterine disorders.**[10]

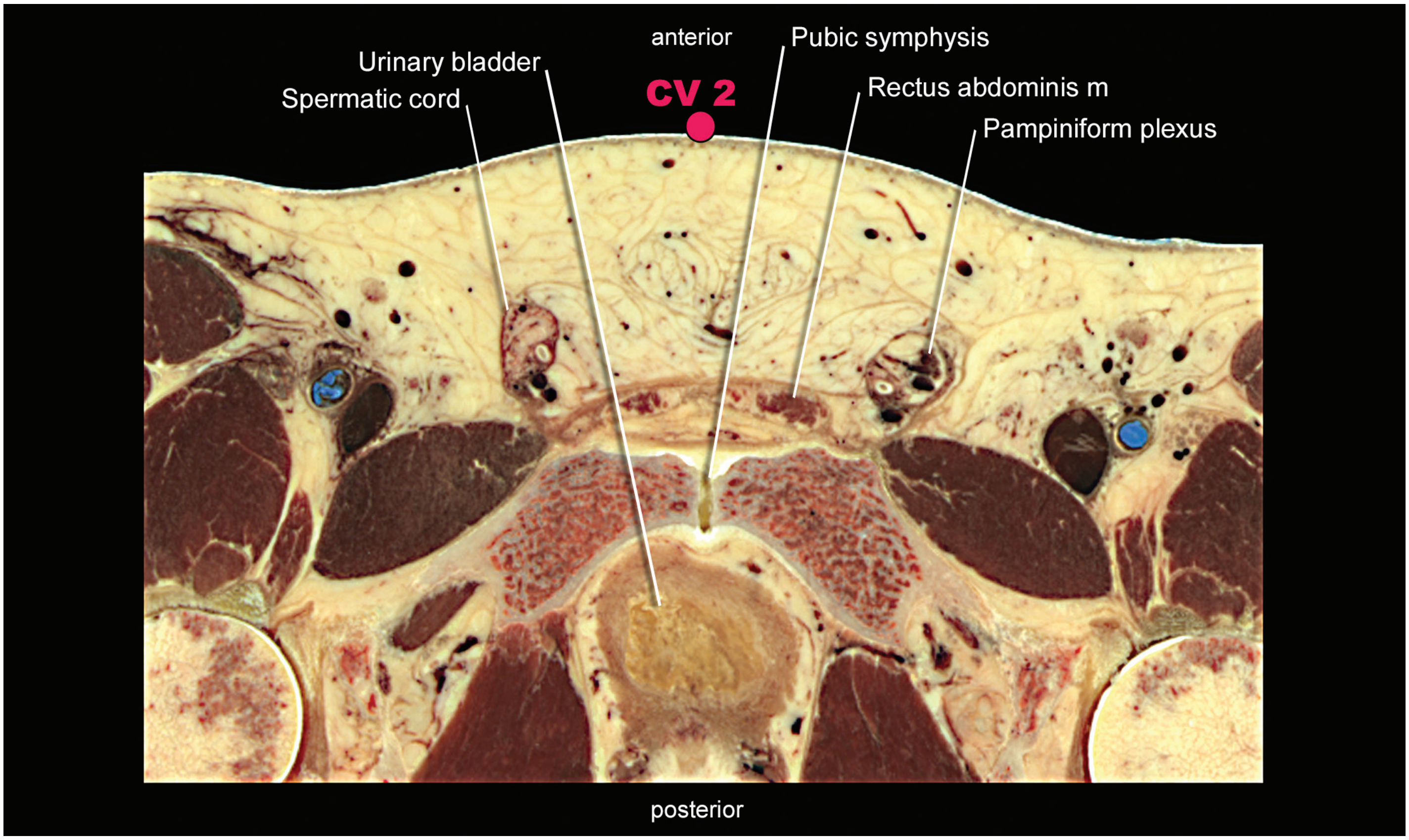


Figure 13-7. (Male pelvis) Somatovisceral and viscerosomatic reflexes can confuse clinical pictures, as trigger points may cause symptoms of genitourinary discomfort, while pelvic organ dysfunction may refer pain to the caudal abdominal wall.

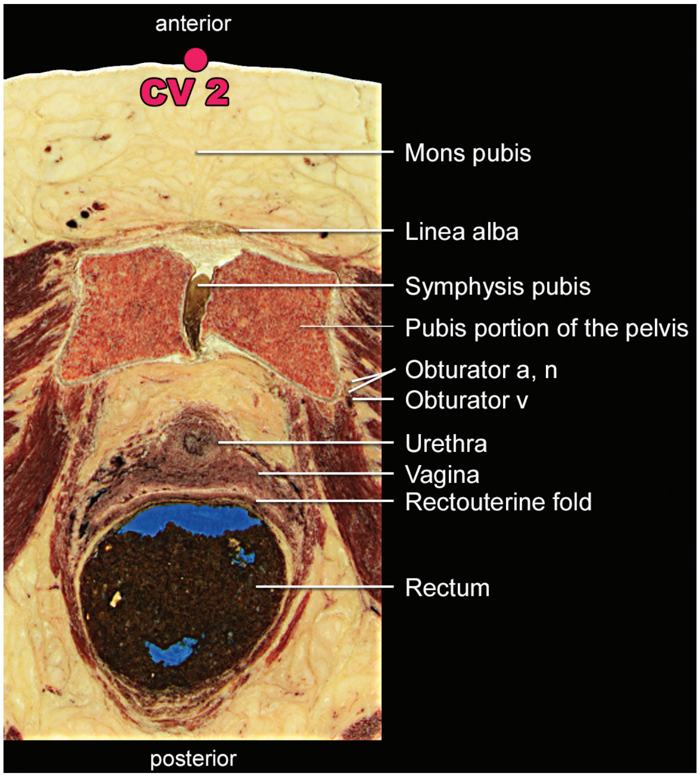


Figure 13-8. (Female pelvis) This cross-section presents contents of the female pelvis deep to CV 2, in contrast to that of the male as shown in Figure 13-7.

References

1. Skinner AV and Lauder GR. Rectus sheath block: successful use in the chronic pain management of pediatric abdominal wall pain. *Pediatric Anesthesia.* 2007;17:1203-1211.
2. Webb CA and Jimenez ML. What is your diagnosis? Osteitis pubis. *JAAPA.* 2008;21(12):68.
3. Anderson RU, Sawyer T, Wise D, et al. Painful myofascial trigger points and pain sites in men with chronic prostatitis/chronic pelvic pain syndrome. *J Urol.* 2009;182(6):2753-2758.
4. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
5. Zhang D. Thirty-six cases of urinary retention treated by acupuncture. *J Tradit Chin Med.* 2008;28(2):83-85.
6. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
7. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves.* Hamilton: BC Decker Inc., 1997. P. 180.
8. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.
9. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
10. Yan H, Huang XH, and Deng GF. (Chinese). Observation on therapeutic effect of acupuncture and moxibustion on disorders of myometrial gland. *Zhongguo Zhen Jiu.* 2008;28(8):579-581.
11. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.
12. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy.* 2011;24:454-461.
13. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.
14. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
15. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves.* BC Decker, Inc.: London, England, 1997, p. 180.
16. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar

nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21:325-333.

17. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol*. 2011;186(2):579-583.

18. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal*. 2002;6(3):20-27.

19. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

20. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

21. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

22. Jun EM, Chang S, Kang DH, et al. Effects of acupressure on dysmenorrhea and skin temperature changes in college students: a non-randomized controlled trial. *Int J Nurs Stud*. 2007;44(6):973-981.

CV 3

Zhong Ji "Central Pole", "Urgent Center"

On the midline of the suprapubic region, 1 cun cranial to the cranial border of the symphysis pubis and 4 cun caudal to the umbilicus. In other words, one can find CV 3 1/5 the distance from the pubic bone to the umbilicus.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may be found in older children suffering from acute abdominal pain. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[13] Congenital anomalies include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus may require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

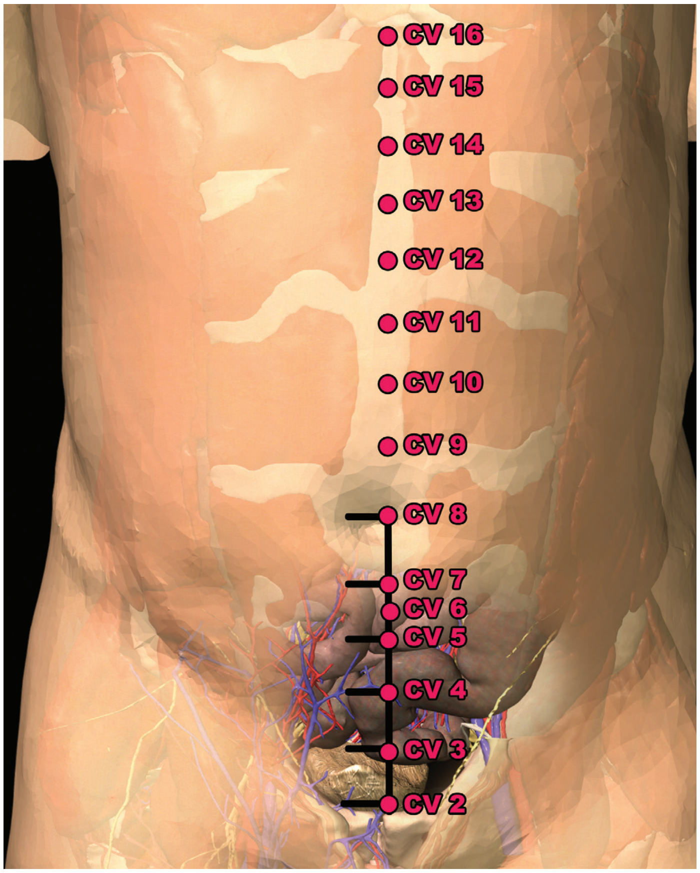


Figure 13-9A. A look inside the abdomen at the level of the caudal abdominal CV points illustrates the relationship between CV 3, the urinary bladder, the sigmoid colon, and pubis.

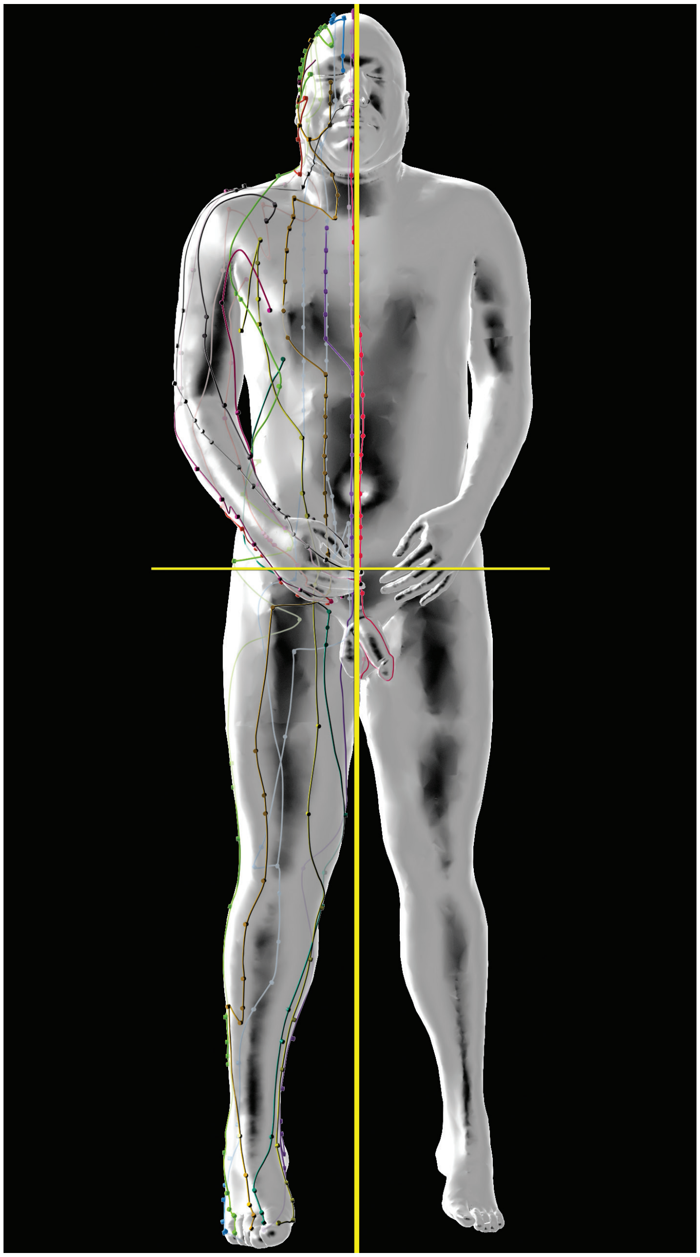


Figure 13-9B. CV 3, at the "Central Pole" of the body, designates the midpoint of the the vertical and horizontal axes, depicted by the intersecting yellow lines.

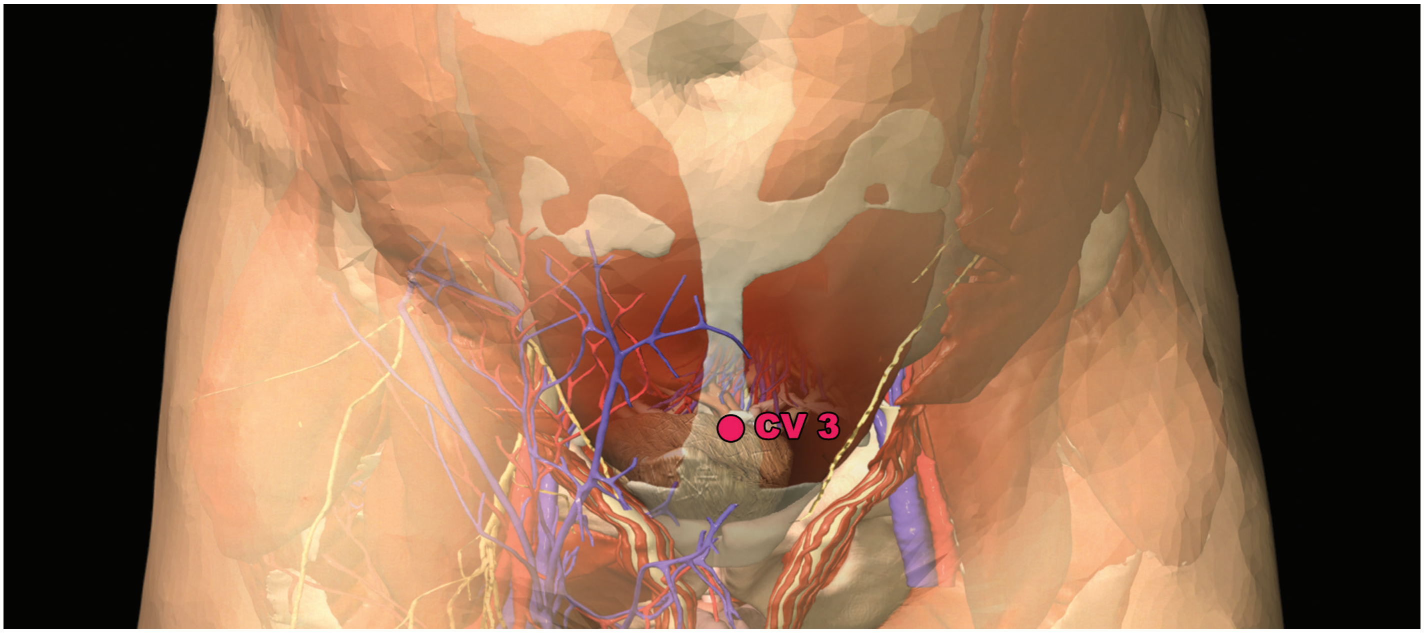


Figure 13-10. The name "Urgent Center" for CV 3 suggests the sense of urgency to void perceived, due to either a full bladder or myofascial dysfunction at CV 3 confusing the nervous system. This image reveals both the urinary bladder along with the overlying muscles of the abdominal wall, where the implicated trigger points may reside.

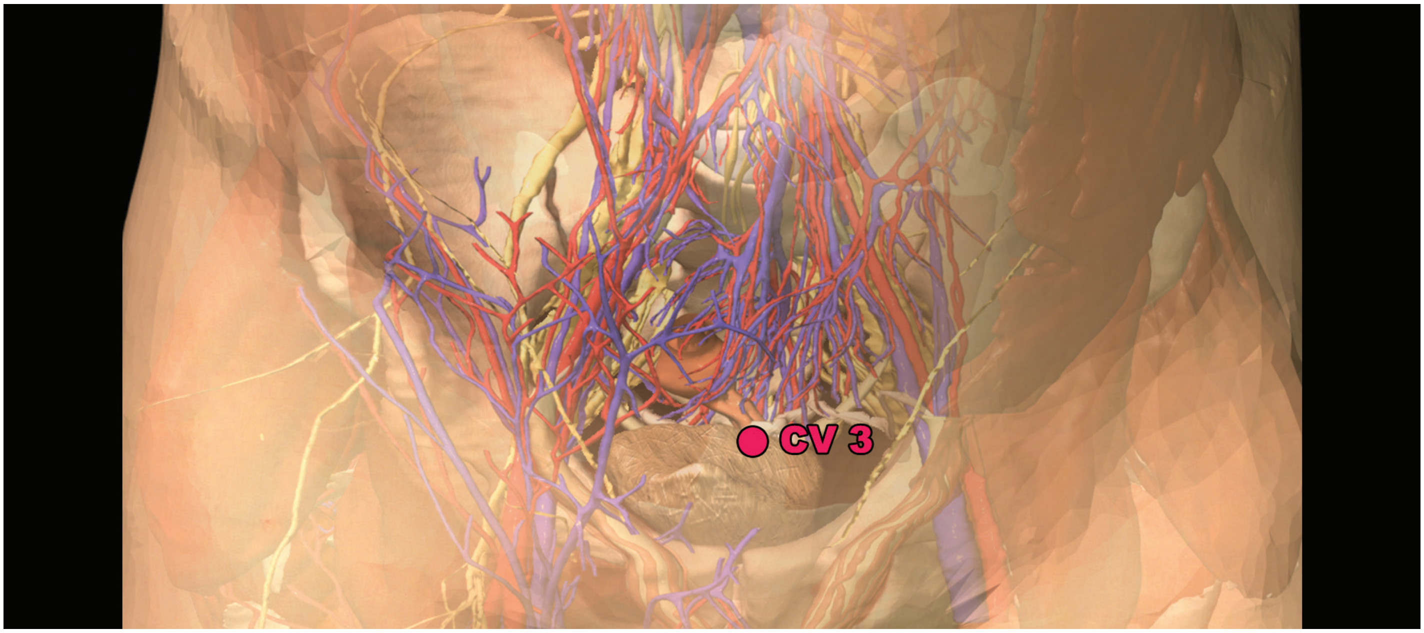


Figure 13-11. Removing the intestines from this image reveals the abundant vasculature of the pelvis. Remember that neuromodulation of the tibial nerve, thoracolumbar spinal cord segments, and sacral nerve roots by means of acupuncture and related techniques influences both circulation and neural input to pelvic organs such as the urinary bladder.

Nerves

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[14]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region. Supplies the skin of the hypogastric region and iliac crest. Also supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve is the first nerve of the lumbar plexus.[15] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or ventral to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.
- **Ilioinguinal nerve (L1, occasionally with T12):** Branches from the ilioinguinal nerve supply the skin of the scrotum and labium majus by means of its anterior scrotal and labial branches, respectively. Other branches supply the skin over the proximal and medial thigh. The ilioinguinal nerve accompanies the spermatic cord or round ligament of the uterus as it moves through the superficial inguinal ring, on the way to its destination of either the scrotum or labium majus, depending on the gender of the individual. The ilioinguinal nerve is involved in the afferent

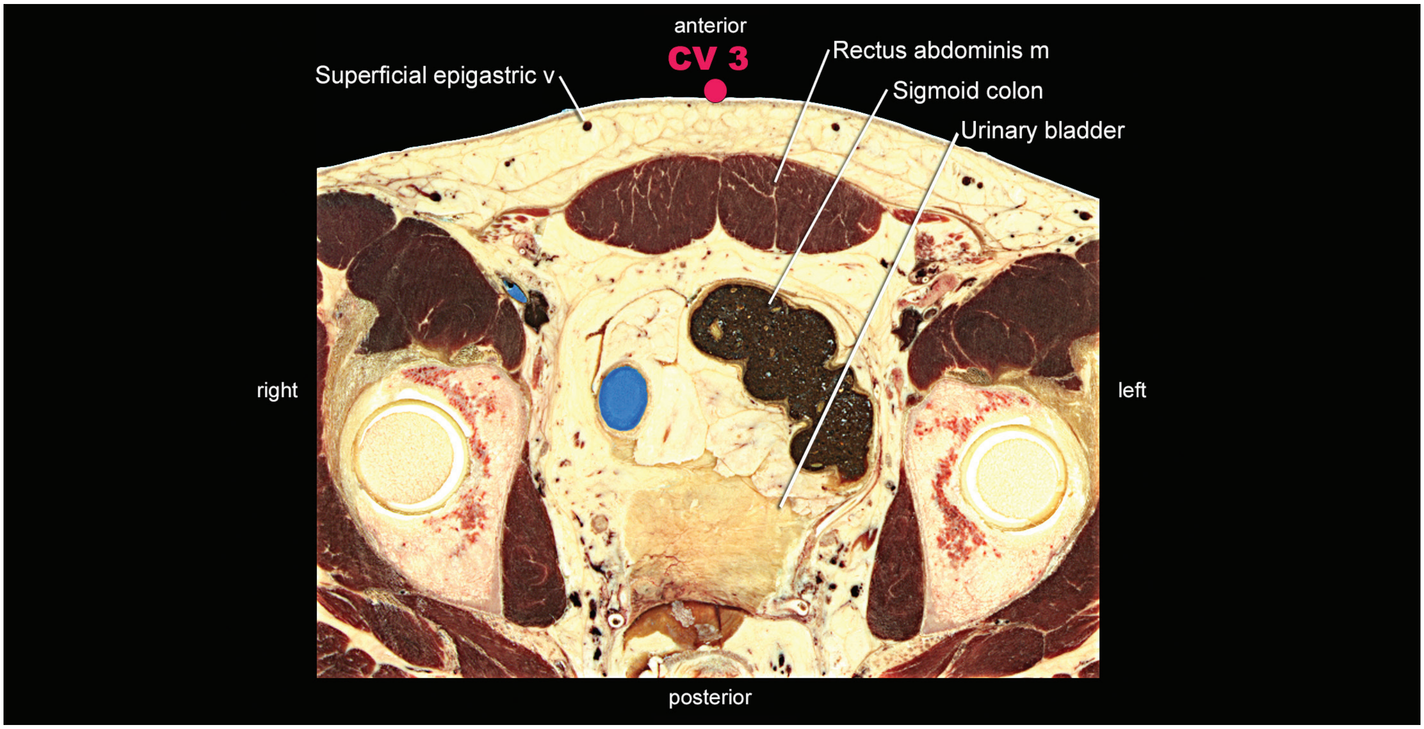


Figure 13-12. Safe needling depth for CV points depends upon patients' muscularity and adiposity. In this cross section of the male pelvis, note the distance between CV 3 and the sigmoid colon. The dorsal aspect of the urinary bladder shows well on this level but the colon is hiding its ventral component.

limb of the cremasteric reflex, along with the genitofemoral nerve (L1, L2). Branches of the ilioinguinal nerve include the anterior scrotal in males and the labial in females. Damage to the ilioinguinal nerve has been called an "infamous complication of inguinal hernia surgery".[16]

- **Thoracoabdominal nerves (T7-T12), ventral rami:** In the paravertebral region, the thoracic mixed autonomic, sensory, and motor nerves divide into a large ventral ramus and a smaller dorsal ramus in the paravertebral spaces. The ventral ramus of each side meets at the CV channel.

Clinical Relevance: CV 3, considered the Front Mu points for the urinary bladder, makes that association by means of overlap between nerves supplying the point as well as this and other pelvic organs through interneuronal connections in thoracolumbar spinal cord segments and the inferior hypogastric plexus.[1]

Gentle mechanical skin stimulation can inhibit transmission of afferent volleys from the bladder to parasympathetic segments in the sacrum. This signal interruption then inhibits rhythmic micturition contractions. The mechanism involves low-frequency inputs from low threshold cutaneous mechanoreceptors activated by gentle skin stimulation.[17] These findings indicate that CV 3 may hold value as a site for stimulation in acupuncture treatment protocols for urinary incontinence. Patients could learn to stimulate their own CV 3 as a daily routine to help resolve disorders of micturition through self-care.

The iliohypogastric nerve communicates extensively with the subcostal and ilioinguinal nerves. The iliohypogastric nerve pierces the transversus abdominis muscle. Some of its branches pierce the aponeurosis of the external oblique muscle. Communication between the genitofemoral and ilioinguinal or iliohypogastric nerves is common, causing overlap of sensory supply. Neurons from T11-L2 travel to the pelvic plexus via the inferior mesenteric plexus and hypogastric nerves.[18] Within the pelvic plexus, synapses take place between the plexus and postganglionic sympathetic fibers that project to the penis. Postganglionic sympathetic fibers consist of two types: cholinergic sympathetic and adrenergic sympathetic neurons. The cholinergic neurons function as vasodilators to the erectile tissue of the penis. Adrenergic neurons activate smooth muscle tissue in the epididymis, vas deferens, seminal vesicles, and prostate gland.

Nerves of the ventromedial abdominal wall form extensive communications between the internal oblique muscle and the transverse abdominis muscle.[19] Nerves of multi-segmental origin that reach the rectus abdominis and deep inferior epigastric artery form plexuses. Nerves from the plexuses run in a craniocaudal direction in close proximity to the deep inferior epigastric artery. Anatomical investigations reveal that abdominal nerves communicate and branch extensively. The variability in spinal nerve origins for the ilioinguinal and iliohypogastric nerves translates into variable analgesia from nerve blocks for inguinal procedures such as herniorrhaphy.

Crosstalk among nerves of the abdominal wall impacts anesthetic procedures such as nerve blocks and neuromodulatory approaches, including acupuncture and related techniques. For example, inputs designed to influence somatovisceral reflexes through Front Mu or other acupuncture points actually neuromodulate several spinal cord segments rather than only one level, thereby extending the treatment's impact more broadly.

Incisions often occur along the linea alba; i.e., the CV line. Abdominal or lumbar surgery may damage thoracoabdominal nerves and their branches, either during the initial incision or during closure with sutures. Sensorimotor loss or nerve entrapment may follow.[20] Entrapment of thoracoabdominal nerves has been identified as the most common cause of abdominal wall pain.[21] Entrapment of the ilioinguinal and iliohypogastric nerves can cause chronic, lower abdominal pain. Injection of local anesthetic relieves the pain, suggesting that acupuncture and related techniques could provide relief as well.

Nerves become entrapped where they move through a fibrous tunnel and where soft tissues such as muscle tension, fibrous bands, or fascial restriction compress their turning points. Entrapment of an anterior branch of a spinal nerve within the rectus abdominis muscle or sheath produces pain in the lower abdomen and pelvis that sometimes simulates gynecologic disease in female patients. In men, entrapped cutaneous abdominal nerves can provoke penile pain. Scars increase the risk of nerve entrapment. Acupuncture may benefit these patients by releasing tension in the tissues and freeing the nerves.

When abdominal surgery injures nerves traveling through one or more planes of the abdominal wall, paresis of the rectus abdominis muscle may ensue, followed by bulging of the abdominal wall.[22] Paresis of the abdominal wall can lead to mechanical complaints as well. Considering the benefits of acupuncture and related techniques for peripheral nerve injury, ilioinguinal nerve injury would likely respond to neuromodulation unless the nerves were severed completely. Chronic pain syndromes that take hold following iliohypogastric or ilioinguinal nerve injury during open inguinal hernia repair or gynecologic surgery should also be addressed with neuromodulation, in addition to adjunctive abdominal support and multimodal analgesia.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart.

These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[23] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[24]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation., the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava.

Indications and Potential Point Combinations

- **Genitourinary or gynecologic problems: pain, amenorrhea, dysmenorrhea, vulvar pruritus, vaginal discharge, postpartum hemorrhage, dysuria, polyuria, urethritis, cystitis, impotence, spermatorrhea, infertility, retained placenta:** CV 3, SP 6, BL points over the sacrum, and other caudal body points to neuromodulate lumbosacral spinal cord segments. Other point options include: CV 3, CV 4, ST 29, SP 6, KI 3, and LR 3.[25]

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[2]
- Acupuncture at CV 3, CV 6, HT 7, BL 23, BL 40, LU 9, LR 2, and LR 3 reportedly succeeded in treating pediatric **nocturnal enuresis**.[3]
- Electroacupuncture at CV 3, CV 4, and BL 32 benefited patients with **spinal cord injuries** by shortening the time to achieve a **balanced bladder,** as long as the treatments occurred within three weeks after injury.[4]
- Acupuncture reportedly benefited patients with **urinary retention** with the following points: CV 2, CV 3, CV 4, SP 6, SP 9, BL 23, BL 28, BL 32, and BL 39.[5]
- Acupuncture at CV 3, BL 23, BL 28, KI 3, SP 6, SP 9, LR 2 (or LR 3) provided effective prophylaxis of **recurrent lower urinary tract infection** in adult women.[6]
- Moxibustion at CV 3, CV 4, and CV 6 lessened symptoms of **post-stroke urinary problems.**[26]
- Manual acupuncture at CV 3, CV 6, GV 4, BL 23, BL 32, LI 4, ST 36, and KI 3, once weekly for ten weeks provided significant improvement in **anal continence** for patients with fecal incontinence via neuromodulation, in ways seemingly similar to sacral nerve stimulation.[7]
- Acupuncture at CV 3, CV 4, CV 6, GV 20, LI 4, BL 23, SP 6, and the Shenmen ear acupuncture point significantly improved symptoms of **primary dysmenorrhea** over those in the placebo group.[8]

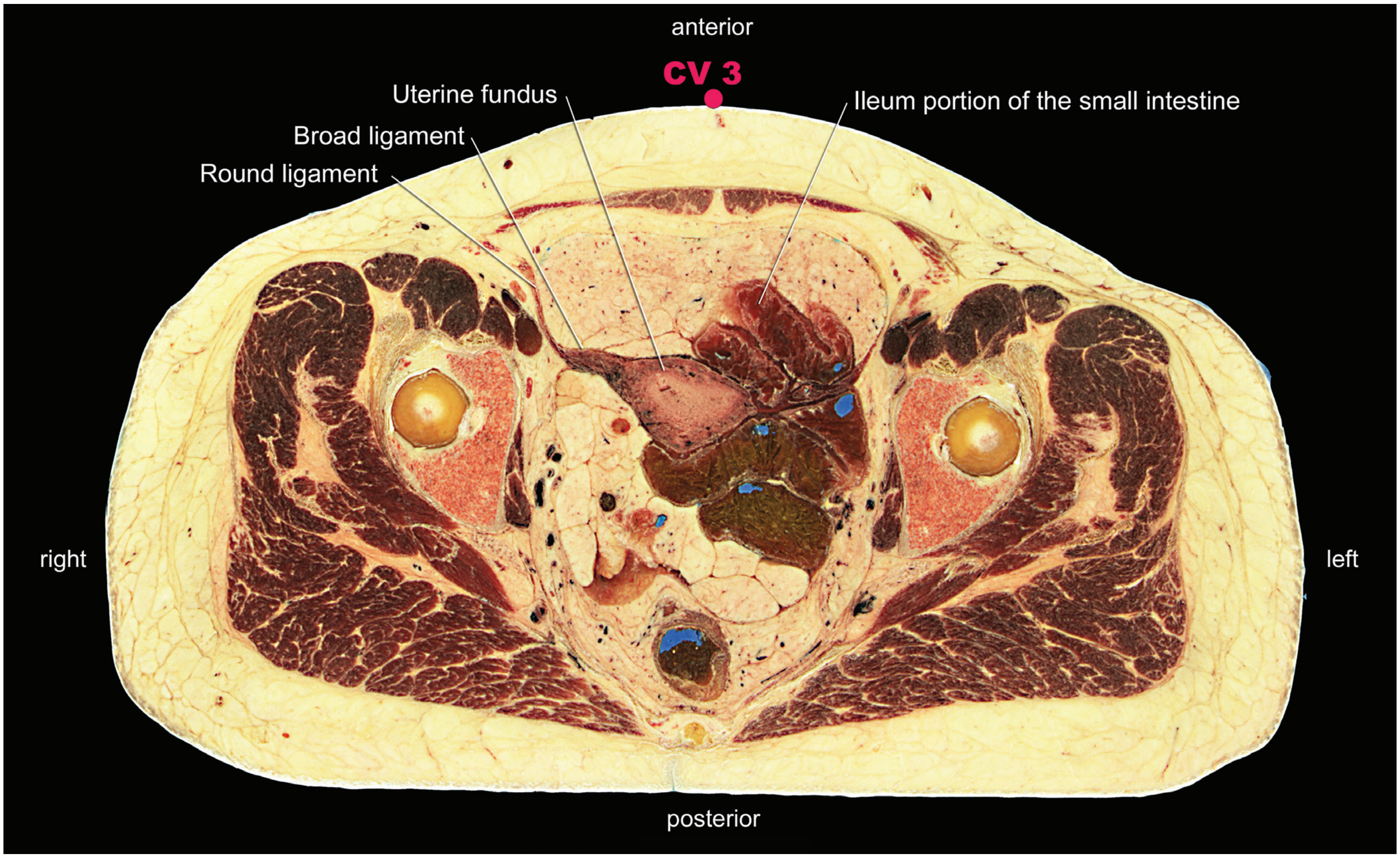


Figure 13-13. In the female pelvis, depicted here, CV 3 relates to the uterus along with the bladder.

- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction.**[9]
- Needling of BL 67 and CV 3 effectively treated **retained placenta** in a case series.[10]
- Moxibustion at CV 3, CV 4, CV 5, CV 7, GV 4, and BL 18, BL 22, BL 23, and BL 52 significantly increased clinical pregnancy rate when introduced as an adjunctive treatment in women receiving in vitro fertilization (IVF) after embryo implantation failed.[27]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV19, LU9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[11]
- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[12]

References

1. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture.* (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
2. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
3. Yuping W, Runfang L, and Hua K. Acupuncture treatment of children nocturnal enuresis – a report of 56 cases. *J Tradit Chin Med.* 2006;26(2):106-107.
4. Cheng P-T, Wong M-K, and Chang P-L. A therapeutic trial of acupuncture in neurogenic bladder of spinal cord injured patients – a preliminary report. *Spinal Cord.* 1998;36:476-480.
5. Zhang D. Thirty-six cases of urinary retention treated by acupuncture. *J Tradit Chin Med.* 2008;28(2):83-85.
6. Aune A, Alraek T, LiHua H, and Baerheim A. Acupuncture in the prophylaxis of recurrent lower urinary tract infection in adult women. *Scand J Prim Health Care.* 1998;16:37-39.
7. Scaglia M, Delaini G, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Autonomic Neuroscience: Basic and Clinical.* 2009;145:89-92.
8. Habek D, Habek JC, Bobic-Vukovic M, et al. *Gynakol Geburtshilfliche Rundsch.* 2003;43:250-253.
9. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. *Journal of Traditional Chinese Medicine.* 2004;24(2):126-127.
10. Chauhan PA, Gasser FJ, and Chauhan AM. Clinical investigation on the use of acupuncture for treatment of placental retention. *American Journal of Acupuncture.* 1998;26(1):19-25.
11. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.
12. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine.* 2005;25(3):177-181.
13. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.
14. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy.* 2011;24:454-461.
15. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.
16. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia.* 2009;13:539-543.
17. Hotta H, Masunaga K, Miyazaki S, et al. A gentle mechanical skin stimulation technique for inhibition of micturition contractions of the urinary bladder. *Autonomic Neuroscience: Basic and Clinical.* 2012;167:12-20.
18. Wilson-Pauwels L, Stewart PA, and Akesson EJ. *Autonomic Nerves.* BC Decker, Inc.: London, England, 1997, p. 180.
19. Rozen WM, Tran TMN, Ashton MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy.* 2008;21:325-333.
20. Van der Graaf T, Verhagen PCMS, Kerver ALA, et al. Surgical anatomy of the 10th and 11th intercostal, and subcostal nerves: prevention of damage during lumbotomy. *J Urol.* 2011;186(2):579-583.
21. Applegate WV. Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *The Permanente Journal.* 2002;6(3):20-27.
22. Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, et al. Abdominal wall paresis as a

complication of laparoscopic surgery. *Hernia*. 2009;13:539-543.

23. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest*. 2001;48(3-4):216-220.

24. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions*. 2012;79:638-639.

25. Birkeflet O, Laake P, and Vollestad N. Traditional Chinese medicine patterns and recommended acupuncture points in infertile and fertile women. *Acupunct Med*. 2012; 30(1):12-16.

26. Yun SP, Jung WS, Park SU, et al. Effects of moxibustion on the recovery of post-stroke urinary symptoms. *Am J Chin Med*. 2007;35(6):947-954.

27. Isoyama Manca di Villahermosa D, Dos Santos LG, Nogueira MB, et al. Influence of acupuncture on the outcomes of in vitro fertilisation when embryo implantation has failed; a prospective randomised controlled clinical trial. *Acupunct Med*. 2013;31(2):157-161.

CV 4

Guan Yuan "Gate of Origin", "Pass Head"

On the ventral midline, 2 cun cranial to the cranial border of the symphysis pubis, 3 cun caudal to the umbilicus.

NOTE: Do not needle in pregnant women except to induce labor. Even then, avoid deep needling.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may be found in older children suffering from acute abdominal pain. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[22] Congenital anomalies include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus may require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

Nerves

- **Subcostal nerve (T12):** Supplies the lowest portions of the external oblique muscles as well as the skin over the hip and anterior superior iliac spine.
- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[23]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region. Supplies the skin of the hypogastric region and iliac crest. Also supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve is the first nerve of the lumbar plexus.[24] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or ventral to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.
- **Thoracoabdominal nerves (T7-T12), ventral rami:** In the paravertebral region, the thoracic mixed autonomic, sensory, and motor nerves divide into a large ventral ramus and a smaller

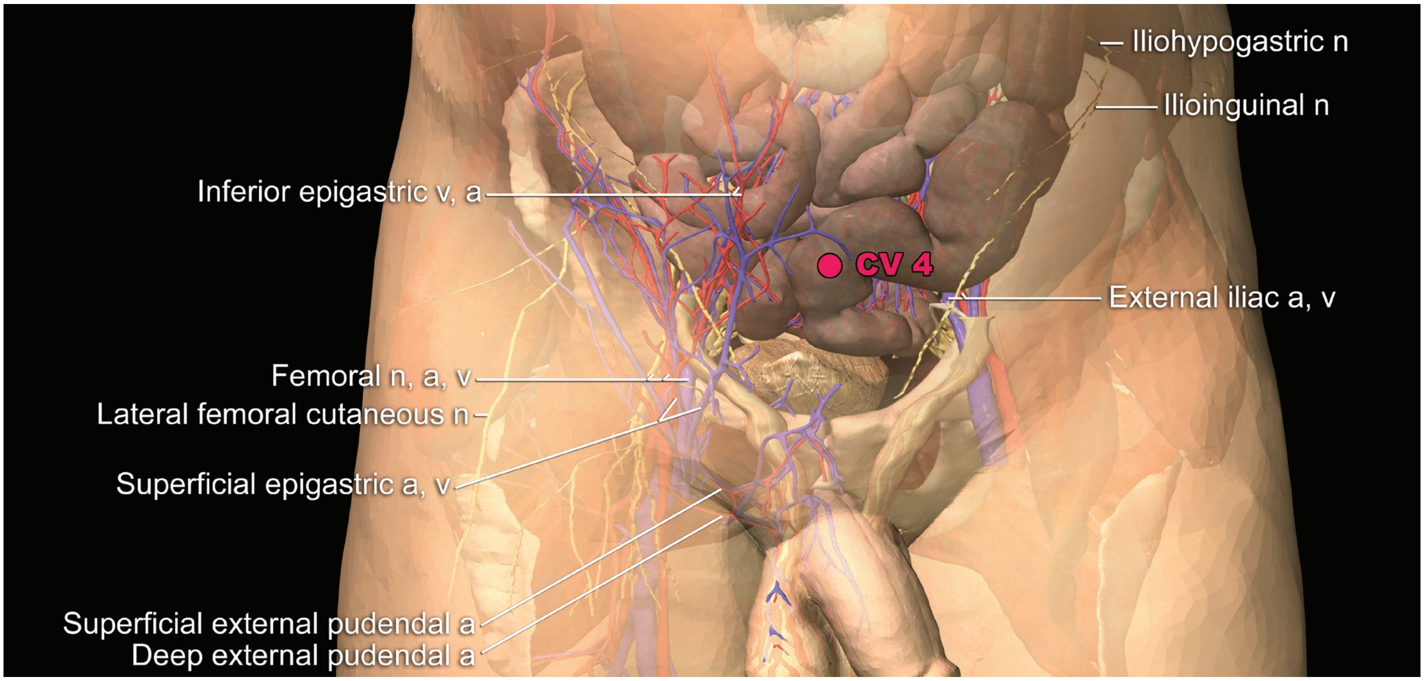


Figure 13-14A. CV 4 has almost thirty alternate names, with many alluding to the uterus ("blood chamber"), fetal development, fetal passage through this region during delivery, "cinnabar field" (Dantian), "elixir field", or "source of life".[32,33] While these names indicate uniquely female aspects, the point's action as a Front Mu point for the small intestine applies to both genders.

dorsal ramus in the paravertebral spaces. The ventral ramus of each side meets at the CV channel.

Clinical Relevance: CV 4, considered the Front Mu point for the small intestine, may impact digestion and genitourinary function by sending somatic afferent stimulation into spinal cord segments that supply both the tissues affected by acupuncture and the associated organs.

Neuroanatomically, CV 4 may, at least in part, influence autonomic input to the genitalia through its relationship to the inferior hypogastric plexus.[1]

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[25] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[26]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation., the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava.

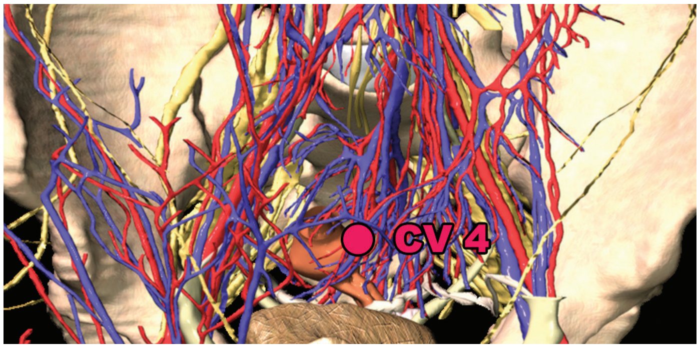


Figure 13-14B. This close-up image of CV 4, the bladder, and the ventral sacrum reveals the sacral nerve roots that supply the bladder and uterus – organs that CV 4 may impact by dint of overlapping innervation of the point and pelvic viscera.

Indications and Potential Point Combinations

- **Reproductive system problems, including seminal discharge, erectile dysfunction, vaginal discharge, menstrual problems (metrorrhagia, amenorrhea, dysmenorrhea), uterine prolapse, postpartum hemorrhage:** CV 4, CV 6,. BL 23, SP 6, GV 20.
- **Urinary problems or voiding difficulty, including dysuria, enuresis, and urethritis:** CV 4, CV 3, BL 28, BL 23.
- **Diarrhea, dysentery:** CV 4, BL 21, BL 27, ST 36, SP 6.
- **Lower abdominal pain:** CV 4, CV 6, ST 25, ST 36, BL 25.
- **Hernia:** CV 4, ST 29, ST 30, local points (cranial, caudal, medial, and lateral to the hernia).
- **Hypotension, shock:** CV 4, HT 9, GV 20, GV 26 (if necessary).

Evidence-Based Applications

- Electroacupuncture at CV 3, CV 4, and BL 32 benefited patients with **spinal cord injuries** by shortening the time to achieve a balanced bladder , as long as the treatments occurred within three weeks after injury.[2]
- Acupuncture reportedly benefited patients with **urinary retention** in a Chinese clinical trial with the following points: CV 2, CV 3, CV 4, SP 6, SP 9, BL 23, BL 28, BL 32, and BL 39.[3]
- Moxibustion at CV 3, CV 4, and CV 6 lessened symptoms of **post-stroke urinary problems.**[27]
- Acupuncture at SP 6, BL 39, BL 28, and CV 4 provided significant improvement in women diagnosed as having **overactive bladder with urge incontinence.**[4]
- Acupuncture at BL 23, BL 28, and GV 4 or CV 4, CV 6, and SP 6 benefited patients with diurnal symptoms associated with **idiopathic bladder instability.**[5]
- Points affecting ovarian function in rats with experimentally induced **inflammation of the ovary** included CV 4, Zigong (EX-CA 1, lateral to SP 13), BL 23, GV 4, GV 1, CV 1, SP 6, ST 36, CV 12, BL 18, and GV 4.6 Of these, CV 4, Zigong (EX-CA 1), BL 23, and GV 4 delivered the most impact.
- Acupuncture at CV 4, CV 6, BL 23, SP 6, LI 4, GB 34, and GV 20 significantly improved the symptoms of **primary dysmenorrhea** up to two years after therapy.[7]
- Moxibustion at CV 3, CV 4, CV 5, CV 7, GV 4, and BL 18, BL 22,

BL 23, and BL 52 significantly **increased pregnancy rate** when introduced as an adjunctive treatment in women receiving in vitro fertilization (IVF) after embryo implantation failed.[28]

- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency after transurethral resection of the prostate.**[8]
- Acupuncture at CV 4, BL 23, BL 25, and ST 25 offers an alternative to pharmacologic **sedation and analgesics in patients receiving extracorporeal shockwave lithotripsy** who are unable to tolerate medication.[9]
- Electroacupuncture at 10 Hz, delivered to LR 3-SP 6, ST 28-EX-CA1, and CV 6-CV 4 demonstrated that acupuncture can **reduce uterine artery impedance.** Treatment of this sort may provide an alternative approach to preventing pre-eclamsia or intrauterine growth restriction in high risk women.[10]
- A case series reported that both acupuncture and moxibustion at BL 23, BL 32, BL 54, SP 6, CV 3, CV 4, KI 12, and LR 3 were effective in treating **erectile dysfunction.**[11]
- Electroacupuncture at CV 4, GV 20, SP 6, KI 3, and HT 7 may have afforded a modulating positive effect on psychogenic and **non-psychogenic erectile dysfunction.** It improved the quality of erection and restored sexual activity in 39% of patients.[12]
- Chinese drug injection at CV 1, CV 4, and LR 10 led to improvements in functional and arterial low-level blood supply **erectile dysfunction** in a Chinese research trial.[13]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[14]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[15]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in improvement in **sperm quality**, specifically in the ultrastructural integrity of spermatozoa.[16]
- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[17]
- Acupuncture and moxibustion at ST 25, ST 36, ST 37, CV 4, SP 6, SP 9, BL 20, BL 21, and BL 25 benefited patients with **chronic nonspecific ulcerative colitis** in a case series.[18]
- A case series reported that acupuncture and moxibustion at ST 25 and CV 4 effectively improved symptoms in **patients with chronic colitis.**
- Electroacupuncture at ST 36, ST 37, ST 25, ST 28, CV 4, and CV 6 alleviated **constipation** through activation of the parasympathetic nervous system.[29]
- Electroacupuncture at CV 12 and CV 4 in **diabetic** rats induced secretion of endogenous β-endorphin; this reduced plasma glucose concentration in an insulin-dependent manner.[19]
- Moxibustion at CV 4 in tumor-bearing mice **improved immune function and regulation.**[20]
- Indirect moxibustion applied to CV 4 and CV 8 three times weekly for four weeks increased catalase activity significantly, suggesting support of the **antioxidant defense system** through heating of these points.[30]
- Electroacupuncture at CV 4 and CV 12 modulated the limbic-prefrontal functional network, which overlaps with functional circuits associated with **cognitive and emotional regulation.**[31]
- Acupuncture at abdominal points augmented the benefits of local points when combined into a treatment involving CV 4, CV 12, ST 26, and SP 15, in addition to ST 34, ST 35, GB 33, GB 34, SP 10, and EX-LE 4 for **osteoarthritis of the knee.**[21]

References

1. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. Medical Acupuncture. (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
2. Cheng P-T, Wong M-K, and Chang P-L. A therapeutic trial of acupuncture in neurogenic bladder of spinal cord injured patients – a preliminary report. Spinal Cord. 1998;36:476-480.
3. Zhang D. Thirty-six cases of urinary retention treated by acupuncture. J Tradit Chin Med. 2008;28(2):83-85.
4. Emmons SL and Otto L. Acupuncture for overactive bladder – a randomized controlled trial. Obstetrics & Gynecology. 2005;106:138-143.
5. Philp T, Shah JR, and Worth PHL. Acupuncture in the treatment of bladder instability. British Journal of Urology. 1988;61:490-493.
6. Wang SJ and Zhu B. (Chinese) Study on relation of ovary-body surface correlativity with acupoints. Zhongguo Zhen Jiu. 2007;27(10):761-765.
7. Habek D, Habek JC, Bobic-Vukovic M, et al. Efficacy of acupuncture for the treatment of primary dysmenorrhea. Gynakol Geburtshilfliche Rundach. 2003;43:250-253.
8. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. Neurourology and Urodynamics. 2004;23:58-62.
9. Quatan N, Bailey C, Larking A, Boyd PJ, and Watkin N. Sticks and stones: use of acupuncture in extracorporeal shockwave lithotripsy. Journal of Endourology. 2003;17(10):867-870.
10. Ho M, Huang L-C, Chang Y-Y, Chen H-Y, et al. Electroacupuncture reduces uterine artery blood flow impedance in infertile women. Taiwan J Obstet Gynecol. 2009;48(2):148-151.
11. Zhao L. Clinical observation on the therapeutic effects of heavy moxibustion plus point-injection in treatment of impotence. Journal of Traditional Chinese Medicine. 2004;24(2):126-127.
12. Kho HG, Sweep CGJ, Chen X, Rabsztyn PRI, and Meuleman EJH. The use of acupuncture in the treatment of erectile dysfunction. International Journal of Impotence Research. 1999;11:41-46.
13. Cui Y, Feng Y, Chen L, et al. [Chinese] Randomized and controlled research of Chinese drug acupoint injection therapy for erectile dysfunction. Zhongguo Zhen Jiu. 2007;27(12):881-885.
14. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. Asian Journal of Andrology. 2003;5:345-348.
15. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. Archives of Andrology. 1997;39:155-161.
16. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. Fertility and Sterility. 2005;84(1):141-147.
17. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. Journal of Traditional Chinese Medicine. 2005;25(3):177-181.
18. Zhang X. 23 cases of chronic nonspecific ulcerative colitis treated by acupuncture and moxibustion. Journal of Traditional Chinese Medicine. 1998;18(3):188-191.
19. Chang SL, Lin JG, Chi TC, Liu IM, and Cheng JT. An insulin-dependent hypoglycaemia induced by electroacupuncture at the Zhongwan (CV 12) acupoint in diabetic rats. Diabetologia. 1999;42:250-255.
20. Wu P, Cao Y, and Wu J. Effects of moxa-cone moxibustion at Guanyuan on erythrocytic immunity and its regulative function in tumor-bearing mice. Journal of Traditional Chinese Medicine. 2001;21(1):68-71.
21. Meng C-R, Fan L, Fu W-B, et al. Clinical research on abdominal acupuncture plus conventional acupuncture for knee osteoarthritis. J Tradit Chin Med. 2009;29(4):249-252.

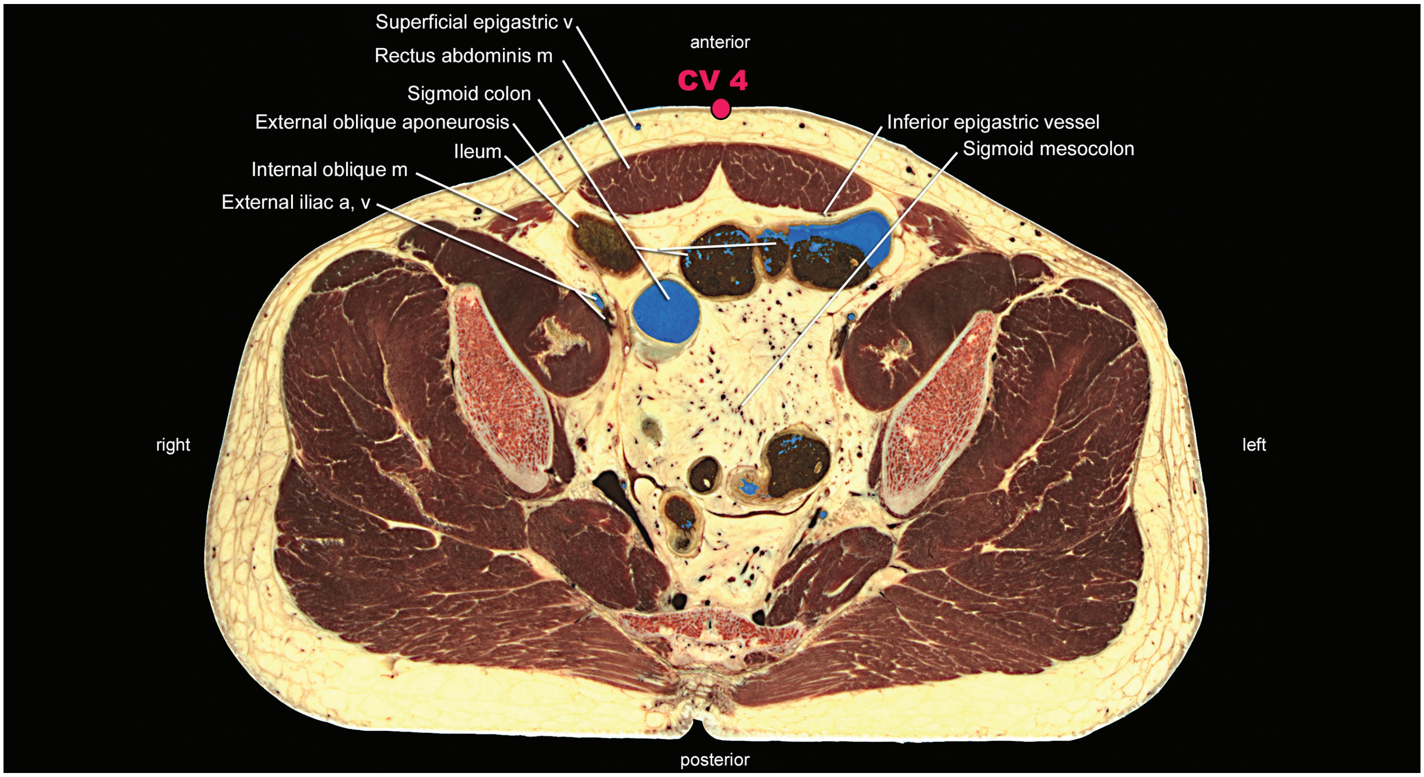


Figure 13-15. The cross-section at CV illustrates the anatomic relationship between CV 4 and the ileum (part of the small intestine).

22. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.
23. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy.* 2011;24:454-461.
24. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.
25. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
26. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.
27. Yun SP, Jung WS, Park SU, et al. Effects of moxibustion on the recovery of post-stroke urinary symptoms. *Am J Chin Med.* 2007;35(6):947-954.
28. Isoyama Manca di Villahermosa D, Dos Santos LG, Nogueira MB, et al. Influence of acupuncture on the outcomes of in vitro fertilisation when embryo implantation has failed; a prospective randomised controlled clinical trial. *Acupunct Med.* 2013;31(2):157-161.
29. Chen CY, Ke MD, Kuo CD, et al. The influence of electro-acupuncture stimulation to female constipation patients. *Am J Chin Med.* 2013;41(2):301-313.
30. Park H, Kim H, Yoo S, et al. Antioxidant effect of indirect moxibustion on healthy subjects: a pilot study. J Tradit Chin Med. 2012;32(4):590-595.
31. Fang J, Wang X, Liu H, et al. The limbic-prefrontal network modulated by electroacupuncture at CV 4 and CV 12. *Evidence-Based Complementary and Alternative Medicine.* 2012; Article ID 515893.
32. Shen X. Acupuncture treatment for kidney deficiency with combined application of points Mingmen and Guanyuan. *J Tradit Chin Med.* 1996;16(4):275-277.
33. Ellis A, Wiseman N, and Boss K. *Grasping the Wind.* Brookline: Paradigm Publications, 1989. Pp. 306-307

CV 5

Shi Men "Stone Gate"

On the ventral midline, 2 cun caudal to the umbilicus, 3 cun cranial to the cranial border of the symphysis pubis.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois.

Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may be found in older children suffering from acute abdominal pain. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[4] Congenital anomalies include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus may require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

Nerves

- **Subcostal nerve (T12):** Supplies the lowest portions of the external oblique muscles as well as the skin over the hip and anterior superior iliac spine.
- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[5]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region. Supplies the skin of the hypogastric region and iliac crest. Also supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve is the first nerve of the lumbar plexus.[6] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or ventral to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.
- **Thoracoabdominal nerves (T7-T12), ventral rami:** In the paravertebral region, the thoracic mixed autonomic, sensory, and motor nerves divide into a large ventral ramus and a smaller dorsal ramus in the paravertebral spaces. The ventral ramus of each side meets at the CV channel.

Clinical Relevance: CV 5, considered the Front Mu point for the elusive structure called the "Triple Heater", may impact digestion and genitourinary function by sending somatic afferent stimulation into spinal cord segments that supply both the tissues affected by acupuncture and the associated organs.

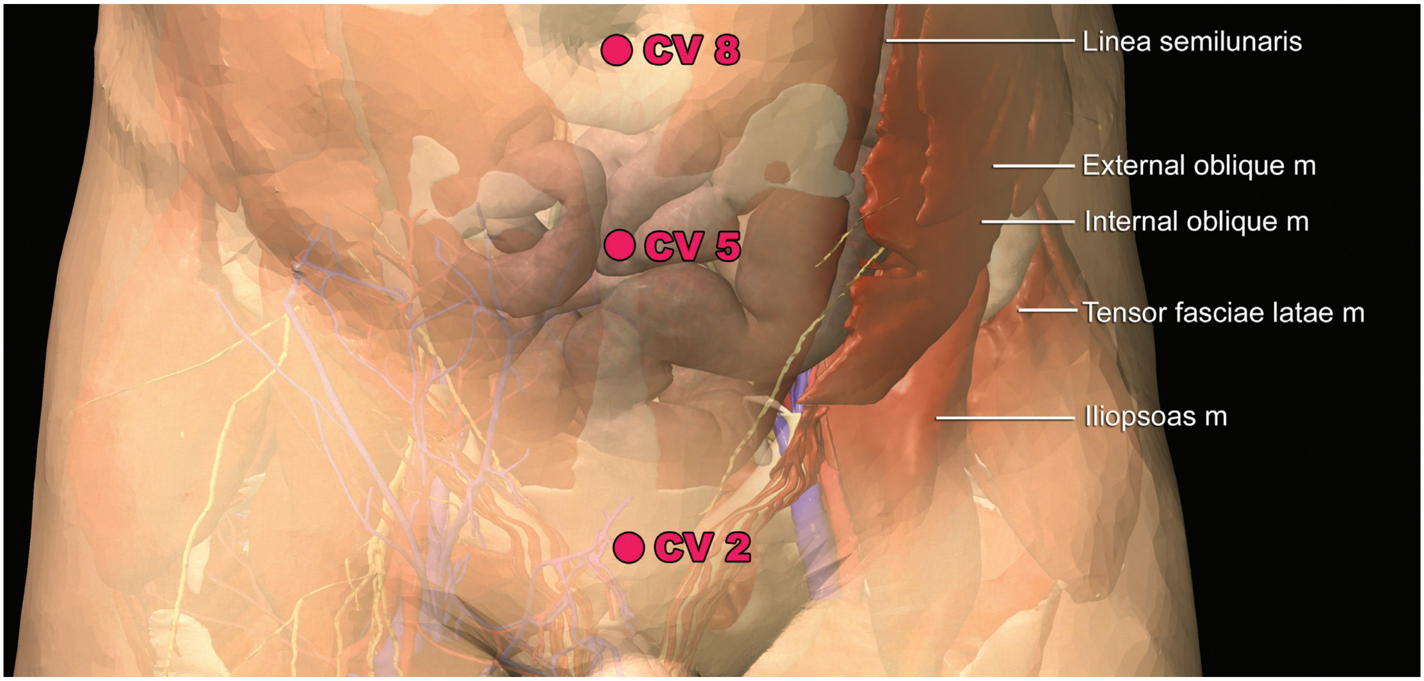


Figure 13-16A. The descriptive term for CV 5, "Stone Gate" alludes to hard, stone-like, masses in the intestines deep to CV 5, as shown here, or to concretions in the urinary tract, described in Figure 13-16B.

Neuroanatomically, CV 5 may, at least in part, influence autonomic input to the genitalia through its relationship to the inferior hypogastric plexus.[1]

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[7] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[8]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation, the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava.

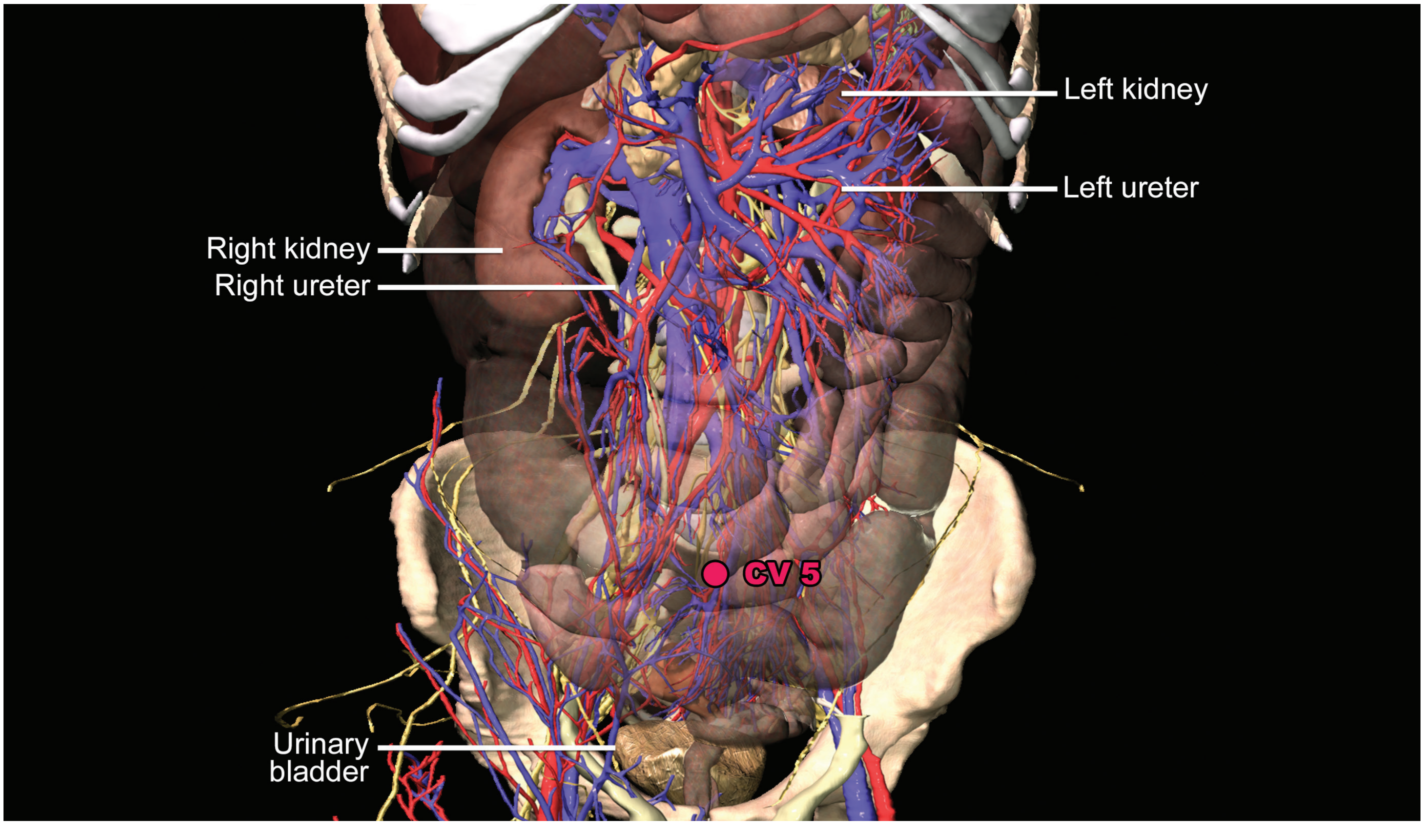


Figure 13-16B. Ureteroliths traversing from kidney to bladder incite pain, inflammation, and possible obstruction. Sympathetic innervation of the ureter arises from the lower fibers of the renal plexus (T11-T12), the superior hypogastric plexus, and the hypogastric nerve and inferior hypogastric plexus.[10] Acupuncture and related techniques applied to CV 5, shown in this image, may neuromodulate the same spinal cord segments that supply the ureter with sympathetic innervation. (The ureter derives its parasympathetic control from the vagus nerve.)

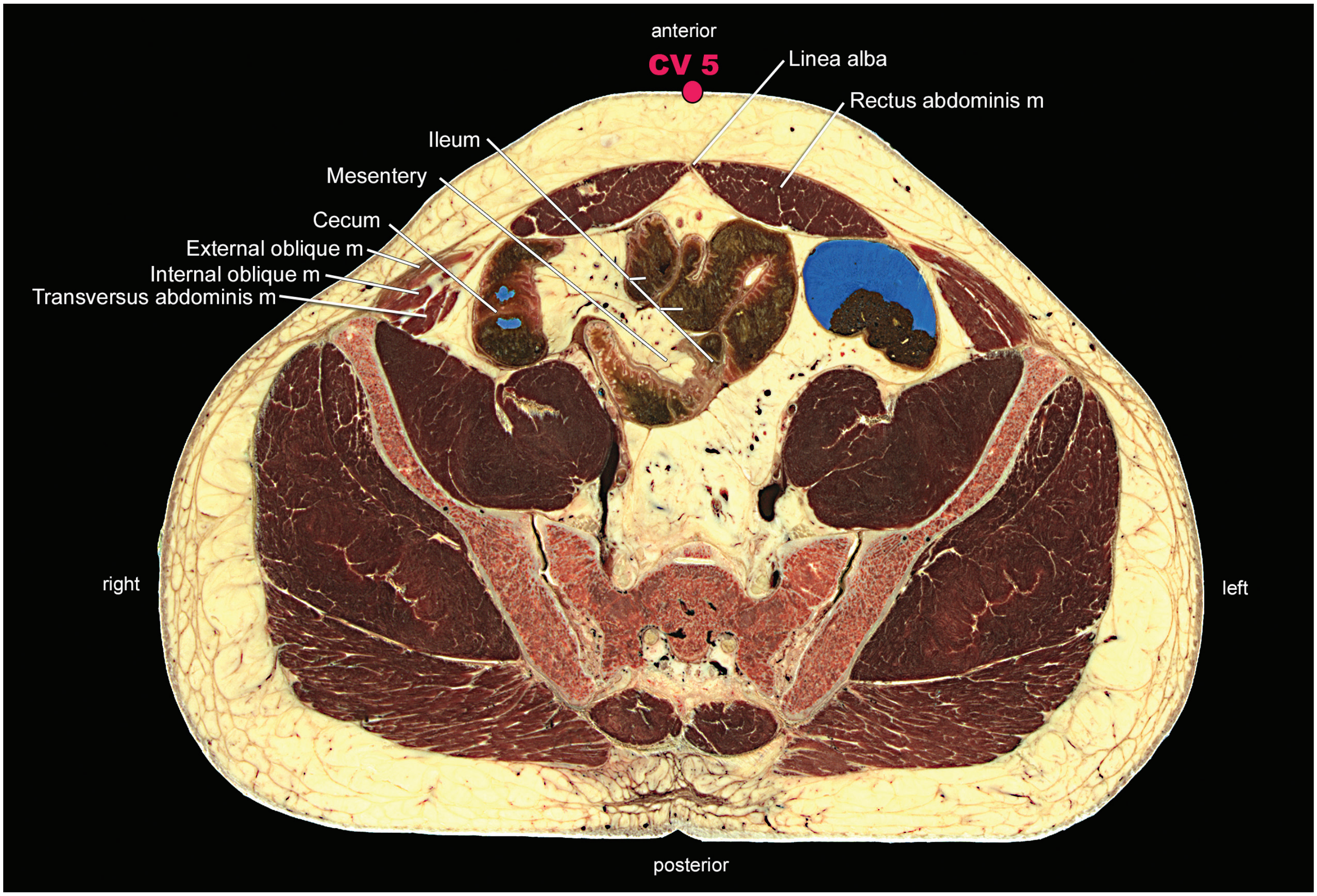


Figure 13-17. This cross-section explains how, by palpating CV 5 between the rectus abdominis muscles, one could find hard, stone-like structures in the ileum of an obstipated or constipated patient.

Indications and Potential Point Combinations

- **Ascites:** CV 5, CV 12, CV 14, KI 16, ST 25, ST 36, KI 27, BL 39, GV 20.
- **Ureterolithiasis:** CV 5, CV 3, GB 25, GB 26, BL 23, BL 52, BL 10, ST 36.
- **Myasthenia gravis:** CV 5, CV 4, CV 12, CV 17, GB 34, ST 36, GV 14, GV 20.

Evidence-Based Applications

- Electroacupuncture at CV 1, CV 2, CV 4, CV 5, BL 21, BL 23, and BL 32 benefited patients with **persistent sensory urgency** after transurethral resection of the prostate.[1]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[2]
- Electroacupuncture "warming therapy" applied to CV 5, CV 4, CV 12, CV 17, and GB 34 combined with pyridostigmine led to a significantly better therapeutic effect on **myasthenia gravis** than that provided by pyridostigmine alone, according to a Chinese study.[3]
- Moxibustion at CV 3, CV 4, CV 5, CV 7, GV 4, and BL 18, BL 22, BL 23, and BL 52 significantly **increased pregnancy rate** when introduced as an adjunctive treatment in women receiving in vitro fertilization (IVF) after embryo implantation failed.[9]

References

1. Ricci L, Minardi D, Romoli M, Galosi AB, and Muzzonigro G. Acupuncture reflexotherapy in the treatment of sensory urgency that persists after transurethral resection of the prostate: a preliminary report. *Neurourology and Urodynamics.* 2004;23:58-62.

2. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.

3. Wang SH, Cui X, and Feng J. (Chinese) Electroacupuncture warming therapy combined with western medicine for treatment of myasthenia gravis and effect on IL-4 level in the patients. *Zhongguo Zhen Jiu.* 2007; 27(12):901-903.

4. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.

5. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. Clinical Anatomy. 2011;24:454-461.

6. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.

7. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.

8. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.

9. Isoyama Manca di Villahermosa D, Dos Santos LG, Nogueira MB, et al. Influence of acupuncture on the outcomes of in vitro fertilisation when embryo implantation has failed; a prospective randomised controlled clinical trial. *Acupunct Med.* 2013;31(2):157-161.

10. Mitchell GAG. The innervation of the kidney, ureter, testicle and epididymis. *J Anat.* 1935;70 (Pt 1):10-32.

CV 6

Qi Hai "Sea of Qi"

On the ventral midline, 1.5 cun caudal to the umbilicus, 3.5 cun cranial to the cranial border of the symphysis pubis.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of thevabdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may be found in older children suffering from acute abdominal pain. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[11] Congenital anomalies include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus may require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

- **Iliohypogastric nerve (L1, some T12 fibers; nerve fiber origin is complex. Sensory nerve origins may derive from as cranial as T11 or as caudal as L3[12]):** The iliohypogastric nerve divides into anterior and lateral cutaneous branches. The lateral branch supplies the skin over the iliac crest while the ventral branch supplies the skin cranial to the pubic region. Supplies the skin of the hypogastric region and iliac crest. Also supplies the internal oblique and transverse abdominal muscles. The iliohypogastric nerve is the first nerve of the lumbar plexus.[13] The lumbar plexus forms from the ventral rami of T12 through L4. Most of the branches of the plexus either pass through or ventral to the psoas major muscle. The lumbar plexus gives off the iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, obturator, and femoral nerves.
- **Thoracoabdominal nerves (T7-T12), ventral rami:** In the paravertebral region, the thoracic mixed autonomic, sensory, and motor nerves divide into a large ventral ramus and a smaller dorsal ramus in the paravertebral spaces. The thoracoabdominal nerves, ventral rami, also supply the periphery of the thoracic diaphragm. The ventral ramus of each side meets at the CV channel.

Clinical Relevance: Nerves supplying CV 6 overlap with

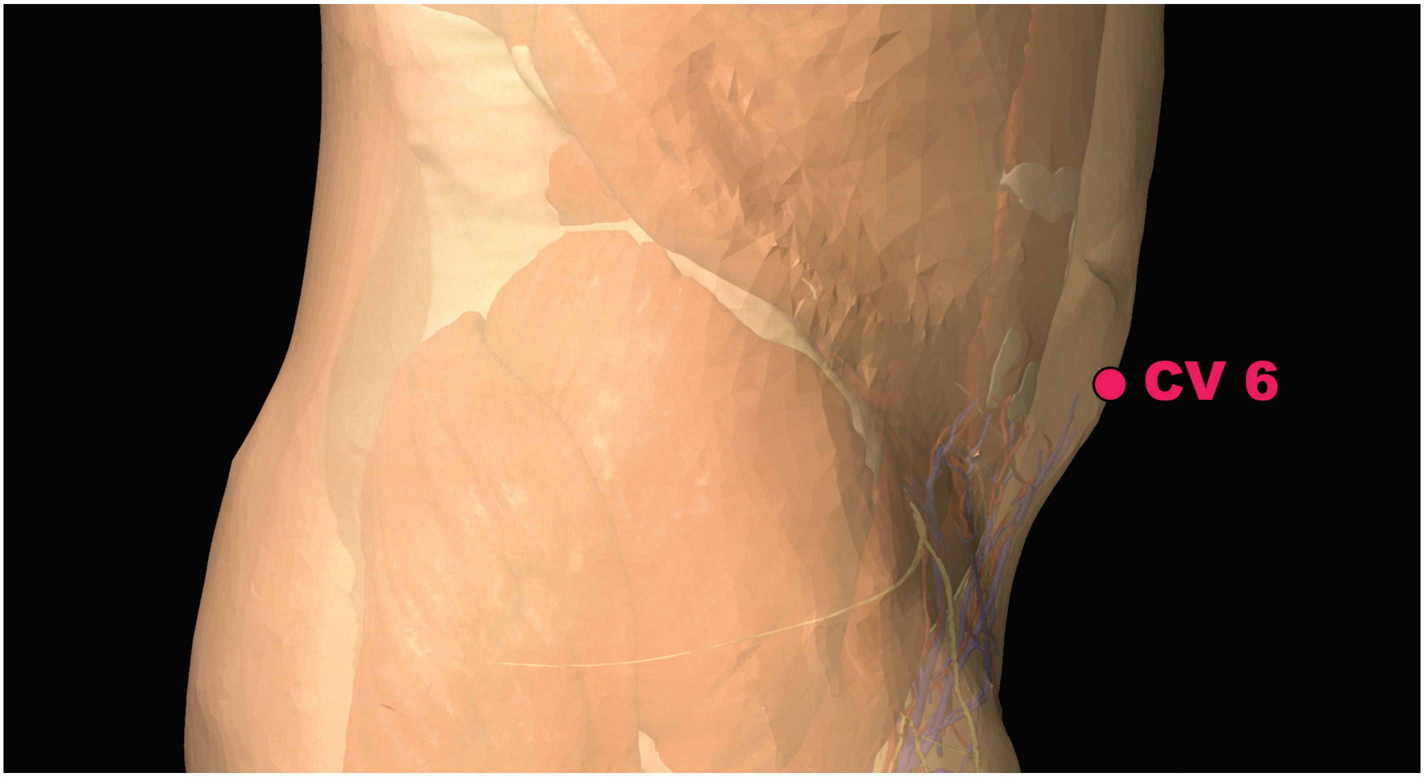


Figure 13-18. The name "Sea of Qi" for CV 6 connotes the bulge in the belly that appears in this image. The abdomen may protrude at this site due to accumulation of fat or the growth of a fetus (in women).

activities of other points in the caudal abdomen; namely, they neuromodulate caudal abdominal visceral activities pertaining to digestive and genitourinary functions.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T11):** Supplies the ventral abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Nerves supplying CV 6 overlap with activities of other points in the caudal abdomen; namely, they neuromodulate caudal abdominal visceral activities pertaining to digestive and genitourinary functions.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[14] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[15]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation, the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava.

Indications and Potential Point Combinations

- **Uterine fibroids, menstrual irregularities, dysmenorrhea:** CV 6, CV 4, CV 3, ST 28, KI 3, SP 6.
- **Fatigue:** CV 6, SP 6, ST 36, PC 6, GV 20.
- **Infertility, impotence:** CV 6, GV 4, BL 23, GV 20, SP 6, KI 3.
- **Constipation, abdominal distension:** CV 6, CV 4, BL 25, BL 27, ST 36, GV 20.

Evidence-Based Applications

- Electroacupuncture at 10 Hz, delivered to LR3-SP6, ST 28-EX-CA 1 (also known as Zigong, located 4 cun below the umbilicus and 3 cun lateral to CV 3), and CV 6-CV 4 demonstrated that acupuncture can reduce uterine artery impedance. Because **preeclampsia** may constitute a circulatory maladaptation disease resulting from defective trophoblastic invasion of the maternal spiral arteries, this type of treatment may provide an alternative means of preventing pre-eclamsia or intrauterine growth restriction in high risk women.[1]
- Dry needling of CV 6, CV 4, CV 3, GV 20, LI 4, BL 23, SP 6, GB 34, and auricular Shen Men significantly outperformed placebo for women with **primary dysmenorrhea** and was effective for at least one year.[2]
- Acupuncture at CV 2, CV 6, CV 12, LI 4, LI 11, PC 6, LR 3, SP 6, ST 36, and GV 20 reduced myalgia, mastalgia, and dysmenorrheal complaints in women with **premenstrual syndrome.**[16]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis**.[3]
- Acupuncture at CV 6, CV 12, CV 17, ST 36, and SP 10 conferred protective effects on cognitive impairments caused by **multi-infarct dementia** in rats, suggesting it may benefit patients with vascular dementia.[4]
- Acupuncture at CV 6, CV 12, CV 17, ST 36, and SP 10 provided significant benefits for patients with **vascular dementia**.[17] Specifically, they exhibited improvements on the mini-mental status examination and Hasegawa's dementia scale.
- Acupuncture at BL 23, BL 28, and GV 4 or CV 4, CV 6, and SP 6 benefited patients with diurnal symptoms associated with **idiopathic bladder instability**.[5]
- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome)**.[6]
- Following a series of acupuncture treatments, men with **poor quality sperm** experienced a significant increase in fertility index, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. Twelve acupuncture points from the following group were selected

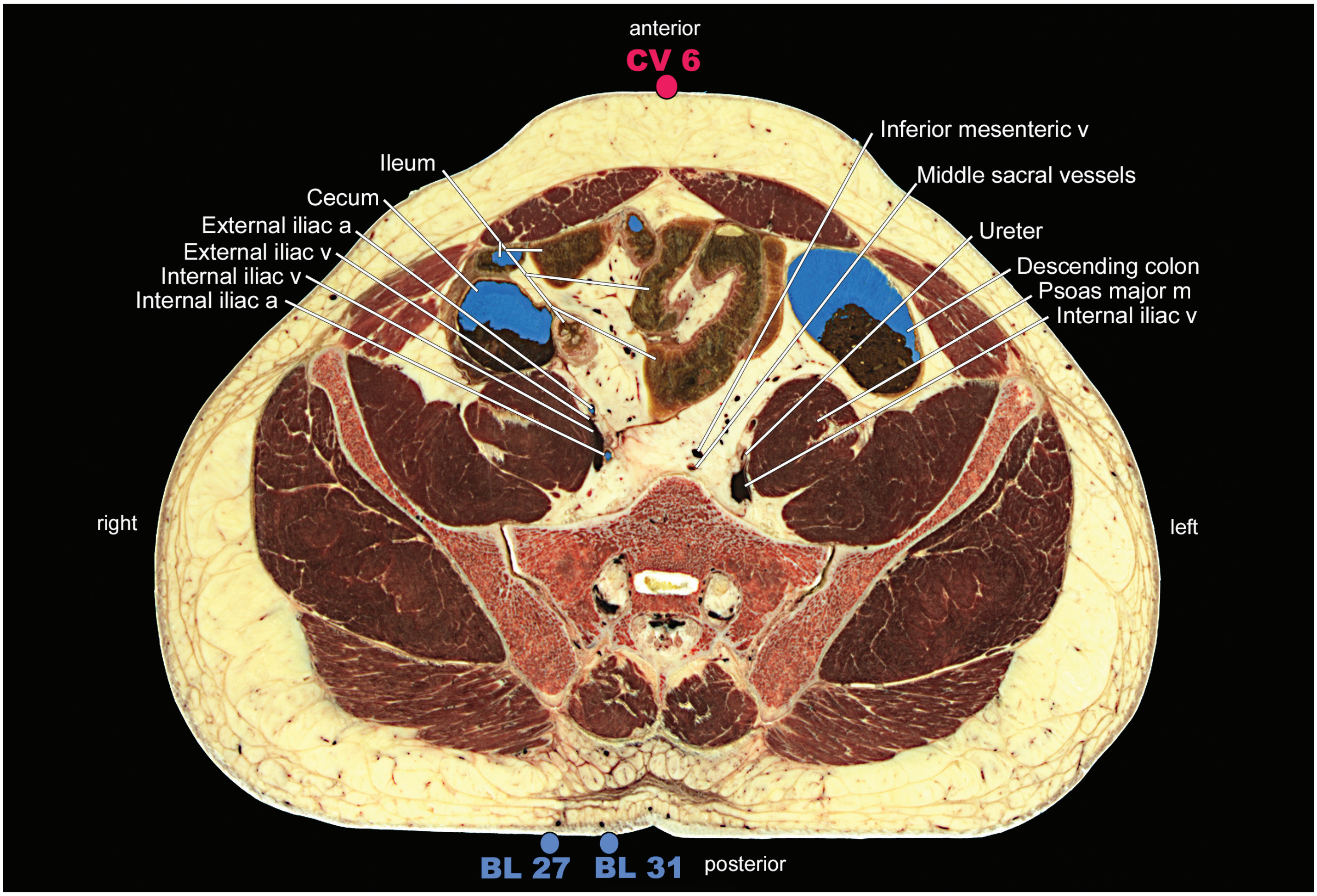


Figure 13-19. In keeping with the term, "Sea of Qi", note the subcutaneous tissue mound deep to the point.

according to patient presentation: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[7]

- Needling and mild moxibustion delivered to BL 23, BL 25, BL 54, CV 3, CV 4, CV 6, SP 6, and ST 28 effectively resolved **chronic prostatitis.**[8]
- Dry needling of CV 6, CV 3, GV 4, BL 23, LI 4, ST 36, and KI 3 neuromodulates recto-anal function in a manner similar to sacral nerve stimulation and showed benefit for patients with **fecal incontinence.**[9]
- Acupuncture at CV 6, ST 36, SP 6, and PC 6 led to small increases in **cerebral oxygen saturation** levels and a significant increase in mean blood flow velocity in the middle cerebral artery during acupuncture.[10]

References

1. Ho M, Huang L-C, Chang Y-Y, Chen H-Y, et al. Electroacupuncture reduces uterine artery blood flow impedance in infertile women. *Taiwan J Obstet Gynecol.* 2009;48(2):148-151.
2. Habek D, Habek JC, Bobic-Vukovic M, et al. *Gynakol Geburtshilfliche Rundsh.* 2003;43:250-253.
3. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
4. Yu J, Liu C, Zhang X, and Han J. Acupuncture improved cognitive impairment caused by multi-infarct dementia in rats. *Physiology and Behavior.* 2005 (in press).
5. Philp T, Shah JR, and Worth PHL. Acupuncture in the treatment of bladder instability. *British Journal of Urology.* 1988;61:490-493.
6. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.
7. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology.* 1997;39:155-161.
8. Yu Y and Kang J. Clinical studies on treatment of chronic prostatitis with acupuncture and mild moxibustion. *Journal of Traditional Chinese Medicine.* 2005;25(3):177-181.
9. Scaglia M, Delaini GG, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Autonomic Neuroscience: Basic and Clinical.* 2009;145:89-92.
10. Litscher G, Schwarz G, Sandner-Kiesling A, et al. Effects of acupuncture on the oxygenation of cerebral tissue. *Neurol Res.* 1998;20(Suppl 1):S28-S32.
11. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.
12. Klassen Z, Marshall E, Tubbs RS, et al. Anatomy of the ilioinguinal and iliohypogastric nerves with observations of their spinal nerve contributions. *Clinical Anatomy.* 2011;24:454-461.
13. Mirilas P and Skandalakis JE. Surgical anatomy of the retroperitoneal spaces, Part IV: retroperitoneal nerves. *Am Surg.* 2010;76(3):253-262.
14. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
15. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.
16. Anil A, Peker T, Goktas T, et al. Importance of acupuncture on premenstrual syndrome. *Clin Exp Obstet Gynecol.* 2012;39(2):209-213.
17. Yu J, Zhang X, Liu C, et al. Effect of acupuncture treatment on vascular dementia. *Neurol Res.* 2006;28(1):97-103.

CV 7

Yin Jiao "Yin Intersection"

On the ventral midline, 1 cun caudal to the umbilicus, 4 cun cranial to the cranial border of the symphysis pubis.

Fascia

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.

Clinical Relevance: Urachal remnant disease, though rare, usually presents in the neonatal period but may be found in older children suffering from acute abdominal pain. Differential diagnoses include appendicitis, inflammatory bowel disease, cystitis, strangulated umbilical hernia, abscess, Meckel's diverticulum, and more.[2] Congenital anomalies include persistent urachus, urachal sinus, urachal cyst, and a vesicourachal diverticulum. Signs and symptoms of urachal infection include fever, pain in the lower midline, urinary dysfunction and/or infection, and a palpable suprapubic mass. While acupuncture and related techniques may assist with recovery, patients with an infected urachus may require surgical excision of the urachal remnant and antibiotics. Do not delay appropriate diagnosis and treatment in favor of trying acupuncture for these patients until medically or surgically indicated measures have been instituted.

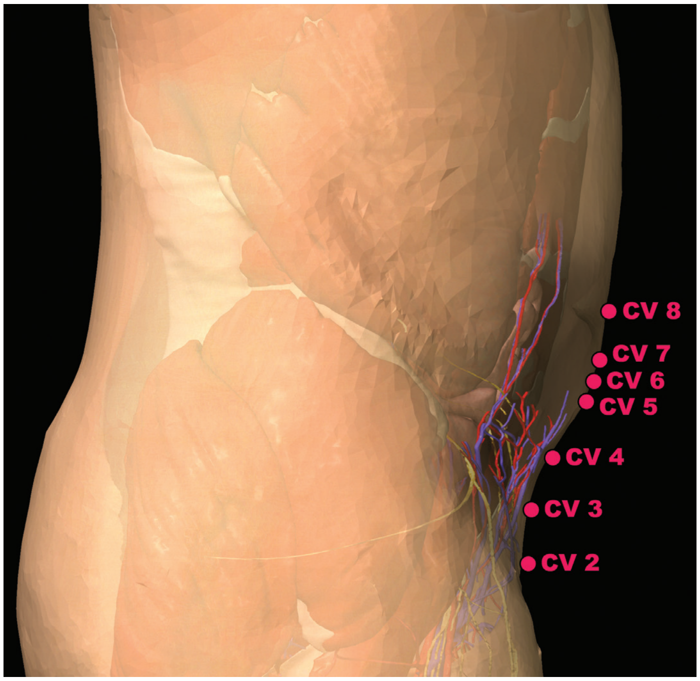


Figure 13-20. This lateral view of the CV points on the caudal abdomen offers a unique perspective of the superficial and deep vessels that participate in the periumbilical arterial and venous anastomoses. The presence of anastomosing vessels on the "Yin" surface of the body, i.e., the abdomen, explain how CV 7 earned the title, "Yin Intersection".

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T11):** Supplies the ventral abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Nerves supplying CV 7 overlap with activities of other points in the caudal abdomen; namely, they neuromodulate caudal abdominal visceral activities pertaining to digestive and genitourinary functions.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.
- **Periumbilical Arterial Anastomoses:** A rich vascular plexus exists between the peritoneum and the posterior rectus sheath beneath the umbilicus.[1] This plexus incorporates contributions from vessels coursing through the median umbilical ligament as well as those running along the ligamentum teres hepaticum, a fibrous cord that is the remnant left umbilical vein.
- **Periumbilical Venous Anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Figure 13-20 exposes the inferior epigastric arteries and veins as they ascend the abdomen.

Three distinct sources contribute to the subumbilical vascular plexus: 1) Deep inferior epigastric arteries and veins, 2) Vessels following the ligamentum teres hepaticum, and 3) Vessels associated with the median umbilical ligament. Most of the arterial vascular supply to this region originates from the deep inferior epigastric arteries via small and large perforating vessels. These perforators course toward the midline from the rectus muscle along premuscular, intramuscular, and postmuscular pathways. The umbilical skin receives blood from the subdermal plexus along with a large number of cutaneous perforators that enter the skin at the rectus abdominis muscle's tendinous intersections.

Rectus sheath hematomas occur in this caudal section of the rectus compartment most frequently. A predilection for the caudal compartment manifests due to the degree of muscle shortening and contraction that takes place at this level as well as the absence of a strong caudal wall. Blood vessel attachments to the muscles are also fixed in position, allowing little room for stretch. Violent muscle contraction or trauma exposes this vulnerable territory to vascular injury and potentially life-threatening hematomata within the sheath. Sudden onset of abdominal pain and swelling of the abdominal wall may arise from an inferior epigastric artery rupture in a previously asymptomatic patient. Coughing or anticoagulant therapy increases the risk.[3] Femoral catheterization may iatrogenically injure the inferior epigastric artery and thereby produce hemorrhage and cause serious morbidity.[4]

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation, the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava. In cases of portal hypertension, blood shuns from the portal system to the systemic venous system. Venous expansions on the abdominal wall delineate superficial collateral drainage alternatives when pathology deters drainage through deeper routes.[5]

Extreme dilation of periumbilical veins results in the recognizable "caput medusae". Circulation through the portal system as it courses through the liver may be reduced or obstructed from either hepatic disease or physical obstruction (e.g., tumor) blocking flow. In these instances, blood from the gastrointestinal tract can still make its way back to the right side of the heart, via the inferior vena cava, by a number of collateral routes. Blood can flow in this reverse direction because the portal veins and its tributaries are valveless.

Unusual collateral vessel connections in vena caval obstruction have shown that elaborate, myriad combinations are possible, including the following pathways: caval-superficial-umbilical-portal, caval-mammary-phrenic-hepatic capsule-portal, cavalmesenteric-portal, caval-renal-portal, caval-retroperitoneal-portal, and intrahepatic cavoportal.[6]

Indications and Potential Point Combinations

- **Periumbilical pain:** CV 7, CV 9, KI 16, ST 25.
- **Abdominal distension:** CV 7, CV 12, ST 25, ST 36, BL 25.

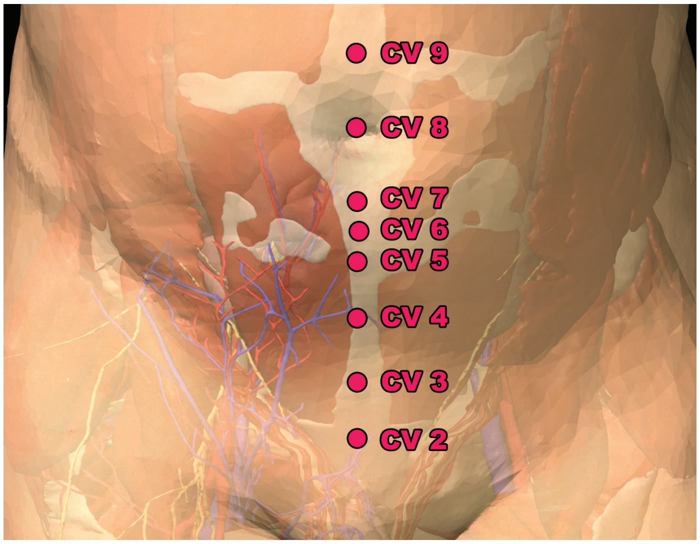


Figure 13-21. Compare the location of periumbilical vessels in this image to their appearance in the previous figure. Imagine the vessels on the individual's left side as well, not shown, reaching toward CV 4 through CV 8. The anatomy thus bespeaks the points' potential influence on circulation through the caudal abdomen.

Evidence-Based Applications

- Moxibustion at CV 7, CV 5, CV 4, CV 3, GV 4, BL 18, BL 22, BL 23, and BL 52 increased **pregnancy** rate after embryo implantation failed.[7]

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. *Plast. Reconstr. Surg.* 1998;102:761-764.
2. Hernandez DM, Matos PP, Hernandez JC, et al. Persistence of an infected urachus presenting as acute abdominal pain. Case report. *Arch Esp Urol.* 2009;62(7):589-592.
3. Miyauchi T, Ishikawa M, and Miki H. Rectus sheath hematoma in an elderly woman under anti-coagulant therapy. *J Med Invest.* 2001;48(3-4):216-220.
4. Safian RD. The inferior epigastric artery: the innocent bystander of femoral catheterization. *Catheterization and Cardiovascular Interventions.* 2012;79:638-639.
5. Yeh H-C, Stancato-Pasik A, Ramos R, et al. Paraumbilical venous collateral circulations: color Doppler ultrasound features. *J Clin Ultrasound.* 1996;24:359-366.
6. Kapur S, Paik E, Resaei A, et al. Where there is blood, there is a way: unusual collateral vessels in superior and inferior vena cava obstruction. *Radiographics.* 2010;30(1):67-78.
7. Isoyama Manca di Villahermosa D, Dos Santos LG, Nogueira MB, et al. Influence of acupuncture on the outcomes of in vitro fertilisation when embryo implantation has failed: a prospective randomised controlled clinical trial. *Acupunct Med.* 2013; 31(2):157-161.
8. Chen HN et al. Safe depth of abdominal acupoints in pediatric patients. *Complement Ther Med.* 2008;16(6):331-335.)

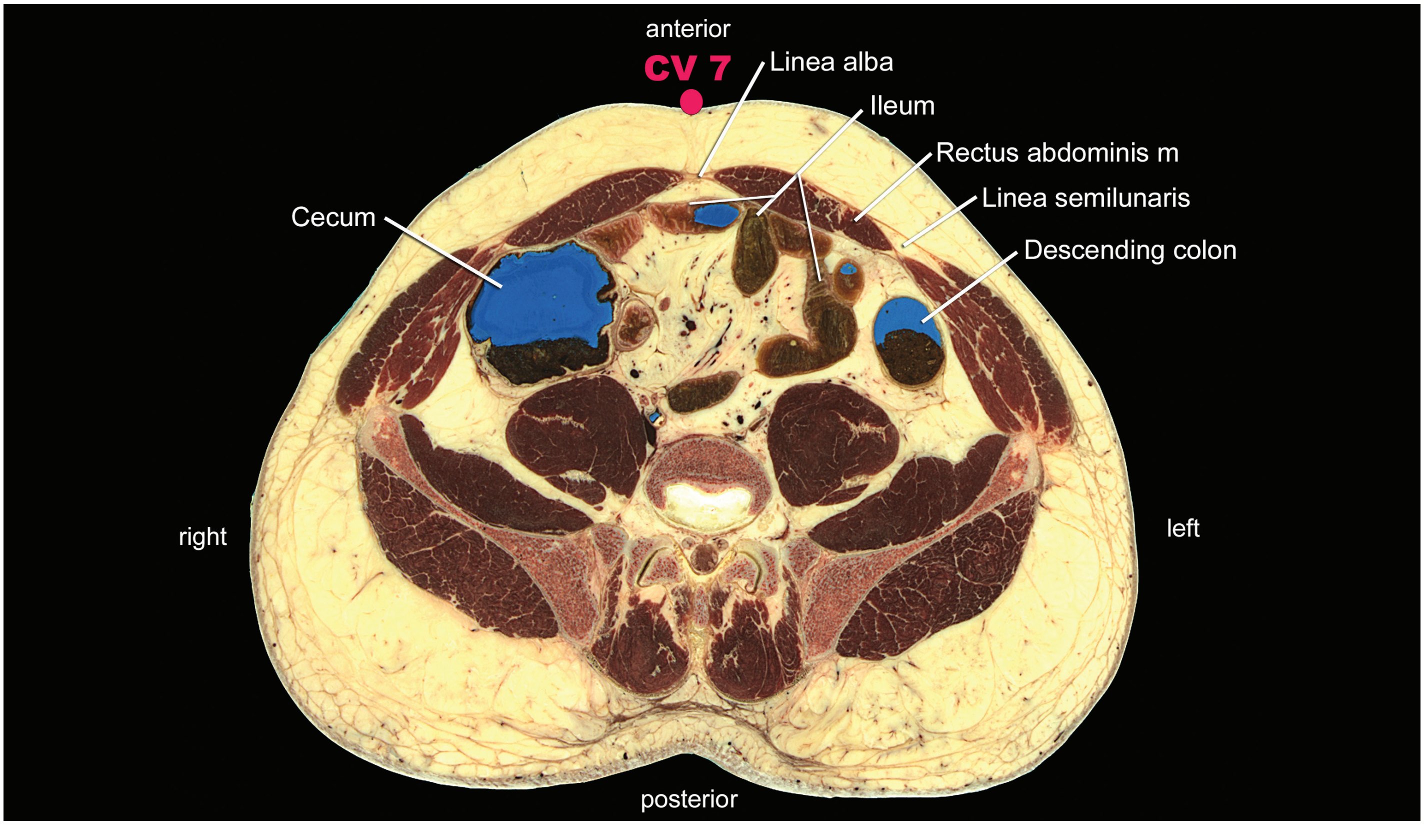

anterior
CV 7
Linea alba
Ileum
Rectus abdominis m
Linea semilunaris
Cecum
Descending colon
right
left
posterior

Figure 13-22. Note the loop of ileum deep to CV 7. Deep needling in a thin patient might injure the small intestine. Safe needling depth thus depends on the age, body weight, and adiposity of patients.[8]

CV 8

Shen Que "Spirit Gateway" "Spirit Palace" "Spirit Gate Tower"

In the center of the umbilicus.

Needling is contraindicated at this point. Treatment usually consists of moxibustion, though laser therapy offers a smoke-free alternative.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extraperitoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullne ss, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament can arise from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is showing increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T10):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Nerves supplying CV 8 overlap with activities of other points in the caudal abdomen; namely, they neuromodulate caudal abdominal visceral activities pertaining mostly to digestive functions. The heat of moxibustion at CV 8 may neuromodulate the enteric nervous system within the walls of the intestine deep to the point. If peristalsis in local loops improved, waves of nerve signals may promulgate throughout the small intestine and restore healthful bowel function. Figure 13-23 reveals the proximity of ileal loops to the falciform ligament and CV 8.

Vessels

- **Superficial epigastric artery:** Supplies the subcutaneous tissue and skin in the area cranial to the pubis.
- **Inferior epigastric artery:** Supplies the rectus abdominis and medial portion of the ventrolateral abdominal wall.
- **Superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial epigastric vein is a tributary of the great saphenous vein.
- **Inferior epigastric vein:** The inferior epigastric veins are tributaries of the external iliac veins. They anastomose with the superior epigastric veins inside the rectus sheath. These valveless veins can, like the superficial epigastric veins, act as

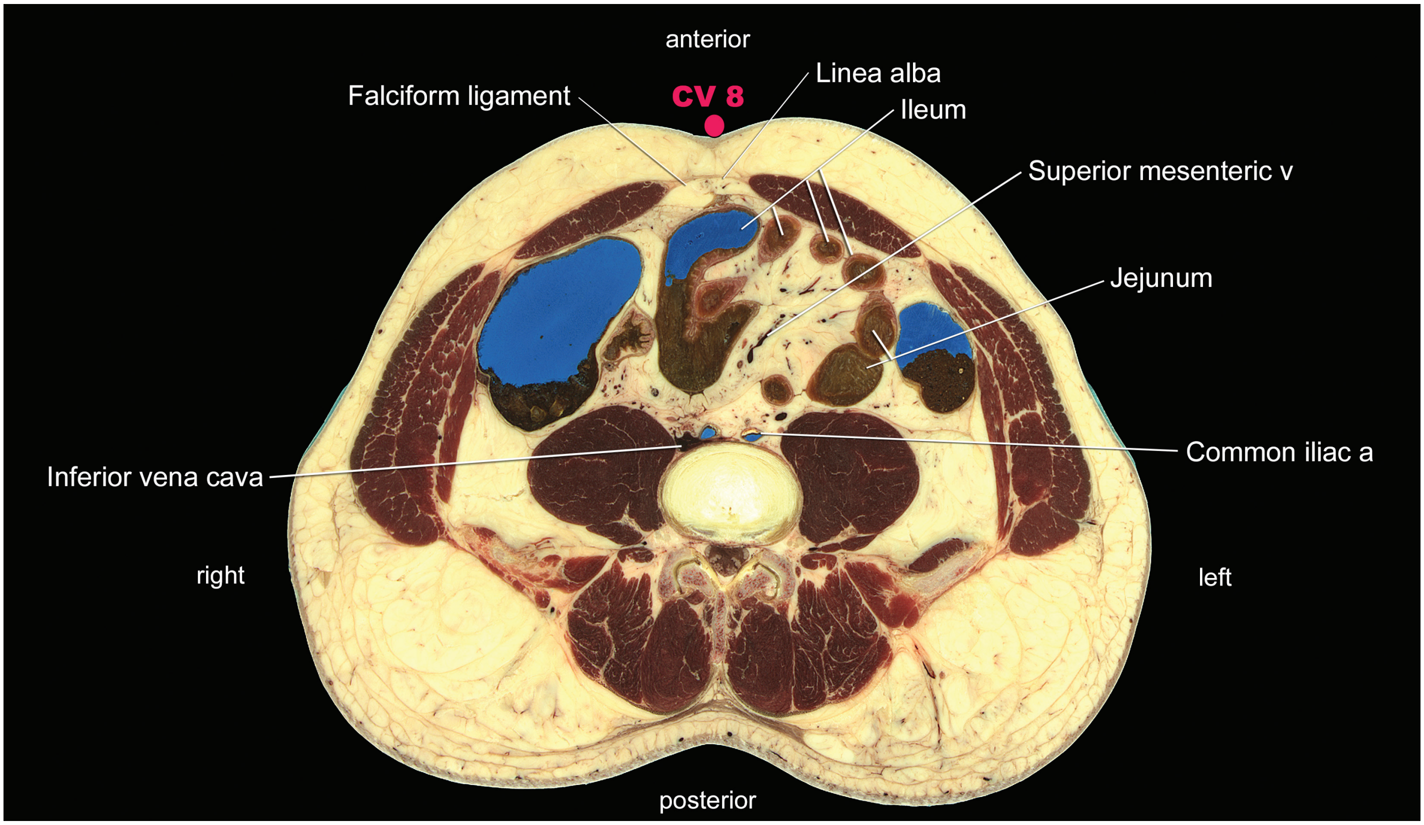


Figure 13-23. The names "Spirit Gate", "Spirit Palace", and "Spirit Gate Tower" for CV 8 connote the connection between the umbilicus and one's mother. Ancient Chinese philosophy held that the umbilicus served as a gate through which the spirit entered and left the body. In ancient times, the quasi-spiritual nature of the point may have made it "off limits" to needle. Or, perhaps then as now, needling the often-unclean umbilicus may have introduced harmful bacteria into falciform ligament tissue and pose the possibility of developing an abscess or sepsis. Note that, in contrast to horizontal sections cranial and caudal to this level, the main organs present in this plane pertain to digestion. No wonder that the main indication for moxibustion at CV 8 is diarrhea!

collateral routes for abdominopelvic blood return to the heart. These venous connections provide a route for venous return from the lower extremities to bypass the inferior vena cava in cases of obstruction or ligation. Instead, they drain into the internal thoracic, subclavian and brachiocephalic veins, and from there, into the superior vena cava.

Periumbilical Arterial Anastomoses: A rich vascular plexus exists between the peritoneum and the posterior rectus sheath beneath the umbilicus.[1] This plexus incorporates contributions from vessels coursing through the median umbilical ligament as well as those running along the ligamentum teres hepaticum, a fibrous cord that is the remnant left umbilical vein.

Periumbilical Venous Anastomoses: The superior and inferior epigastric veins anastomose with veins in the falciform ligament.

Clinical Relevance: The inferior epigastric vessels supply the rectus abdominis muscle in this region; in more cranial regions, they anastomose abundantly with the superior epigastric vessels within the confines of the rectus sheath on its deep surface. Figure 13-20 exposes the inferior epigastric arteries and veins as they ascend the abdomen.

Three distinct sources contribute to the subumbilical vascular plexus: 1) Deep inferior epigastric arteries and veins, 2) Vessels following the ligamentum teres hepaticum, and 3) Vessels associated with the median umbilical ligament. Most of the arterial vascular supply to this region originates from the deep inferior epigastric arteries via small and large perforating vessels. These perforators course toward the midline from the rectus muscle along premuscular, intramuscular, and postmuscular pathways. The umbilical skin receives blood from the subdermal plexus along with a large number of cutaneous perforators that enter the skin at the rectus abdominis muscle's tendinous intersections.

The valveless epigastric veins serve as collateral drainage routes for abdominopelvic blood. In the event of vena caval obstruction or ligation, the epigastric veins ferry venous blood craniad across the abdominal wall and into the internal thoracic, subclavian and brachiocephalic veins. From there, it empties into the superior vena cava. In cases of portal hypertension, blood shuns from the portal system to the systemic venous system. Venous expansions on the abdominal wall delineate superficial collateral drainage alternatives when pathology deters drainage through deeper routes.[9]

Extreme dilation of periumbilical veins results in the characteristic "caput medusae". Circulation through the portal system as it courses through the liver may be reduced or obstructed from either hepatic disease or physical obstruction (e.g., tumor) blocking flow. In these instances, blood from the gastrointestinal tract can still make its way back to the right side of the heart, via the inferior vena cava, by a number of collateral routes. Blood can flow in this reverse direction because the portal veins and its tributaries are valveless.

Unusual collateral vessel connections in vena caval obstruction have shown that elaborate, myriad combinations are possible, including the following pathways: caval-superficial-umbilical-portal, caval-mammary-phrenic-hepatic capsule-portal, cavalmesenteric-portal, caval-renal-portal, caval-retroperitoneal-portal, and intrahepatic cavoportal.[10]

The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[11] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Diarrhea:** Moxa at CV 8.

Evidence-Based Applications

- Moxa on CV 8 increased serum interleukin (IL)-2 and IL-12 levels, as well as **NK cell activity** in mice with transplanted tumors.[2]
- External application of the herbal mixture Huweigo to CV 8 for thirty days resulted in relief of **stomach pain**.[3]

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. *Plast. Reconstr. Surg*. 1998;102:761-764.
2. Qiu X, Chen K, Tong L, Shu X, Lu X, Wen H, and Deng C. Effects of moxibustion at Shenque (CV 8) on serum IL-12 level and NK cell activities in mice with transplanted tumor. *Journal of Traditional Chinese Medicine*. 2004;24(1):56-58.
3. Ba Y, Xiang N, Tan Z, and Zhang Y. Treatment of epigastralgia by external application of Huweigao at Shenque point. *Journal of Traditional Chinese Medicine*. 1999;19(3):214-217.
4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
9. Yeh H-C, Stancato-Pasik A, Ramos R, et al. Paraumbilical venous collateral circulations: color Doppler ultrasound features. *J Clin Ultrasound*. 1996;24:359-366.
10. Kapur S, Paik E, Resaei A, et al. Where there is blood, there is a way: unusual collateral vessels in superior and inferior vena cava obstruction. *Radiographics*. 2010;30(1):67-78.
11. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

CV 9

Shui Fen "Water Separation" "Water Divide"

On the ventral midline, 1 cun cranial to the umbilicus, 7 cun below the xiphisternal synchondrosis. Figure 13-24 illustrates the 8 cun count between the umbilicus and the xiphisternal junction.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Median umbilical ligament:** This remnant of the urachus had at one time joined the apex of the fetal bladder to the umbilicus. The median umbilical ligament represents the embryologic remnant of the cloaca and allantois. Coursing from the urinary bladder to the umbilicus, the median umbilical fold covers the median umbilical ligament.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extraperitoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[2] Venous blood from the falciform drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

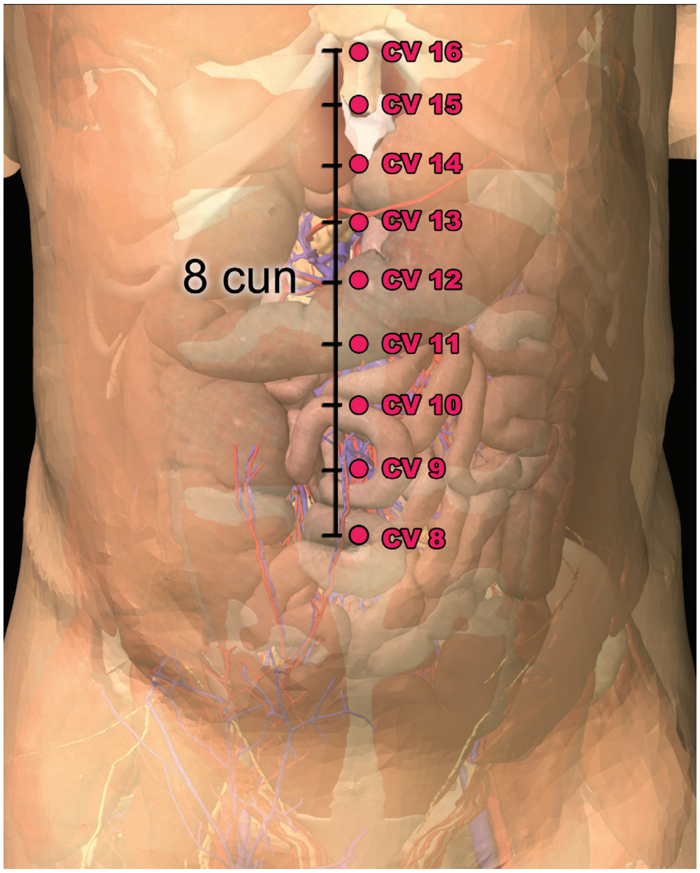


Figure 13-24. The name for CV 9, "Water Divide", refers to the activities of digestion and water absorption taking place in the small intestine, deep to the point.

Clinical Relevance: Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[3] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[4] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[5] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[6] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should not enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

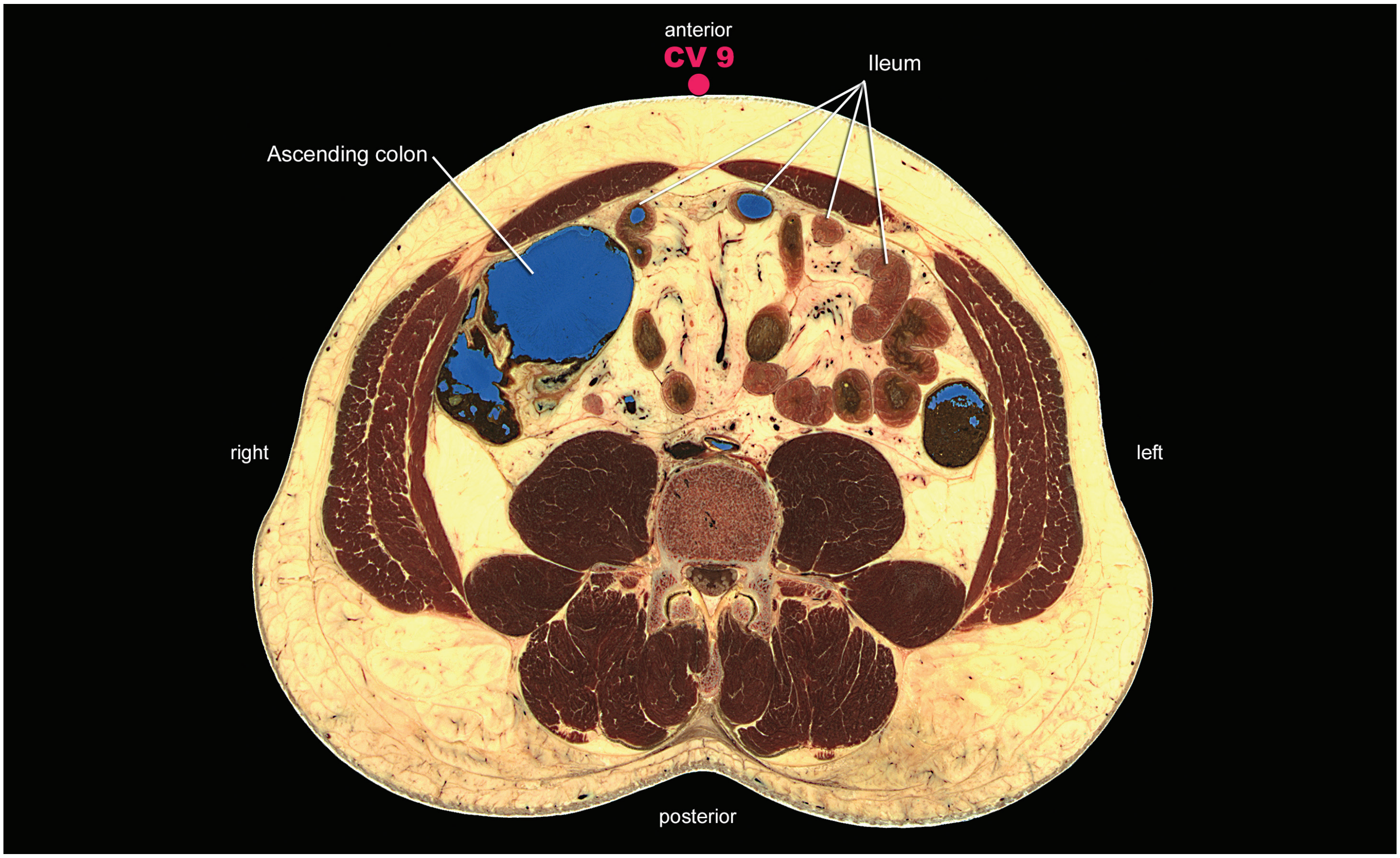


Figure 13-25. The loops of bowel and associated mesentery in this cross-section set the stage for one to consider how to neuromodulate digestive function by means of cutaneovisceral reflexes between CV 9 and organs supplied by the T9 (+/-) spinal cord segments.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T9):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Nerves supplying CV 9 overlap with activities of other points in the mid-abdomen; namely, they neuromodulate visceral activities pertaining mostly to digestive functions.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.

- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.

- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. Usually, the superficial inferior epigastric vein is a tributary of the great saphenous vein while the superior epigastric vein carries deoxygenated blood and drains into the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.

- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[7]

- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath.[1] This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[8] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions. Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Diarrhea, constipation:** CV 9, CV 12, ST 36, BL 25, GV 20.
- **Periumbilical pain:** CV 9, CV 7, LR 14, GB 24.
- **Ascites:** CV 9, CV 5, BL 23, ST 25, ST 36.

Evidence-Based Application

- Laser acupuncture with 0.25J per point thrice weekly for one month, applied to CV 9, SP 15, ST 25, ST 28, ST 40, and auricular points "stomach" and "hunger" reduced weight and body mass in patients with **"visceral postmenopausal obesity",** i.e., abdominal girth increase in older adults.[9]

References

1. Stokes RB, Whetzel TP, Sommerhaug E, and Saunders CJ. Arterial vascular anatomy of the umbilicus. *Plast. Reconstr. Surg.* 1998;102:761-764.
2. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
3. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.
4. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.
5. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.
6. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.
7. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy.* 2008;21:89-98.
8. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons.* 2004;57:392-397.
9. Hu WL, Chang CH, and Hung YC. Clinical observation on laser acupuncture in simple obesity therapy. *Am J Chin Med.* 2010;38(5):861-867.

CV 10

Xia Wan or Xia Guan "Lower Stomach Cavity" "Lower Stomach Duct" "Lower Venter"

On the ventral midline, 2 cun cranial to the umbilicus, 6 cun Caudal to the xiphisternal synchondrosis. To find CV 10, first find the midpoint between the xiphisternal junction at CV 16 and the umbilicus, or CV 8 (a distance of 8 cun). This takes you to CV 12. Next, locate CV 10 midway between CV 12 and CV 8. Refer to Figure 13-26 for point placement according to cun measurement.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Falciform ligament:** A double layer of peritoneum, containing the ligamentum teres, paraumbilical veins, and fat. It courses from the umbilicus to the diaphragm at the tendinous portion of the abdominal aspect. The paraumbilical veins and the umbilical vein (which becomes vestigial in the adult to form the ligamentum teres) comprise an accessory portal system in communication with the systemic venous network.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extraperitoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[2] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[3]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastatic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[4] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[5] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[6] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[7] Sepsis involving the ligament may develop from infection spreading by direct extension

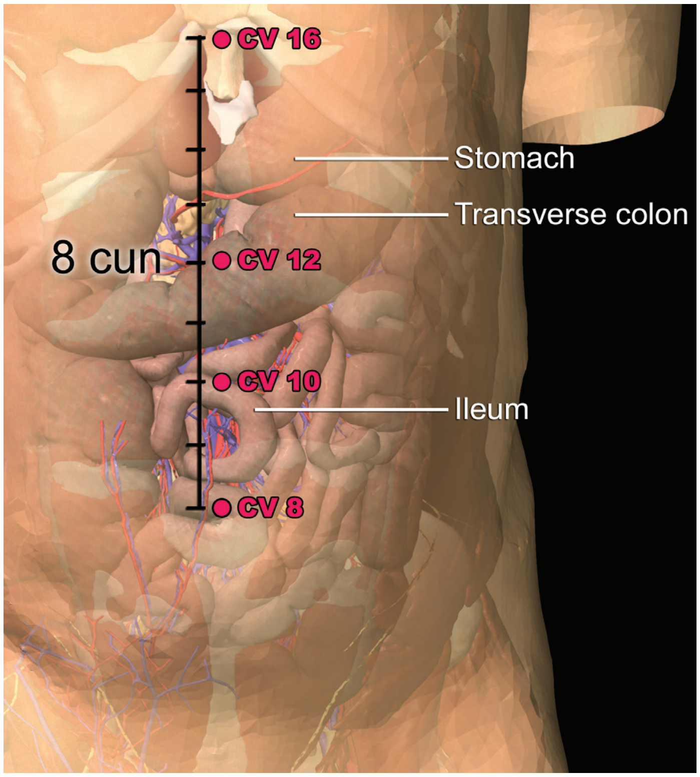


Figure 13-26. As shown by this image, CV 10 as the "Lower Stomach Cavity" and "Lower Stomach Duct" has less of an anatomical relationship with the stomach than the intestines. Likely, the name "lower stomach" referred to the intestinal tract rather than the stomach per se.

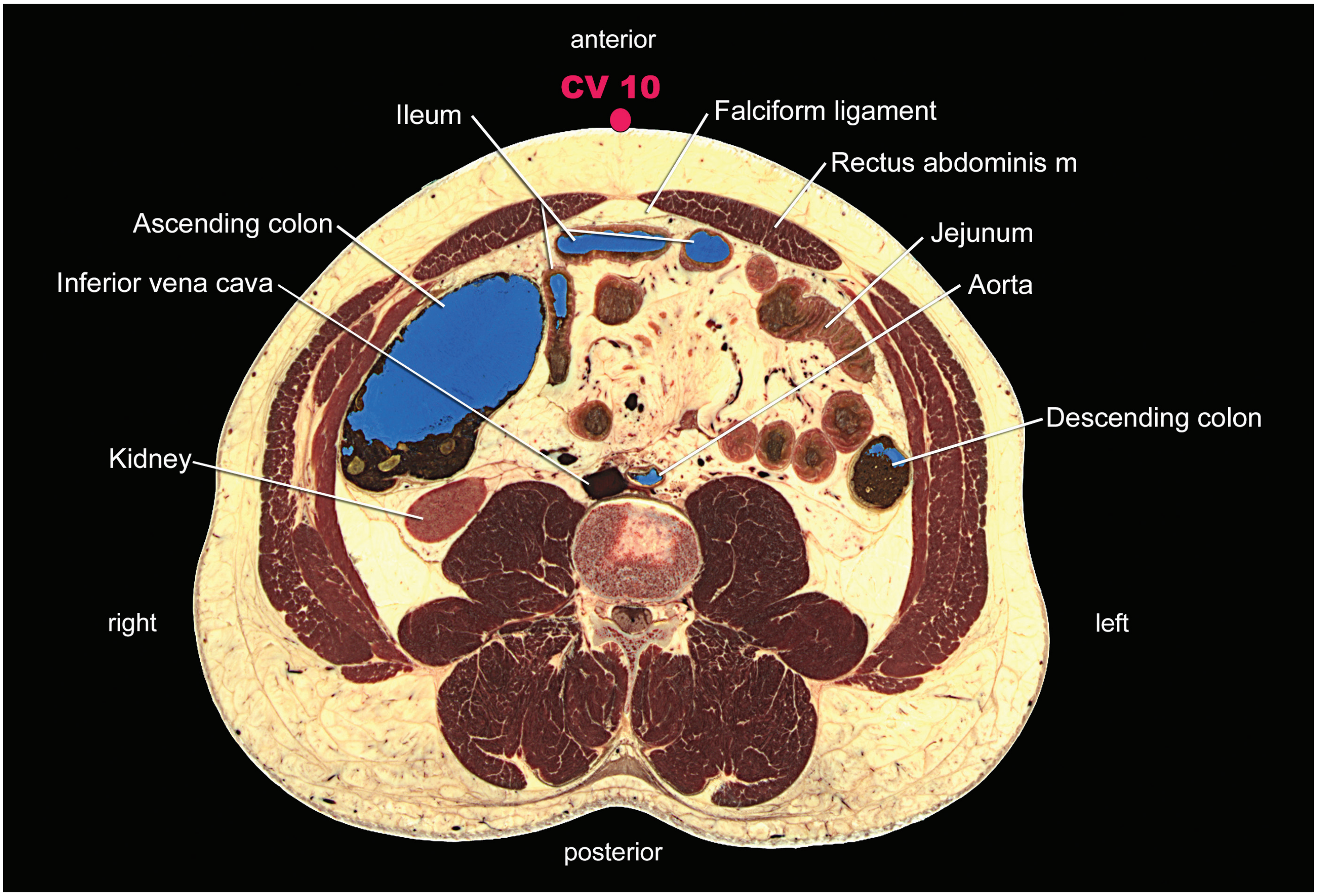


Figure 13-27. Acupressure at CV 10 can "disinhibit" the intestines and promote peristalsis. Try it on yourself to test its effectiveness.

or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T8, T9):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 10 have predominantly metabolic and digestive indications. This is because treatment at these sites influences nerves connected to spinal cord segments that help control these activities.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[8]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the

peritoneum and the posterior rectus sheath.[1] This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[9] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Painful or distended abdomen, diarrhea, vomiting, inappetance, poor digestion and assimilation, constipation:** CV 10, ST 25, ST 36, BL 25, BL 27, BL 10.
- **Insomnia:** CV 10, CV 12, CV 4, CV 6, KI 17, ST 24, ST 36, GV 20.

Evidence-Based Applications

- Acupuncture at CV 10, CV 12, CV 4, CV 6, II 18, ST 24, Xiafengshidian and Qipang (just below the umbilicus on either side of the midline separated by the width of the mouth) outperformed drug treatment for **insomnia** combined with sham acupuncture, according to a Chinese clinical trial.[1]

References

1. Wang XY, Yuan SH, Yang HY, et al. Abdominal acupuncture for insomnia in women: a randomized controlled clinical trial. *Acupuncture Electrother Res*. 2008;33(1-2):33-41.
2. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
3. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
4. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
5. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
6. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
7. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
8. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.
9. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

CV 11

Jian Li "Strengthen the Interior"

On the ventral midline, 3 cun cranial to the umbilicus, 5 cun caudal to the xiphisternal synchondrosis.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[1] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

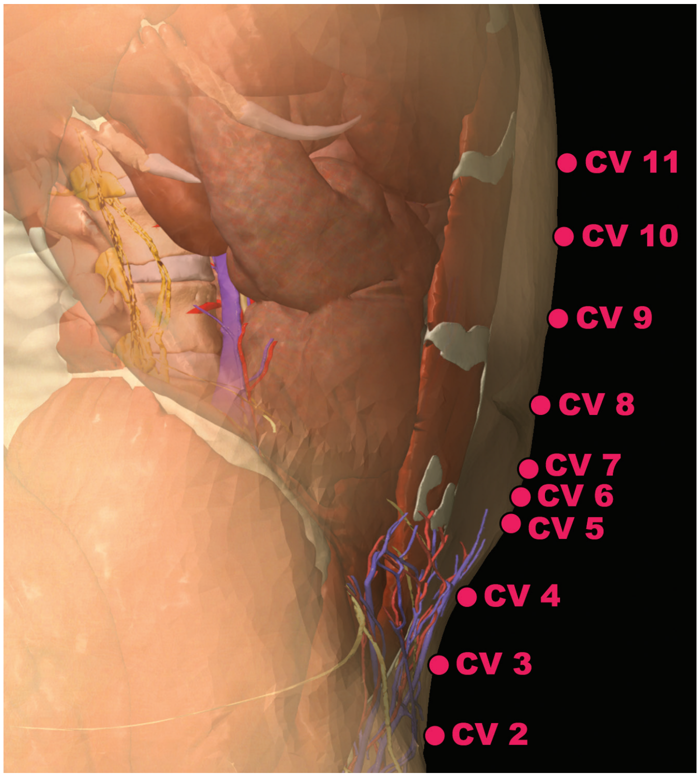


Figure 13-28. This right lateral view of the abdomen depicts CV 11 as it relates to other CV points as well as to internal structures. "Strengthen the Interior" connotes the way in which the muscular ventral abdominal wall contains and compresses organs of the trunk.

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[2]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastastic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[3] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[4] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[5] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[6] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should

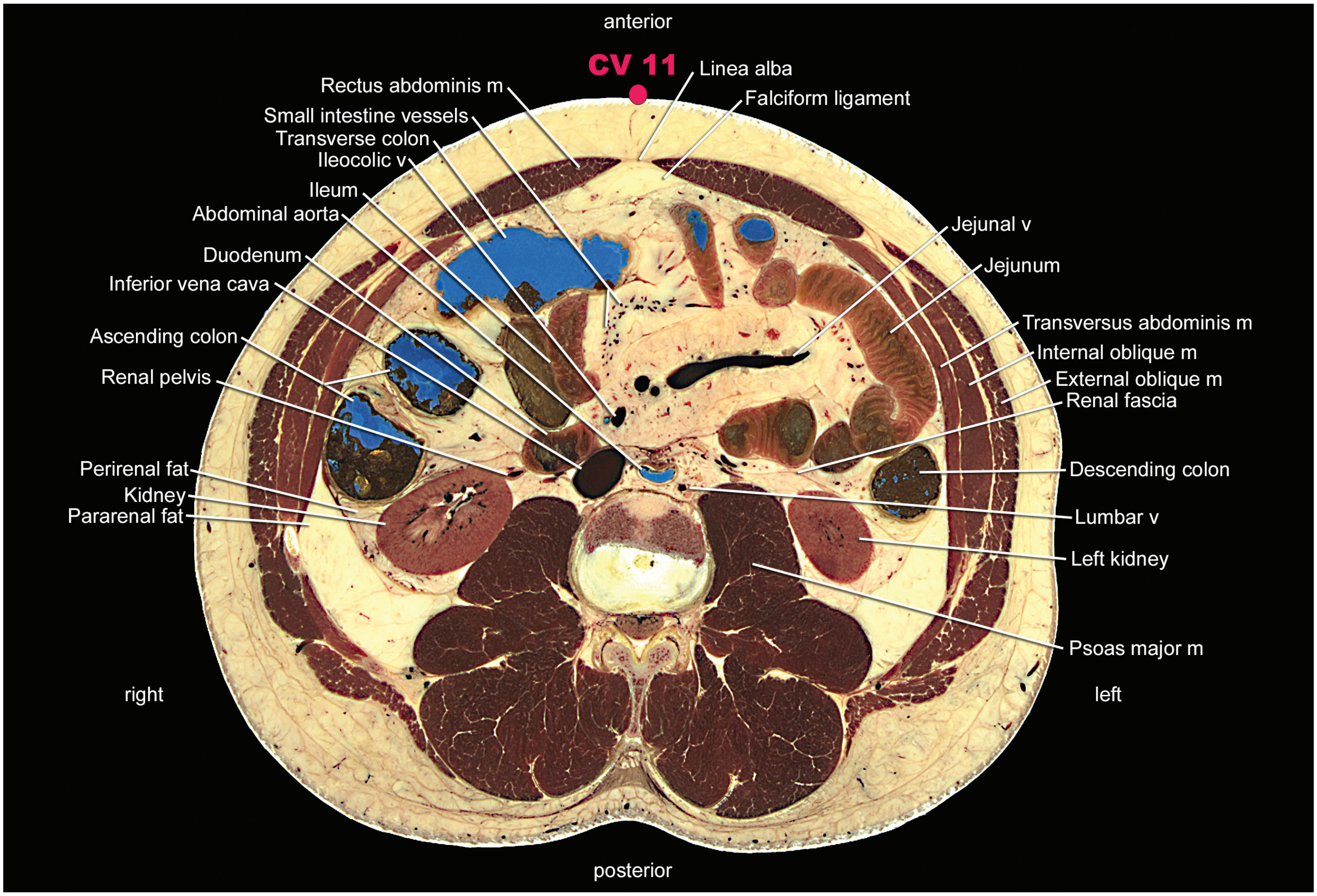

anterior
CV 11
Linea alba
Falciform ligament
Rectus abdominis m
Small intestine vessels
Transverse colon
Ileocolic v
Ileum
Abdominal aorta
Duodenum
Inferior vena cava
Ascending colon
Renal pelvis
Perirenal fat
Kidney
Pararenal fat
Jejunal v
Jejunum
Transversus abdominis m
Internal oblique m
External oblique m
Renal fascia
Descending colon
Lumbar v
Left kidney
Psoas major m
right
left
posterior

Figure 13-29. A variety of structures occupies this cross section, including loops of small and large bowel, intestinal vessels, the kidneys, and prominent paraspinal musculature. In addition to providing structural support, CV 11 may also "strengthen the interior", as its descriptive title suggests, by neuromodulating metabolic activities of internal organs that derive nutrients from ingested foodstuffs.

remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T8):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 11 have predominantly metabolic and digestive applications. This is because treatment at these sites influences nerves connected to spinal cord segments that help control these activities.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[7]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath.[1] This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and

the arteries in the ligamentum teres hepaticum and the median umbilical ligament.

- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction.

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[8] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Indications and Potential Point Combinations

- **Abdominal discomfort, dyspepsia, feelings of fullness:** CV 11, CV 6, ST 36, BL 23, BL 25.
- **Ascites:** CV 11, CV 9, CV 7, SP 9, SP 21.
- **Nausea:** CV 11, PC 6, ST 36, GV 20.

References

1. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
2. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
3. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
4. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
5. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
6. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
7. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.
8. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

CV 12

Zhong Guan, Zhong Wan

"Middle Cavity", "Central Venter", or "Central Stomach Duct"

On the ventral midline, 4 cun cranial to the umbilicus, midway between the umbilicus and the xiphisternal synchondrosis. In the center of the epigastrium.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[12] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[13]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastastic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[14] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[15] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[16] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[17] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

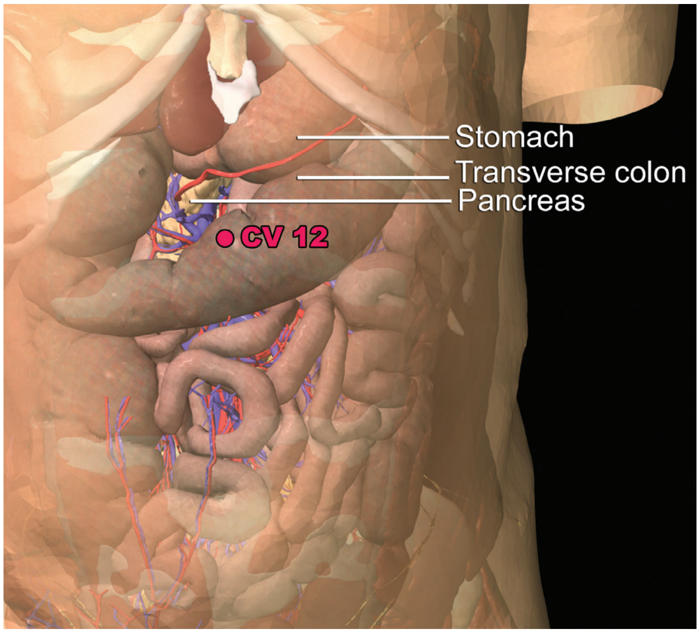


Figure 13-30. CV 12, as the "Central Stomach Duct" and major point in the "Middle Cavity" also serves as the Front Mu point for the stomach organ, influencing a host of digestive activities.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T7, T8):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 12 have predominantly metabolic and digestive applications. This is because treatment at these sites influences nerves connected to spinal cord segments that help control these activities.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[18]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath. This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.
- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction. Blunt trauma to the abdomen may also cause vena caval blockage, leading to venous engorgement from pubis (CV 2) to xiphoid (CV 16) and as far lateral as LR 13.[19]

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[20] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Avoid needling engorged vessels on the abdominal wall.

Indications and Potential Point Combinations

- **Most abdominal and digestive problems, including stomach pain, vomiting, gastritis, stomach or duodenal ulcers, abdominal distension, diarrhea, anorexia, and retention of food in stomach:** CV 12, PC 6, ST 36, SP 6, BL 21, Yintang (GV 24.5).
- **Feeling "scattered" or agitated:** CV 12, PC 6, LR 3, LI 4, GV 20.

Evidence-Based Applications

- Regarding the effects of acupuncture on canine gastric motility using ST 36, ST 40, ST 41, ST 42, ST 45, BL 12, or CV 12, only stimulation of ST 36 or BL 21 promoted gastric motility, whereas **motility decreased** with CV 12 stimulation. No significant changes in motility occurred after acupuncture at ST 40, ST 41, ST 42, or ST 45.[1]
- Moxibustion (using Artemisia vulgaris) at CV 12, ST 25, and ST 36 was effective in **preventing acute gastric lesions** induced by indomethacin in rats.[2]
- Acupuncture at CV 12, ST 36, PC 6, SP 4, BL 20, and BL 21, with either the adjunct points LI 11, GB 34, and LR 3 or CV 6, CV 4, and SP 6 improved gastric emptying in a case series of patients with **diabetic gastroparesis**.[3]
- Acupuncture at ST 36, CV 12, and PC 6 served as an effective short- and medium-term treatment for **chronic idiopathic dyspepsia,** with fewer adverse effects and longer effectiveness than treatment with the prokinetic agent, domperidone.[4]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully treated **sleep-related laryngospasm from gastroesophageal reflux,** refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[5]
- Electroacupuncture at CV 12, ST 36, PC 6, LR 3, and SP 4 daily for six weeks, in conjunction with zhizhukuanzhong capsules (a Chinese herbal formula) improved quality of life and reduced intraesophageal acid and bile reflux in patients with confirmed **gastroesophageal reflux disease (GERD).**[21]
- Acupuncture at CV 12, ST 36, SP 6, and PC 6 once daily for one week for multiple courses over a six week period experienced significant alleviation of symptoms and less intraesophageal acid and bile reflux. Results were not significantly different from patients who received omeprazole and mosapride.[22]
- Electroacupuncture (EA) at CV 4 and CV 12 in diabetic rats induced secretion of endogenous β-endorphin; this **reduced**

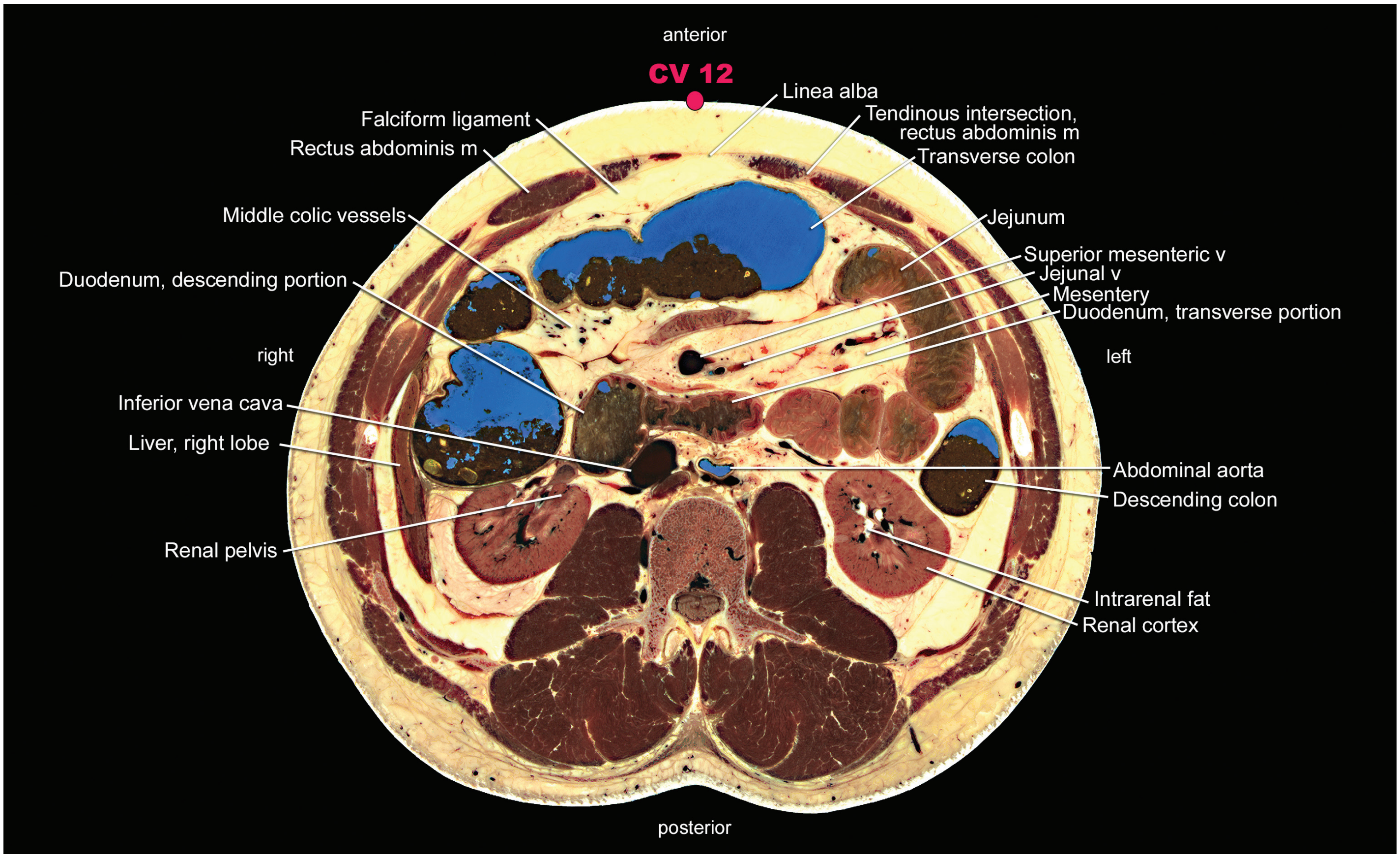


Figure 13-31. Early Chinese acupuncturists viewed CV 12 as an influential point for bowels, an impression this cross-section reinforces. This image also shows the falciform ligament arcing toward the liver, true to its name of "sickle-shaped".

plasma glucose concentration in an insulin-dependent manner.[6]

- EA at CV 12 caused beta-endorphin release from the adrenal gland, which subsequently **lowered plasma glucose** in an insulin-dependent manner.[7]
- Bee venom stimulation of CV 12 produced **visceral antinociception** in mice that was associated with α2-adrenoceptors, but not naloxone-sensitive opioid receptors.[8]
- Acupuncture at CV 6, CV 12, CV 17, ST 36, and SP 10 conferred protective effects on cognitive impairments caused by multiinfarction dementia in rats, suggesting it may benefit patients with **vascular dementia.**[9]
- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in prophylaxis of **migraine** compared to flunarizine.[10]
- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud's syndrome,** demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[11]

References

1. Jeong SM, Kim H-Y, and Nam T-C. Effect of traditional acupuncture on canine gastric motility. *J Vet Clin.* 2002;19(4):397-400.
2. Freire AO, Sugai GCM, Blanco MM, Tabosa A, Yamamura Y, and Mello LEAM. Effect of moxibustion at acupoint Ren-12 (Zhongwan), St-25 (Tianshu), and St-36 (Zuzanli) in the prevention of gastric lesions induced by indomethacin in Wistar rats. *Digestive Diseases and Sciences.* 2005;50(2):366-374.
3. Wang L. Clinical observation on acupuncture treatment in 35 cases of diabetic gastroparesis. *Journal of Traditional Chinese Medicine.* 2004;24(3):163-165.
4. Cittadini M, Marmori F, Diacinti D, and Walker JI. Randomized trial of acupuncture compared with prokinetic drugs and sham acupuncture for chronic idiopathic dyspepsia. *Medical Acupuncture.* 14(2). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol14_2/article2.html.
5. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci.* 2003;326(2):107-109.
6. Chang SL, Lin JG, Chi TC, Liu IM, and Cheng JT. An insulin-dependent hypoglycaemia induced by electroacupuncture at the Zhongwan (CV 12) acupoint in diabetic rats. *Diabetologia.* 1999;42:250-255.
7. Lin J-G, Chang S-L, and Cheng J-T. Release of beta-endorphin from adrenal gland to lower plasma glucose by the electroacupuncture at Zhongwan acupoint in rats. *Neuroscience Letters.* 2002;326:17-20.
8. Kwon Y-B, Kang M-S, Han H-J, Beitz AJ, and Lee J-H. Visceral antinociception produced by bee venom stimulation of the Zhongwan acupuncture point in mice: role of α2 adrenoceptors. *Neuroscience Letters.* 2001;308;133-137.
9. Yu J, Liu C, Zhang X, and Han J. Acupuncture improved cognitive impairment caused by multi-infarct dementia in rats. *Physiology and Behavior.* 2005 [in press].
10. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache.* 2002;42:855-861.
11. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine.* 1997;241:119-124.
12. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
13. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
14. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.
15. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.
16. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.
17. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.
18. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior

abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.

19. Schattner A, Adi M, and Friedman J. A case of curious collaterals. *Am J Med*. 2009;122(8):724-725

20. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

21. Zhang C, Guo L, Guo X, et al. Clinical curative effect of electroacupuncture combined with zhizhukuanzhong capsules for treating gastroesophageal reflux disease. *J Tradit Chin Med*. 2012;32(3):364-371.

22. Zhang CX, Qin YM, and Guo BR. Clinical study on the treatment of gastroesophageal reflux by acupuncture. *Chin J Integr Med*. 2010;16(4):298-303.

CV 13

Shang Guan, Shang Wan

"Upper Cavity" "Upper Stomach Duct" "Upper Venter"

On the ventral midline, 3 cun caudal to the xiphisternal synchondrosis, or 5 cun cranial to the umbilicus.

Compare the locations of CV 13, the "Upper Venter" to CV 12, the "Central Venter", and CV 10, the "Lower Venter" in Figure 13-32.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[3] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[4]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastastic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[5] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[6] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[7] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[8] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should

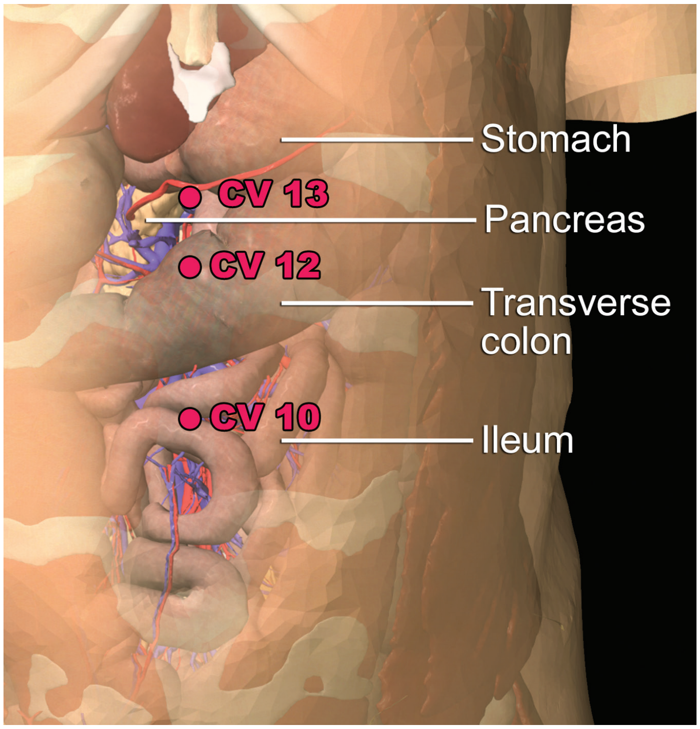


Figure 13-32. The upper, middle, and lower "venters", alternate titles for CV 13, CV 12, and CV 10, respectively, may refer to the stomach, transverse colon, and ileum, as shown here.

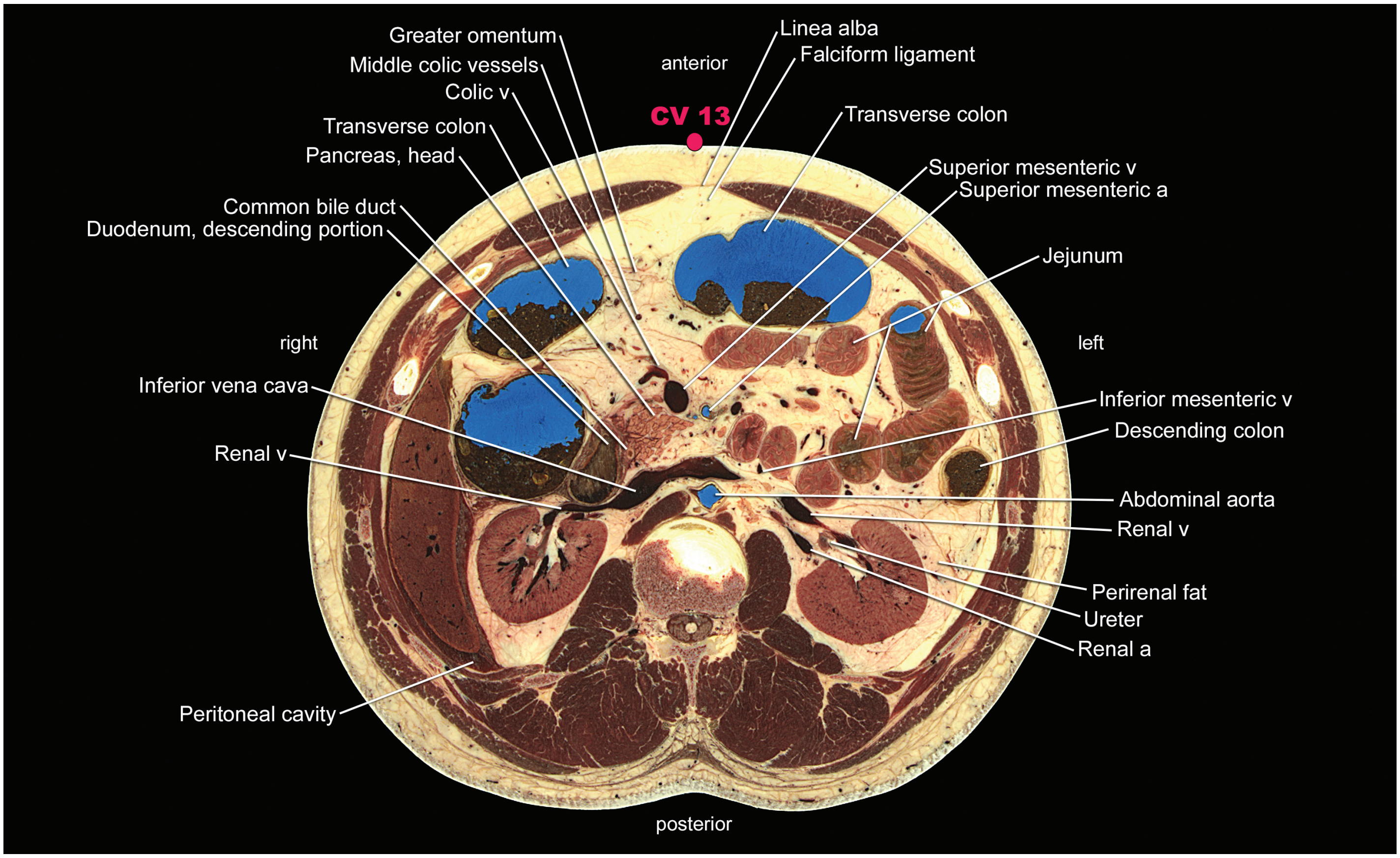

Greater omentum
Middle colic vessels
Colic v
Transverse colon
Pancreas, head
Common bile duct
Duodenum, descending portion
anterior
CV 13
Linea alba
Falciform ligament
Transverse colon
Superior mesenteric v
Superior mesenteric a
Jejunum
right
left
Inferior vena cava
Renal v
Inferior mesenteric v
Descending colon
Abdominal aorta
Renal v
Perirenal fat
Ureter
Renal a
Peritoneal cavity
posterior

Figure 13-33. The cornucopia of organs in this cranial abdominal cross-section highlights the potential for diverse somatovisceral reflex potential of CV 13. While the stomach has not appeared in the same plane as any of the "stomach duct" or "venter" sites (i.e., CV 13, CV 12, and CV 10), this cross section exposes the relationships of several other digestive structures, including the duodenum, common bile duct, pancreas, jejunum, and transverse colon with CV 13. The vena cava, singular vessel affiliated with the CV channel, displays its linkage with the renal vein.

remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T7, T8):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 13 have predominantly metabolic and digestive applications. This is because treatment at these sites influences nerves connected to spinal cord segments that help control these activities.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[9]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath. This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.[10]
- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in

the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction. Blunt trauma to the abdomen may also cause vena caval blockage, leading to venous engorgement from pubis (CV 2) to xiphoid (CV 16) and as far lateral as LR 13.

Clinical Relevance: The anatomical layout of vessels around the umbilicus becomes of heightened importance during body contouring procedures such as abdominoplasty.[11] The venous drainage of the abdominal wall is even more variable than the arterial network, accentuating the risk of insufficient circulatory recovery of blood supply and drainage after abdominoplasty and transverse rectus abdominis myocutaneous (TRAM) flap reconstructions.

Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues.

Avoid needling engorged vessels on the abdominal wall.

Indications and Potential Point Combinations

- **Gastritis, stomach pain, abdominal distension, nausea, vomiting:** CV 13, ST 25, ST 36, PC 6, BL 20, BL 21.
- **Hiccoughs (hiccups):** CV 13, CV 14, CV 22, KI 21, BL 17.

Acupressure to these points while inhaling slowly and deeply can also counteract hiccoughs, as an alternative to needling them.

- **Cholecystitis:** CV 13, GB 24, LR 14, LR 3, BL 18, BL 19, ST 36, GB 34.
- **Seizures, agitation:** CV 13, HT 7, PC 5, ST 40, LR 2, GV 20.

Evidence-Based Applications

- Transcutaneous electrical acupuncture point stimulation applied to PC 6 and CV 13 prevented **postoperative vomiting** following pediatric tonsillectomy as well as ondansetron, and with fewer side effects.[1]
- Acupuncture at PC 6 and CV 13 was as effective alternative to ondansetron for the prevention of **postoperative vomiting in children** undergoing dental surgery with general anesthesia.[2]

References

1. Kabalak AA, Akcay M, Akcay F, and Gogus N. Transcutaneous electrical acupoint stimulation versus ondansetron in the prevention of postoperative vomiting following pediatric tonsillectomy. *Journal of Alternative and Complementary Medicine*. 2005;11(3):407-413.
2. Somri M, Vaida SJ, Sabo E, Yassain G, Gankin I, and Gaitini LA. Acupuncture versus ondansetron in the prevention of postoperative vomiting. A study of children undergoing dental surgery. *Anaesthesia*. 2001;56:927-932.
3. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
4. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
5. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
6. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. Journal of Medical Case Reports. 2012;6:206.
7. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
8. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
9. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.
10. Schattner A, Adi M, and Friedman J. A case of curious collaterals. *Am J Med*. 2009;122(8):724-725
11. O'Dey DM, Heimburg DV, Prescher A, et al. The arterial vascularization of the abdominal wall with special regard to the umbilicus. *The British Association of Plastic Surgeons*. 2004;57:392-397.

CV 14

Ju Que "Great Tower Gate"
"Great Palace" "Great Watchtower"

On the ventral midline, 2 cun caudal to the xiphisternal synchondrosis, or 6 cun cranial to the umbilicus.

Connective Tissues

- **Linea alba:** The linea alba arises from the anterior and posterior layers of the rectus sheath, which interlace in the anterior midline. The rectus sheath embodies the strong fibrous compartment that incompletely encloses the rectus abdominis and pyramidalis muscles. This fibrous compartment, in turn, arises from the aponeuroses of the flat abdominal muscles – the external and internal obliques and the transverse abdominal muscles.
- **Transversalis fascia:** This firm fascial sheet lines most of the abdominal wall, covers the deep surface of the transverse abdominal muscle and its aponeurosis, and is contiguous with and deep to the linea alba.
- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[4] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[5]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastastic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[6] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[7] Patients with disorders affecting the

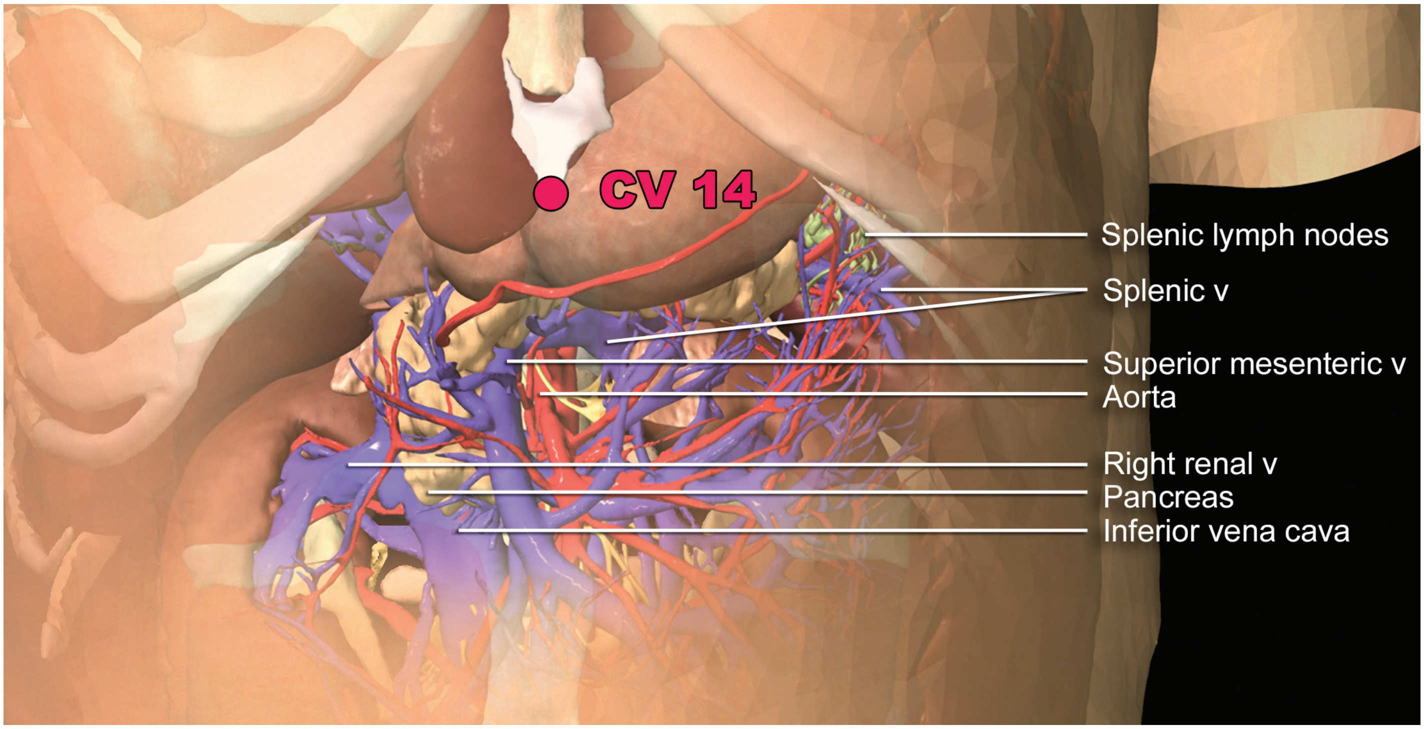


Figure 13-34. The name "Great Tower Gate" for CV 14 indicates its position near the tip of the xiphoid process. To the ancient Chinese, the xiphoid and sternum resembled a *"Ju Que"* or ancient sword. Metaphorically, *Ju Que* protects the heart at the watchtower entrance to the inner sanctum (thorax) that houses the heart.

falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[8] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[9] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T7):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 14 have predominantly metabolic and digestive applications. This is because treatment at these sites influences nerves connected to spinal cord segments that help control these activities. That said, however, the classification of CV 14 as the Front Mu point for the heart suggests some crossover effects for organs of the caudal thorax.

Gallstone pain sometimes appears at CV 14.[10] Pain may also refer to GB 24, GV 6, and GV 11.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.
- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[11]
- **Note about the periumbilical arterial anastomoses:** A rich vascular plexus lies beneath the umbilicus, between the peritoneum and the posterior rectus sheath. This plexus incorporates a network of vessels arriving via the median umbilical ligament and the ligamentum teres hepaticum, a fibrous, cordlike remnant of the left umbilical vein. Vessels from both sides of the midline communicate with the anastomoses. Three sources contribute to the subumbilical vascular plexus: the deep inferior epigastric arteries (via small and large perforating vessels) and the arteries in the ligamentum teres hepaticum and the median umbilical ligament.
- **Note about the periumbilical venous anastomoses:** The superior and inferior epigastric veins anastomose with veins in the falciform ligament to form the periumbilical venous anastomoses. Excessive dilation ("caput medusae") of the periumbilical veins occurs as a consequence of portal hypertension, secondary to liver disease or obstruction. Blunt trauma to the abdomen may also cause vena caval blockage, leading to venous engorgement from pubis (CV 2) to xiphoid (CV 16) and as far lateral as LR 13.[12]

Clinical Relevance: Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues in the cranial thorax.

Avoid needling engorged vessels on the abdominal wall.

Indications and Potential Point Combinations

- **Lack of will or motivation:** CV 14, ST 25, CV 6, BL 23, LR 3, GV 24.5 (Yintang).
- **Anxiety, fear:** CV 14, BL 15, HT 7, PC 7, LR 3, GV 20.
- **Feeling of pain or fullness in the chest, palpitations:** CV 14, CV 17, PC 6, PC 7, BL 13, BL 14, BL 15, LR 2, LR 3.
- **Stomach pain, nausea, vomiting, gastric reflux, esophageal motility disorders, acid regurgitation:** CV 14, CV 15, CV 22, ST 36, BL 10, BL 17, BL 18.
- **Stomach problems of emotional origin:** CV 14, CV 12, KI 21, ST 36, Yintang.

Evidence-Based Applications

- Following **acute myocardial infarction,** patients receiving acupuncture at CV 14, CV 17, ST 36, PC 6, and SP 6 demonstrated the following changes: reduced blood viscosity and myocardial oxygen consumption, improved microcirculation and left ventricular function, improved collateral circulation, and reduced the area of infarction.[1]

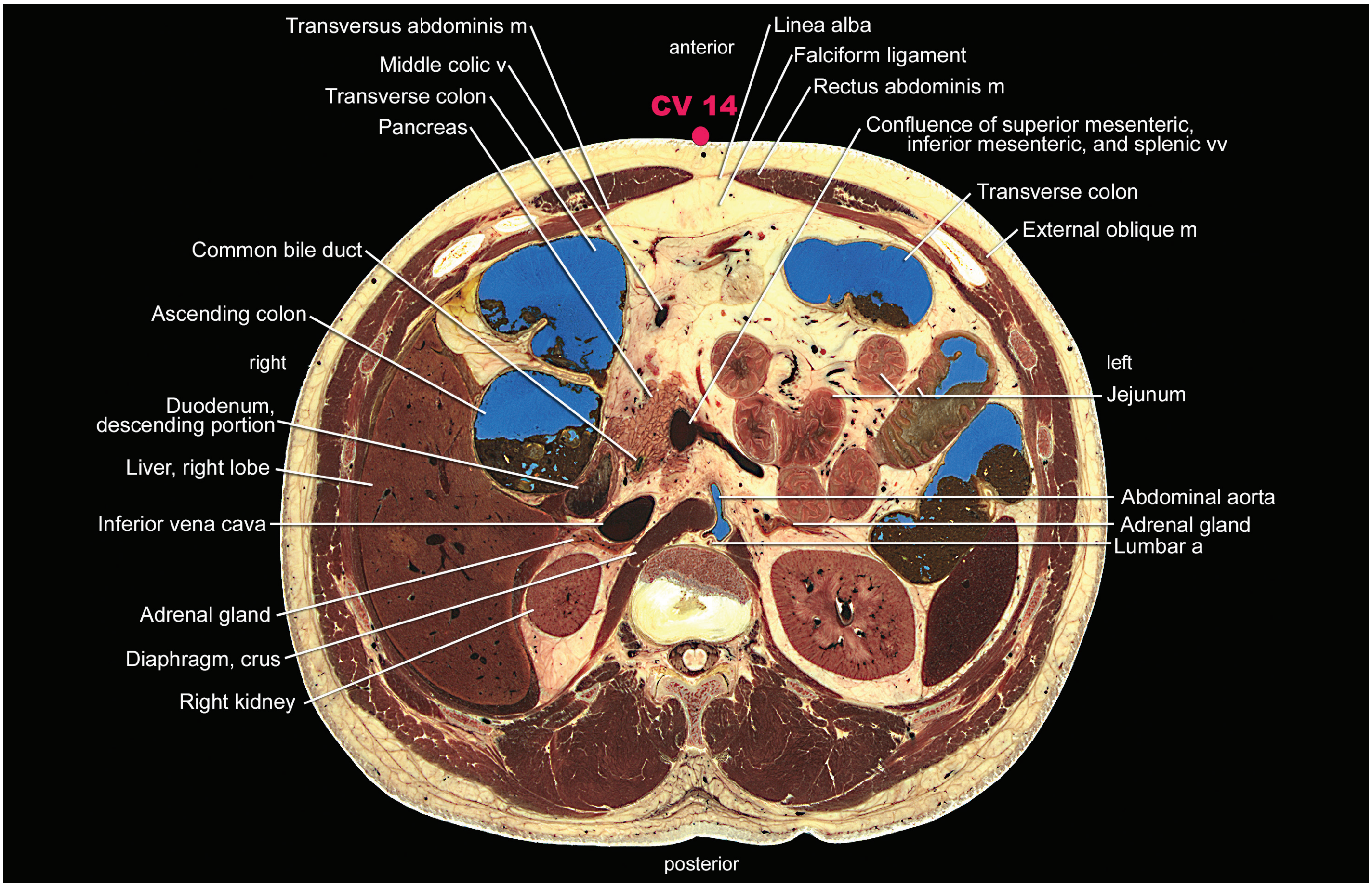

Transversus abdominis m
Middle colic v
Transverse colon
Pancreas
anterior
CV 14
Linea alba
Falciform ligament
Rectus abdominis m
Confluence of superior mesenteric, inferior mesenteric, and splenic vv
Transverse colon
External oblique m
Common bile duct
Ascending colon
right
left
Jejunum
Duodenum, descending portion
Liver, right lobe
Abdominal aorta
Inferior vena cava
Adrenal gland
Lumbar a
Adrenal gland
Diaphragm, crus
Right kidney
posterior

Figure 13-35. The relationship of CV 14 to the heart may pertain more closely to the effects of neuromodulation of cranial abdominal organs such as the liver, adrenal gland, and pancreas, all of which participate in adaptation to stress.

- Laser acupuncture significantly outperformed sham laser for the treatment of **mild to moderate depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[2]
- Laser acupuncture at CV 14, LR 14, LR 8, HT 7, and KI 3 reduced depressive symptoms in patients with **major depressive disorder** in a randomized, double-blind, placebo controlled trial.[13]
- Laser acupuncture applied to CV 14, LR 14, LR 8, and HT 7 stimulated, as a group, the **frontal-limbic-striatal brain regions,** through the patterns of neural activity differed slightly for each individual point.[14]
- Acupuncture at LU 9, ST 36, ST 40, SP 1, SI 3, BL 15, LR 3, CV 12, and CV 14 induced long-lasting reductions in attacks of primary **Raynaud's syndrome,** demonstrated effectiveness comparable to nifedipine, and did so without adverse effects.[3]

References

1. Zhu B, Bi L, Liang S, Pang L, Wang S, Liu J, Jiang A, Li C, Ye Z, Yang H, Chen Z, Wang K, Bian S, Guo X, and Hong H. Effect of acupuncture on left ventricular function, microcirculation, blood rheology and cyclicnucleotides in patients with acute myocardial infarction. *Journal of Traditional Chinese Medicine.* 1989;9(1):63-68.
2. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine*. 2005;23(3):103-111.
3. Appiah R, Hiller S, Caspary L, Alexander K, and Creutzig A. Treatment of primary Raynaud's syndrome with traditional Chinese acupuncture. *Journal of Internal Medicine.* 1997;241:119-124.
4. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
5. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery.* 2009;79(10):678-680.
6. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia.* 2013;17(1):95-100.
7. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports.* 2012;6:206.
8. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology.* 2012;27(8):1409.
9. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology.* 2011;22(2):213-215.
10. Berhane T, Vetrhus M, Hausken T, et al. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: the results of a prospective study. *Scandinavian Journal of Gastroenterology.* 2006;41:93-101.
11. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy.* 2008;21:89-98.
12. Schattner A, Adi M, and Friedman J. A case of curious collaterals. *Am J Med.* 2009;122(8):724-725
13. Quah-Smith I, Smith C, Crawford JD, et al. Laser acupuncture for depression: a randomised double blind controlled trial using low intensity laser intervention. *J Affect Disord.* 2013;148(2-3):179-187.
14. Quah-Smith I, Sachdev PS, Wen W, et al. The brain effects of laser acupuncture in healthy individuals: an fMRI investigation. *PLoS One.* 2010;5(9):e12619.

CV 15

Jiu Wei "Turtledove Tail"

On the ventral midline, 1 cun caudal to the xiphisternal synchondrosis, or 7 cun cranial to the umbilicus.

Connective Tissues

- **Falciform ligament:** This sickle-shaped ligament attaches the liver to the ventral body wall. An embryologic remnant of the ventral mesentery, the falciform ligament denotes the separation of the most caudal portion of the left liver lobe into medial and lateral segments. The ligament attaches to the deep surface of the rectus abdominis as far down as the umbilicus. It comprises two mesothelial layers of peritoneum filled with extra-peritoneal fat; the free edge houses the embryonic remnant of the ligamentum teres hepatis (obliterated left umbilical vein), muscular fibers, and paraumbilical veins. These vessels may re-open in patients with portal hypertension, as the congestion in the liver purses venous blood toward the abdominal wall and into previously dormant vascular pathways. The falciform ligament receives its blood supply from the left phrenic artery and a branch of the middle segment artery of the liver.[2] Blood that travels in veins within the falciform ligament usually drains into the left inferior phrenic vein. The paraumbilical veins together with the umbilical vein create an accessory portal system in communication with the systemic venous system. The inferior epigastric veins connect to the paraumbilical veins (of Burrow).

In Cruveilhier-Baumgarten syndrome, blood makes its way once again through the umbilical vein to the paraumbilical veins and on toward the umbilicus. There, the veins anastomose with systemic abdominal veins to create portosystemic anastomosis.[3]

Clinical Relevance: When infection, herniation, developmental anomalies, or vascular compromise affect the falciform ligament, it can cause nebulous abdominal pain and a feeling of abdominal fullness or dyspepsia. The falciform ligament with its lymphatic and vascular anatomic complexity allows spread of infection, or blood from intraabdominal pathology to the abdominal and thoracic wall.

Metastastic spread of pancreatic adenocarcinoma along the gastrohepatic ligament to the falciform ligament and on to the umbilicus is called the "Sister Mary Joseph" nodule, a sign of subumbilical metastasis.

Internal hernias, such as those involving the falciform ligament, can develop within defects in the ligament that begin as congenital defects or were acquired after trauma, pregnancy, or laparoscopic surgery.[4] During the latter, the placement of a laparoscopic trocar can tear a rent in the ligament. A congenital or acquired hernia in the ligament may trap, obstruct, or strangulate a loop of intestine.[5] Patients with disorders affecting the falciform ligament typically complain of severe abdominal pain in the cranial abdomen, possibly localized to the right upper quadrant. Cysts in the falciform give patients the perception of fullness, an abdominal mass, pain, or dyspepsia in the vicinity of the space-occupying lesion.

Falciform ligament abscess is another potential complication of laparoscopic surgery,[6] although gallbladder and hepatic pathology have also been determined as causative factors in abscess formation. Other pathology striking the structure includes inflammation after acute cholecystitis; ligament necrosis, and hematoma.[7] Sepsis involving the ligament may develop from infection spreading by direct extension or lymphatic spread. The extensive network connecting the falciform to other areas creates a complex vascular and lymphatic interchange through which infection can spread to and from, including the diaphragm, liver, retroperitoneum, and thoracoabdominal wall.

Hemorrhage is occurring with increased frequency of occurrence due to the rising number of patients receiving anticoagulant medication; bleeding may spread into the rectus sheath or remain within the ligament.

Acupuncture at KI and CV points between the sternum and umbilicus should neither enter the abdomen nor invade the falciform ligament. Rather, the benefit of local needling should remain superficial to avoid the ligament but at least indirectly influence tension in the tissue and local blood flow. Massage and laser therapy provide noninvasive alternative means of releasing the structure.

Nerves

- **Thoracoabdominal nerves (T7-T11, mainly T7):** Supplies the anterior abdominal muscles and the skin overlying them. Also supplies the periphery of the diaphragm.

Clinical Relevance: Acupuncture points in the cranial abdomen such as CV 15 may have both caudal thoracic and cranial abdominal applications, in that its position over the xiphoid process marks a zone of transition.

Vessels

- **Superior superficial epigastric artery:** Supplies the subcutaneous tissue and skin above the umbilicus. A direct continuation

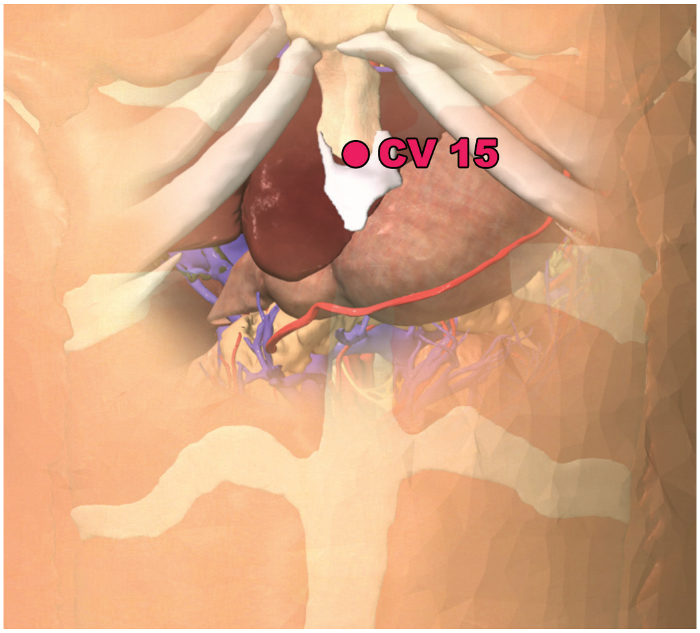


Figure 13-36. The xiphoid process resembles a "turtledove's tail", hence its descriptive name. To extend the metaphor, the sternum embodies the bird's back and the ribs, its wings.

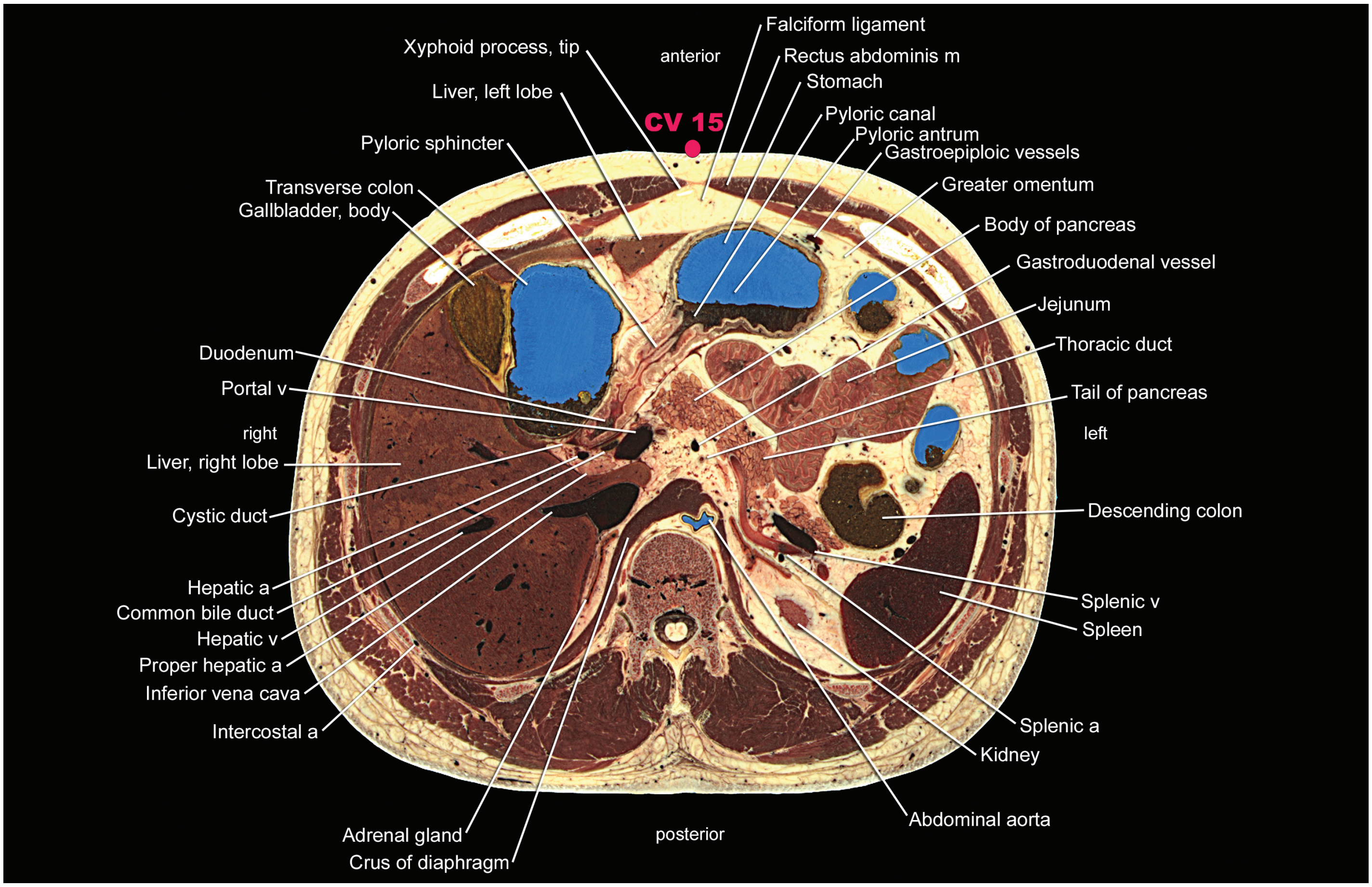

Xyphoid process, tip
anterior
Falciform ligament
Rectus abdominis m
Stomach
Liver, left lobe
CV 15
Pyloric canal
Pyloric antrum
Gastroepiploic vessels
Pyloric sphincter
Greater omentum
Transverse colon
Gallbladder, body
Body of pancreas
Gastroduodenal vessel
Jejunum
Duodenum
Thoracic duct
Portal v
Tail of pancreas
right
left
Liver, right lobe
Cystic duct
Descending colon
Hepatic a
Common bile duct
Hepatic v
Proper hepatic a
Inferior vena cava
Splenic v
Spleen
Intercostal a
Splenic a
Kidney
Abdominal aorta
Adrenal gland
posterior
Crus of diaphragm

Figure 13-37. Emotional disorders may cause tension and digestive disturbances in the central cranial abdomen, just caudal to the sternum. Here at the "pit" of the stomach, CV 15 relates closely to the pyloric sphincter, the so-called "pit". Cholecystokinin (CCK), a brain-gut peptide that regulates gastrointestinal function, inhibits gastric motility and emptying.[9] This neurotransmitter also mediates panic disorder, pain, and anxiety. As such, a somato-emotional connection between anxiety and visceral dysfunction manifests at CV 15.

of the internal thoracic artery, the superior epigastric artery descends within the rectus sheath, deep to the rectus abdominis muscle. It supplies the rectus abdominis muscle and the superior portion of the anterolateral abdominal wall. It anastomoses with the inferior superficial epigastric artery.

- **Superior deep epigastric artery:** Supplies the rectus abdominis and medial portion of the anterolateral abdominal wall.
- **Superior superficial epigastric vein:** The superficial epigastric veins provide collateral circulation routes for abdominopelvic venous blood. These valveless veins offer an additional route for venous blood to return to the heart in cases of inferior vena caval obstruction or ligation. The superior epigastric vein carries deoxygenated blood into the internal thoracic vein; as such, this vessel becomes a tributary of the internal thoracic vein. The superior and inferior superficial epigastric vessels anastomose at the level of the umbilicus.
- **Superior deep epigastric vein:** The superior epigastric vein, like its superficial counterpart, empties into the internal thoracic vein. Valves in the superior deep epigastric veins direct blood flow craniad, while those in the inferior group send blood caudad.[8]

Clinical Relevance: Laser therapy and other physical medicine measures assist in the restoration of circulation and should be considered for wound healing issues in the cranial thorax.

Indications and Potential Point Combinations

- **Abdominal disorders, spastic discomfort, nausea and vomiting, gastric reflux:** CV 15, PC 6, ST 36, GV 20, LR 3, BL 18, BL 19.
- **Esophageal motility disorders:** CV 15, CV 14, CV 17, CV 22, ST 36, BL 16, GV 14.
- **Hiccoughs:** CV 15, CV 14, CV 22, BL 17. Acupressure at CV 14, KI 21.
- **Seizures:** CV 15, HT 7, ST 36, LR 2, LR 3, GV 20, Yintang.
- **Chest pain, palpitations, pericarditis:** CV 15, CV 14, BL 14, BL 15, PC 6, CV 17, ST 36, GV 20.
- **Mental disorders, agitation, depression:** CV 15, HT 7, Yintang, LR 3, LI 4, SP 6, GV 20.

Evidence-Based Applications

- Laser acupuncture significantly outperformed sham laser for the treatment of mild to moderate **depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[1]

References

1. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in*

Medicine. 2005;23(3):103-111.

2. Bills D. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
3. Bills D and Moore S. The falciform ligament and the ligamentum teres: friend or foe. *ANZ Journal of Surgery*. 2009;79(10):678-680.
4. Egle J, Gupta A, Mittal V, et al. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia*. 2013;17(1):95-100.
5. Shiozaki H, Sakurai S, Sudo K, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *Journal of Medical Case Reports*. 2012;6:206.
6. Lim ZS, Tan JYG, Fanning S, et al. Hepatobiliary and pancreatic: falciform ligament necrosis. *Journal of Gastroenterology and Hepatology*. 2012;27(8):1409.
7. Sari S, Ersoz F, Emin M, et al. Hematoma of the falciform ligament: a rare cause of acute abdomen. *The Turkish Journal of Gastroenterology*. 2011;22(2):213-215.
8. Rozen WM, Ashton MW, and Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clinical Anatomy*. 2008;21:89-98.
9. Chua AS and Keeling PW. Cholecystokinin hyperresponsiveness in functional dyspepsia. *World J Gastroenterol*. 2006;12(17):2688-2693.

CV 16

Zhong Ting "Center Courtyard" "Central Palace"

On the ventral midline at the xiphisternal synchondrosis. Lands at or near the 5th intercostal space.

Joints

- **Xiphisternal synchondrosis (joint):** Indicates the inferior limit of the central thoracic cavity, the upper limit of the liver, the inferior border of the heart, and the central tendon of the diaphragm. The xiphisternal joint is usually level with the 9th thoracic vertebrae.[2]

Clinical Relevance: The xiphisternal angle has been dubbed the "angle of obesity", as a protruding abdomen causes the xiphoid process to point outward.[3]

Trauma surgeons may perform sub-xiphisternal pericardial windows in order to alleviate tamponade of the heart during aggressive surgical management of penetrating thoracic injuries.[4]

Patients with a history of complex surgery of the cranial abdomen may have undergone xiphoidectomy.[5] In this case, one would not locate CV 16 at the xiphisternal joint, but instead at the caudal end of the sternum.

Variant xiphoid morphology, as when it appears bifid, duplicated, or even trifurcated, may be mistaken on imaging as a xiphoid fracture.[6] These variations in the anatomy of the xiphoid, along with patent foramina in the sternum at more cranial CV points, could allow a needle to enter the thoracic cavity. Therefore, needle CV 16 to CV 21 carefully in order to avoid inadvertent organ puncture.

Should a patient present with a pulsatile bruise at the xiphisternal joint, DO NOT NEEDLE and have the patient seek IMMEDIATE emergency medical attention. A painless, pulsatile, sub-xiphisternal bruise may indicate ventricular free wall rupture.[7] The condition usually requires urgent surgery. While most left ventricular wall ruptures happen within the first week after myocardial infarction, delayed rupture can occur and become fatal if not addressed right away.

Foreign bodies or other causes of esophageal stimulation can cause pain in the central chest and mimic acute coronary syndrome.[8] For example, a coin lodged at the level of CV 16 can induce angina-like symptoms and electrocardiographic changes by means of neural reflexes between the esophagus and heart.

Peristernal chrondritis or perichondritis, conditions referred to as "Tietze's syndrome", pertain to the finding of a tender, nonsuppurative swelling at the xiphisternal, costochondral, sternoclavicular, or manubriosternal junctions.

Tietze's syndrome manifests most often as pain, with symptoms reminiscent of cardiac, pulmonary, abdominal, or other serious diseases.[9] The confusing presentation likely arises due to somatovisceral reflexes involving nerves that supply the body wall, local organs, and possibly the nervi vasorum of the internal thoracic arteries. At CV 16, the internal thoracic arteries course close to the xiphisternal joint (see Figure 13-39) where they are about to enter the posterior, or dorsal, layer of the rectus sheath. Nerves supplying the joint as well as the vessels may become compressed when the stomach fills with food and fluids; the problem will worsen in obese individuals. Tietze's syndrome may also be confused with ruptured peptic ulcer, duodenal ulcer, pancreatitis, epigastric hernia, and hiatal hernia.

The stomach lies close to CV 16, as seen in Figure 13-39. A full

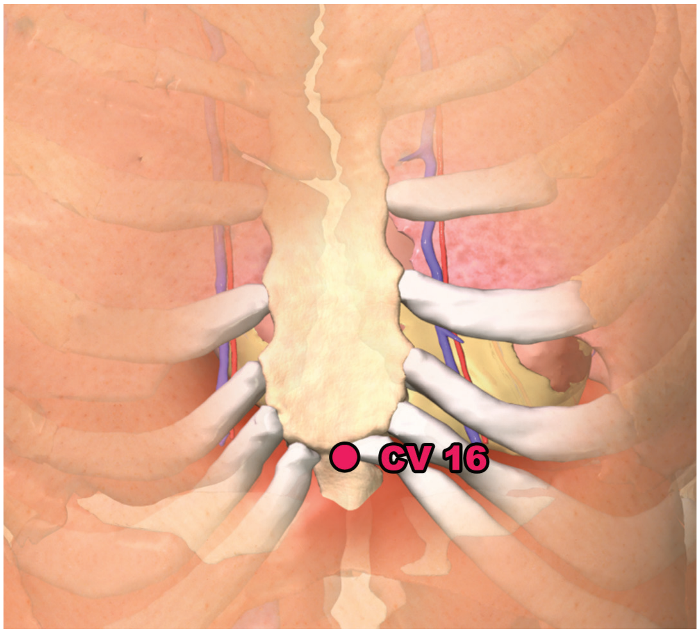


Figure 13-38A. CV 16, as the "Central Courtyard" or "Central Palace", hovers near the heart, the sovereign organ, or emperor in Chinese medicine. Indeed, the heart appears in this image through a window in the chest. Note the relationship of the muscular thoracic diaphragm to the xiphoid process in this image. The vena cava is revealed here as a reminder of the connection between the CV channel, this singular vessel, and its tributaries.

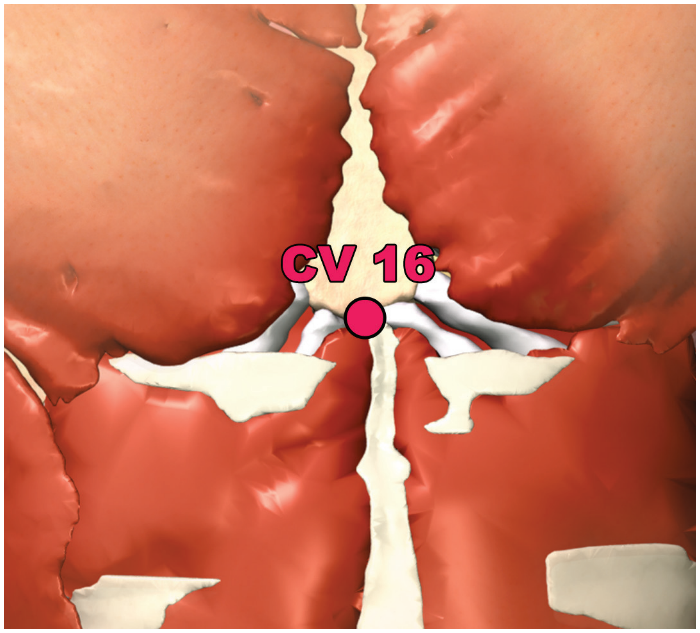


Figure 13-38B. CV 16 marks the site of muscular attachment involving the rectus abdominis, pictured here, and the diaphragm, seen in Figure 13-38A. No wonder the xiphisternal junction can develop pain and inflammation (i.e., costochondritis).

stomach and obese belly increase the likelihood of xiphisternal costochondritis due to heightened intra-abdominal pressure. Nearly half of patients experience increased pain after a meal. Most report that digital pressure on the xiphisternal junction reproduces the symptoms.

Diagnosis is based on finding tenderness to palpation at CV 16; palpation of the xiphisternal junction should take place in any patients complaining of pain in the thorax, shoulders, or cranial abdomen. Remember, however, that both a somatic and visceral problem could co-occur. If local nerve block or acupuncture alleviates the pain, this suggests that xiphisternal somatic dysfunction caused the problem, although re-evaluation should be planned.

Nerves

- **5th and 6th intercostal nerves:** Supply the skin.

Clinical Relevance: Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) may produce chronic pain syndromes such as postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[10] The latter arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves that meet along the CV channel. The neuromas typically appear on the left intercostal spaces and arise where sternal wires or needles were inserted at the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

A wide array of somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27 as well as the sternum itself, from CV 16 to CV 21. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve "unhappiness" as well as upper thoracic spinal cord changes resulting from nociceptive afferent bombardment originating in dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicles and 1st costal cartilages. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[11]
- **Internal thoracic vein:** The internal thoracic veins develop as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and connect deep to the xiphoid process.[12] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. View them in cross section at CV 16 in Figure 13-39. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[13]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Thoracic issues of chest pain or fullness, rib pain, anxiety:** CV 16, CV 17, CV 14, PC 5, PC 2, BL 15, BL 16, local points, KI 27, KI 10, KI 3, BL 60.
- **Abdominal problems such as gastroesophageal reflux disease (GERD):** CV 16, CV 14, CV 12, CV 22, PC 6, ST 36, LR 3.
- **Hiccoughs (Hiccups):** Acupressure at CV 16.
- **Emotional stress and apprehension:** Acupressure at CV 16 to aid in releasing the diaphragm and relieving precordial tension.
- **Esophageal tension or a foreign body (e.g., a "stuck" potato chip):** CV 16, CV 17, tender points along the sternum, CV 21.

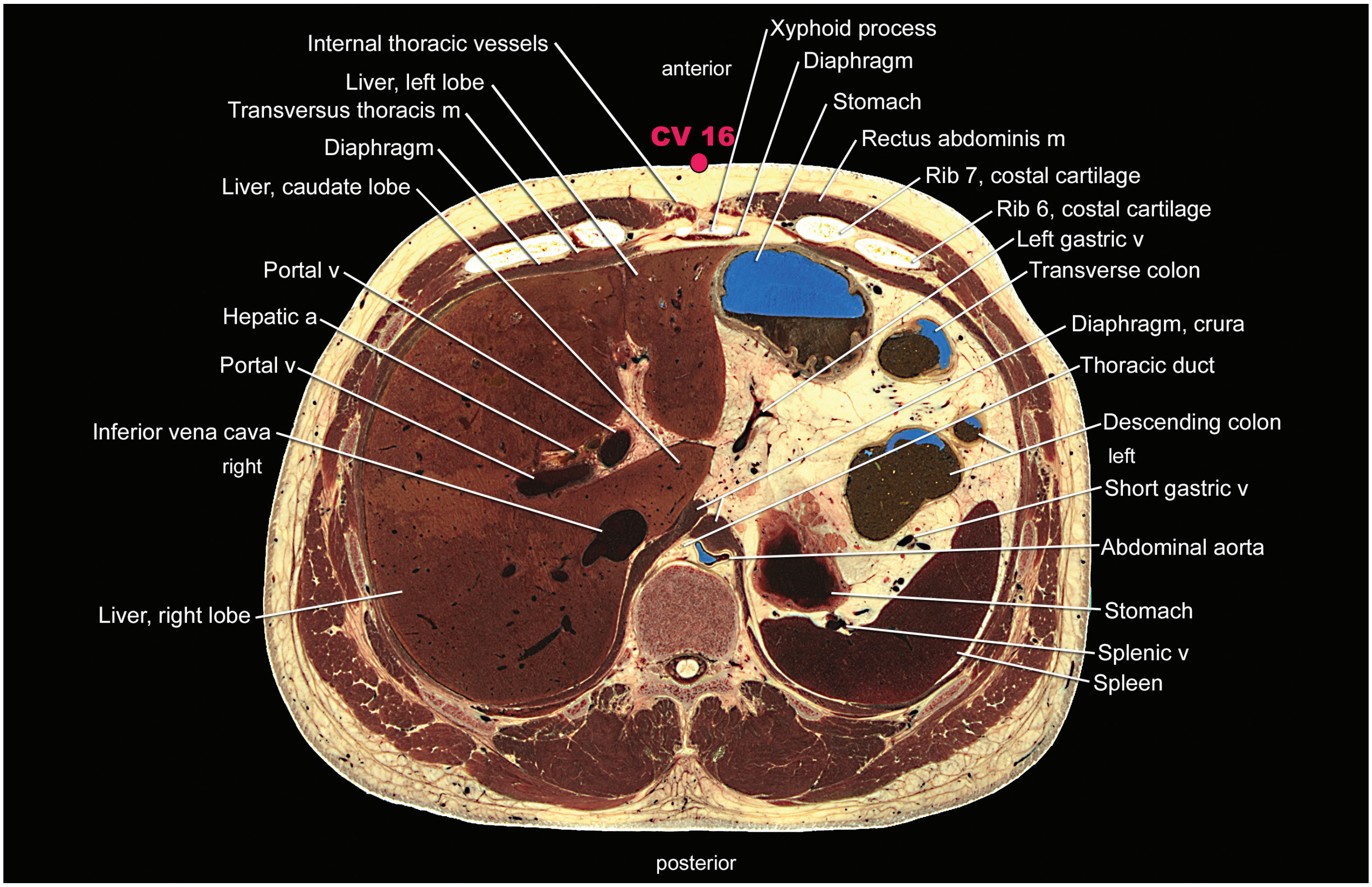

Internal thoracic vessels
Liver, left lobe
Transversus thoracis m
Diaphragm
Liver, caudate lobe
Portal v
Hepatic a
Portal v
Inferior vena cava
right
Liver, right lobe
anterior
CV 16
Xyphoid process
Diaphragm
Stomach
Rectus abdominis m
Rib 7, costal cartilage
Rib 6, costal cartilage
Left gastric v
Transverse colon
Diaphragm, crura
Thoracic duct
Descending colon
left
Short gastric v
Abdominal aorta
Stomach
Splenic v
Spleen
posterior

Figure 13-39. The Central Courtyard, CV 16, indicates the juncture of two different bodily worlds: the thorax and abdomen. The thoracic diaphragm separates them, as shown by this cross section, enveloping the trunk from xiphoid to vertebra. Note the numerous internal thoracic vessels on either side of the midline surrounding the xiphoid. The vessels connect from rectus sheath to parasternal groove.

Evidence-Based Applications

- Acupuncture-like stimulation of the truncal region in the vicinity of CV 16 activated lower thoracic spinal nerves, leading to reflex regulation of **gastric motility** via the gastric sympathetic nerves in a spinal segmental fashion.[1]
- Acupuncture applied to CV 17 reduced the heart rate and increased the power of the high-frequency component of **heart rate variability** (an indicator of cardiac vagal activity), whereas acupuncture at CV 16 did not.[14]

References

1. Sato A, Sato Y, and Uchida S. Reflex modulation of visceral functions by acupuncture-like stimulation in anesthetized rats. *International Congress Series.* 2002;1238:111-123.
2. Mirjalili SA, Hale SJM, Buckenham T, et al. A reappraisal of adult thoracic surface anatomy. *Clinical Anatomy.* 2012;25:827-834.
3. Barker VC. The angle of obesity: a simple measurement for body typing. *N Z Med J.* 1976;84(577):437-439.
4. Von Oppell UO, Bautz P, and De Groot M. Penetrating thoracic injuries: what we have learnt. *Thorac Cardiovasc Surg.* 2000;48(1):55-61.
5. De Lima Vazquez V and Sugarbaker PH. Xiphoidectomy. *Gastric Cancer.* 2003;6(2):127-129.
6. El-Busaid H, Kaisha W, Hassanali J, et al. Sternal foramina and variant xiphoid morphology in a Kenyan population. *Folia Morphol.* 2012;71(1):19-22.
7. Pinto N, Platts D, Thomson B, et al. Presentation with pulsatile xiphisternal bruise – survival with a chronic ventricular rupture. *Heart, Lung and Circulation.* 2011;20:132-135.
8. Kandan SR, Augustine DX, Mansfield RJ, et al. 10p for an angiogram: the cardio-oesophageal reflex. *BMJ Case Rep.* 2010; bcr0520091870.
9. Jelenko C. Perichondritis (Tietze's Syndrome) at the xiphisternal joint: a mimic of severe disease. *Journal of the American College of Emergency Physicians.* 1977;6(12):536-542.
10. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
11. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.
12. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol.* 2007;66(1):25-32.
13. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.
14. Kurono Y, Minagawa M, Ishigami T, et al. Acupuncture to Danzhong but not to Zhongting increases the cardiac vagal component of heart rate variability. *Autonomic Neuroscience: Basic and Clinical.* 2011;161:116-120.

CV 17

Shan Zhong "Chest Center"

On the ventral midline, level with the 4th intercostal space. Approximately between the nipples in males.

Caution: Do not needle deeply; should the patient have one at CV 17, a patent sternal foramen might allow needle passage through the sternum and into the heart, risking cardiac tamponade or other potentially fatal injury.[1]

Bones

- **Body of sternum:** Younger individuals have four sternebrae in place of a consolidated sternum. These sternebrae articulate with each other via sternal synchondroses, or primary cartilaginous joints. The sternebral joints usually fuse, starting at the caudal portion, between the time of puberty and the mid-twenties. Ridges along the sternum designate lines of fusion, or synostoses.

Clinical Relevance: Sternal foramina sometimes remain patent. This can make deep needling over sternal foramina life-threatening if a wayward needle enters the heart. Sternal foramina exist in 4% of females and 10% of males.[2] Standard chest radiographs may not indicate which foramina remain open.

Nerves

- **Fourth intercostal nerve:** Supplies the skin.

Clinical Relevance: Like other CV points, CV 17 confers its benefits through somatic afferent stimulation of bilateral intercostal nerves. These ventral rami supply strips of muscle and skin around the trunk. Somatic afferent stimulation at CV points interact with interneurons in the gray matter of the spinal cord, affecting organs innervated by the same spinal cord segments.

Chinese medicine associates CV 17 with the pericardium as its Front Mu point. While the pericardium does lie close to CV 17 as shown in Figures 13-40 and 13-41, the cardiac plexus, not the pericardium, is what produces the physiologic changes traditionally attributed to the pericardium. The cardiac plexus houses both sympathetic and vagal nerve branches; it resides in the epicardium, a thin layer of mesothelium formed by the visceral layer of the serous pericardium.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) may produce chronic pain syndromes such as postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[7] The latter arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves that meet along the CV channel. The neuromas typically appear on the left intercostal spaces and arise where sternal wires or needles were inserted at the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

Both somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27 as well as the sternum itself, from CV 16 to CV 21. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve irritation as well as upper thoracic spinal cord "wind-up" secondary to nociceptive afferent bombardment by nerves ferrying neural traffic from dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[8]
- **Internal thoracic vein:** The internal thoracic veins develop as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and

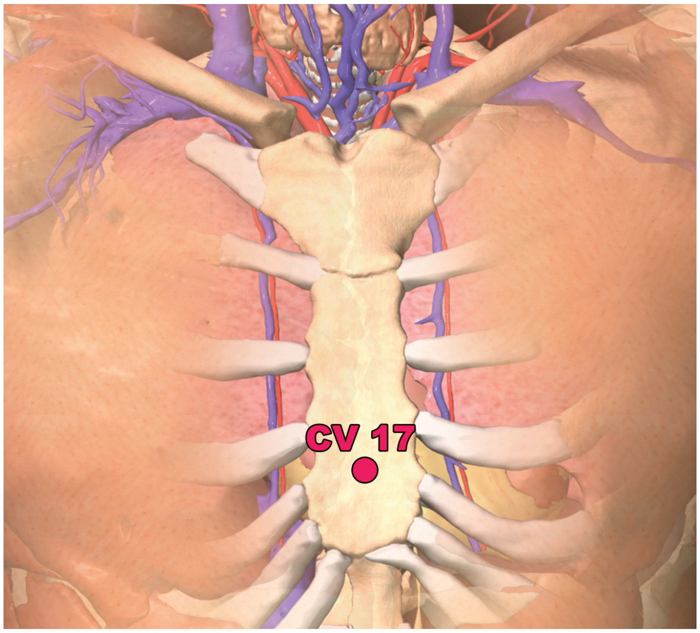


Figure 13-40. CV 17, in the center of the chest, impacts respiration, cardiac function, and parasternal circulation, as indicated by the local anatomy.

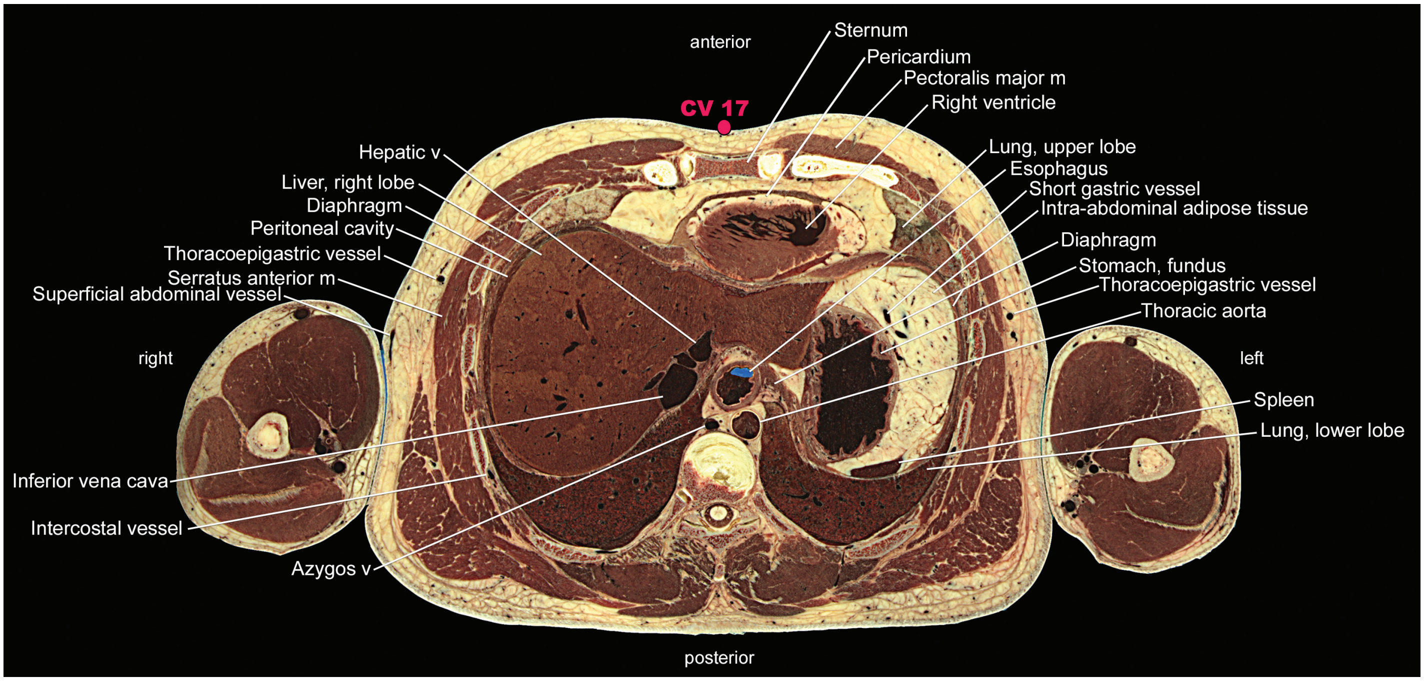

anterior
Sternum
Pericardium
Pectoralis major m
CV 17
Right ventricle
Hepatic v
Liver, right lobe
Diaphragm
Peritoneal cavity
Thoracoepigastric vessel
Serratus anterior m
Superficial abdominal vessel
Lung, upper lobe
Esophagus
Short gastric vessel
Intra-abdominal adipose tissue
Diaphragm
Stomach, fundus
Thoracoepigastric vessel
Thoracic aorta
right
left
Spleen
Lung, lower lobe
Inferior vena cava
Intercostal vessel
Azygos v
posterior

Figure 13-41. This cross-section at CV 17, "Chest Center", contains organs from the thorax as well as the abdomen. Most importantly, this image reveals the connection between CV 17 and the pericardium, i.e., the structure associated with this Front Mu point.

connect deep to the xiphoid process.[9] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[10]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Anxiety, stress, tension:** CV 17, HT 7, LR 3, GV 20, Yintang (GV 24.5).
- Cardiopulmonary or thoracic problems; e.g., dyspnea, hiccough, chest pain, palpitations, cough, asthma, bronchitis, pleuritis, intercostal neuralgia: CV 17, local points that are tender to palpation on chest wall, CV 15, CV 22, KI 21, LU 7, ST 36,
- Lactation insufficiency, mastitis: CV 17, SI 1, SI 11, ST 18.
- Nausea, vomiting: CV 17, PC 6, ST 36.
- Esophageal tension or a foreign body (e.g., a "stuck" potato chip): CV 16, CV 17, tender points along the sternum, CV 21.

Evidence-Based Applications

- Acupuncture at CV 6, CV 12, CV 17, ST 36, and SP 10 conferred protective effects on cognitive impairments caused by multi-infarction dementia in rats, suggesting it may benefit patients with **vascular dementia.**[3]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully treated **sleep-related laryngospasm** with gastroesophageal reflux, refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[4]
- In rats, acupuncture at CV 17, LU 1, ST 36, SP 6, GV 14, and BL 13 effectively reduced the sizes of experimentally induced **immune-mediated pulmonary inflammatory lesions.**[5]
- Following **acute myocardial infarction,** patients receiving acupuncture at CV 14, CV 17, ST 36, PC 6, and SP 6 demonstrated the following changes: reduced blood viscosity and myocardial oxygen consumption, improved microcirculation and left ventricular function, improved collateral circulation, and reduced the area of infarction.[6]
- Acupuncture at CV 17, PC 6, HT 7, GV 20, and Yintang (GV 24.5) reduced **anxiety** in women receiving *in vitro* fertilization.[11]
- Acupuncture applied to CV 17 **reduced the heart rate** and

increased the power of the high-frequency component of heart rate variability (an indicator of cardiac vagal activity), whereas acupuncture at CV 16 did not.[12]

References

1. Halvorsen, T B, et al. Fatal cardiac tamponade after acupuncture through congenital sternal foramen. 1995; 345(8958):1175-1175.
2. McCormick WF. Sternal foramina in man. *Am J Forensic Med Pathol*. 1981;2:249-252.
3. Yu J, Liu C, Zhang X, and Han J. Acupuncture improved cognitive impairment caused by multi-infarct dementia in rats. *Physiology and Behavior*. 2005 (in press).
4. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci*. 2003;326(2):107-109.
5. Katsuya EM, Pedreira de Castro MA, Whitaker Carneira CR, et al. Acupuncture reduces immune-mediated pulmonary inflammatory lesions induced in rats. *Forsch Komplementmed*. 2009;18:413-416.
6. Zhu B, Bi L, Liang S, Pang L, Wang S, Liu J, Jiang A, Li C, Ye Z, Yang H, Chen Z, Wang K, Bian S, Guo X, and Hong H. Effect of acupuncture on left ventricular function, microcirculation, blood rheology and cyclicnucleotides in patients with acute myocardial infarction. *Journal of Traditional Chinese Medicine*. 1989;9(1):63-68.
7. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg*. 1989;69:81-82.
8. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology*. 2011;58(6):654.
9. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol*. 2007;66(1):25-32.
10. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg*. 2006;43:707-713.
11. Isoyama D, Cordts EB, de Souza van Niewegen AM, et al. Effect of acupuncture on symptoms of anxiety in women undergoing in vitro fertilisation: a prospective randomised controlled study. *Acupunct Med*. 2012;30(2):85-88.
12. Kurono Y, Minagawa M, Ishigami T, et al. Acupuncture to Danzhong but not to Zhongting increases the cardiac vagal component of heart rate variability. *Autonomic Neuroscience: Basic and Clinical*. 2011;161:116-120.

CV 18

Yu Tang “Jade Hall”

On the ventral midline at the level of the 3rd intercostal space. To locate the 3rd intercostal space, first find the sternomanubrial junction, also called the “Angle of Louis”. This identifies the level of the 2nd rib. Count down two intercostal spaces to reach the 3rd intercostal location CV 18 resides on the midline.

Caution: Do not needle deeply; should the patient have a patent sternal foramen, the needle may pass through the sternum and into the heart, risking cardiac tamponade or other injury.[1] Review the relationship of CV 18 to the heart in Figure 13-43.

Bones

- **Body of sternum:** Younger individuals have four sternebrae in place of a consolidated sternum. These sternebrae articulate with each other via sternal synchondroses, or primary cartilaginous joints. The sternebral joints usually fuse, starting at the caudal portion, between the time of puberty and the mid-twenties. However, they may remain open lifelong. Ridges along the sternum designate lines of fusion, or synostoses.

Clinical Relevance: Sternal foramina sometimes remain patent. In such individuals, deep needling can cause serious injury if a wayward needle enters the heart.

Sternal foramina exist in 4% of females and 10% of males.[2] Standard chest radiographs may not indicate which foramina continue to exist.

In that the sternum structurally supports the stability of the thoracic spine in flexion-extension, side-bending, and axial rotation, fracture of the bone significantly reduces thoracic integrity and stabilization.[3]

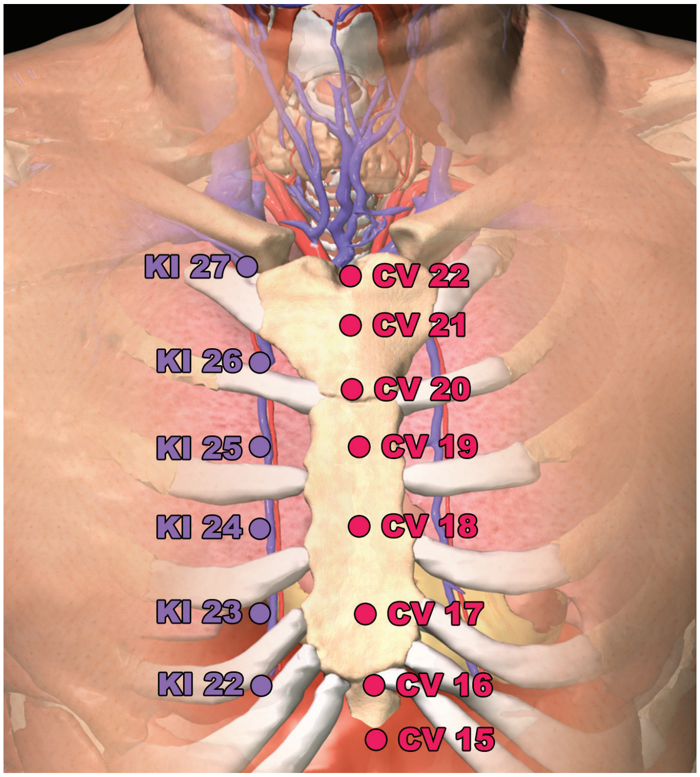


Figure 13-42. Applications for CV 18 pertain to mainly local pain, anxiety, and esophageal motility disorders. Acupressure works well at sternal CV points; patients can perform self-treatment readily and regularly.

Nerves

- **3rd intercostal nerve:** Supplies the skin.

Clinical Relevance: Like other CV points, CV 18 confers its benefits through somatic afferent stimulation of bilateral intercostal nerves. These ventral rami supply strips of muscle and skin around the trunk. Somatic afferent stimulation at CV points interact with interneurons in the gray matter of the spinal cord, affecting organs innervated by the same spinal cord segments.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) may produce chronic pain syndromes such as postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[4] The latter arises from two potential pathologies: trigger points along the parasternal “corridor” (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves that meet along the CV channel. The neuromas typically appear on the left intercostal spaces and arise where sternal wires or needles were inserted at the intercostal spaces. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

Both somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal “corridor” demarcated by the KI channel from KI 22 to KI 27 as well as the sternum itself, from CV 16 to CV 21. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Mechanisms involve somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve irritation as well as upper thoracic spinal cord “wind-up” secondary to nociceptive afferent bombardment by nerves ferrying neural traffic from dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax posterior to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in an inferior direction posterior to the superior six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the

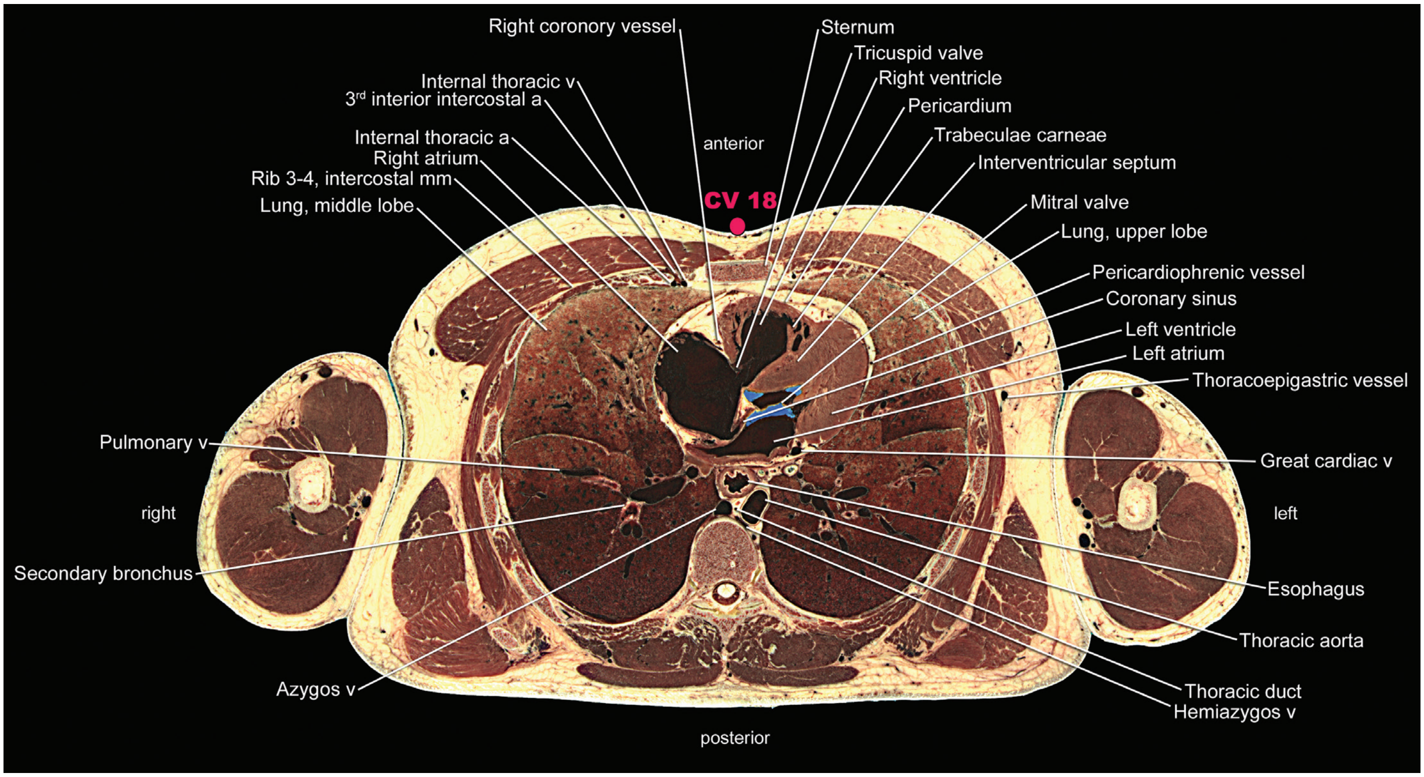

Right coronory vessel
Sternum
Tricuspid valve
Internal thoracic v
3rd interior intercostal a
Right ventricle
Pericardium
Internal thoracic a
anterior
Trabeculae carneae
Right atrium
Interventricular septum
Rib 3-4, intercostal mm
CV 18
Lung, middle lobe
Mitral valve
Lung, upper lobe
Pericardiophrenic vessel
Coronary sinus
Left ventricle
Left atrium
Thoracoepigastric vessel
Pulmonary v
Great cardiac v
right
left
Secondary bronchus
Esophagus
Thoracic aorta
Azygos v
Thoracic duct
Hemiazygos v
posterior

Figure 13-43. The term “Jade Hall” alludes to the position of importance the heart has taken within the thorax.

epigastric arteries and then on to the limbs.[5]

- **Internal thoracic vein:** The internal thoracic veins develop as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and connect deep to the xiphoid process.[6] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[7]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Local pain:** CV 18, KI 27, and regional tender points.
- **Anxiety:** CV 18, HT 7, BL 10, SP 6.
- **Esophageal motility issues:** Acupressure along sternal midline, including CV 18, as well as local points in the epigastrium and CV 22.

References

1. Halvorsen, T B, et al. Fatal cardiac tamponade after acupuncture through congenital sternal foramen. 1995; 345(8958):1175-1175.
2. McCormick WF. Sternal foramina in man. *Am J Forensic Med* Pathol. 1981;2:249-252.
3. Watkins R 4th, Watkins R 3rd, Williams L, et al. Stability provided by the sternum and rib cage in the thoracic spine. *Spine.* 2005;30(11):1283-1286.
4. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
5. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.
6. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol.* 2007;66(1):25-32.
7. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

CV 19

Zi Gong "Purple Palace"

On the ventral midline, at the level of the 2nd intercostal space, found just caudal to the sternomanubrial junction, or "Angle of Louis", which is a readily palpable landmark. Refer to Figure 13-44 for relative location of the sternomanubrial junction (that finds the 2nd rib) and CV 19 at the adjacent intercostal space.

Caution: Do not needle deeply. Inserting a needle through sternal foramen at CV 19 might enter the heart, as illustrate by Figure 13-45. Fatal injury may ensue.[1]

Bones

- **Body of sternum:** Younger individuals have four sternebrae in place of a consolidated sternum. These sternebrae articulate with each other via sternal synchondroses, or primary cartilaginous joints. The sternebral joints usually fuse, starting at the caudal portion, between the time of puberty and the mid-twenties. However, they may remain open lifelong. Ridges along the sternum designate lines of fusion, or synostoses.

Clinical Relevance: Sternal foramina sometimes stay patent throughout life. In such individuals, deep needling can cause serious injury if a wayward needle enters the heart. Sternal foramina exist in 4% of females and 10% of males.[2] Standard chest radiographs may not indicate which foramina continue to exist.

In that the sternum structurally supports the stability of the thoracic spine in flexion-extension, side-bending, and axial rotation, fracture of the bone significantly reduces thoracic integrity and stabilization.[4] In such instances, acupuncture and related techniques could prove beneficial to address myofascial restriction and neuropathic pain.

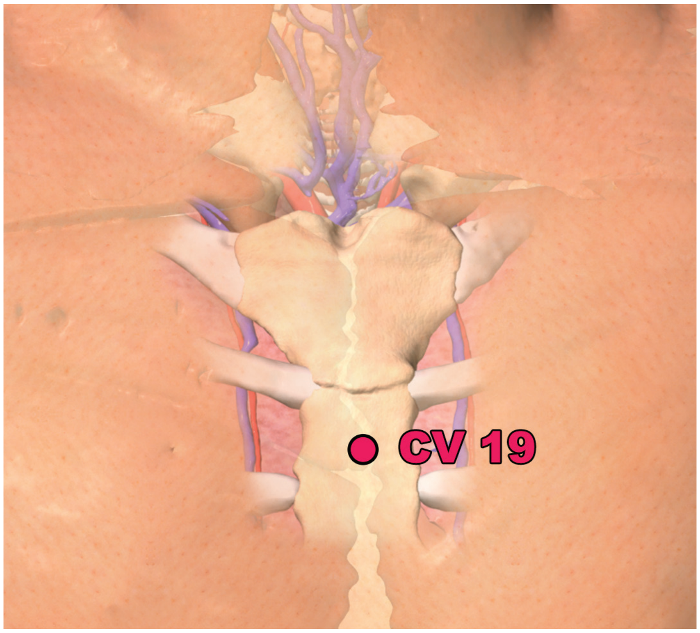


Figure 13-44. CV points located on the sternum have treatment applications for anxiety and apprehension perceived as chest discomfort. Of course, do not assume that chest pain is non-cardiogenic unless ruled out satisfactorily, but acupuncture and related techniques can aid in alleviating the precordial discomfort that noncardiac causes incite. Palpate the entire sternum and precordium for trigger points or tenderness to palpation and select as needed to help dissipate the tension through systemic and segmental neuromodulation.

Nerves

- **2nd intercostal nerve:** Supplies the skin.

Clinical Relevance: Like other CV points, CV 19 confers its benefits through somatic afferent stimulation of bilateral intercostal nerves. These ventral rami supply strips of muscle and skin around the trunk. Somatic afferent stimulation at CV points interact with interneurons in the gray matter of the spinal cord, affecting organs innervated by the same spinal cord segments.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) may produce chronic pain syndromes such as postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[5] The latter arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves that meet along the CV channel. The neuromas typically appear on the left intercostal spaces and arise where sternal wires were inserted. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

Both somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27 as well as the sternum itself, from CV 16 to CV 21. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Etiopathogenesis involves somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve irritation as well as upper thoracic spinal cord "wind-up" secondary to nociceptive afferent bombardment by nerves ferrying neural traffic from dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax dorsal to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in a caudal direction dorsal to the cranial six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[6]
- **Internal thoracic vein:** The internal thoracic veins develop

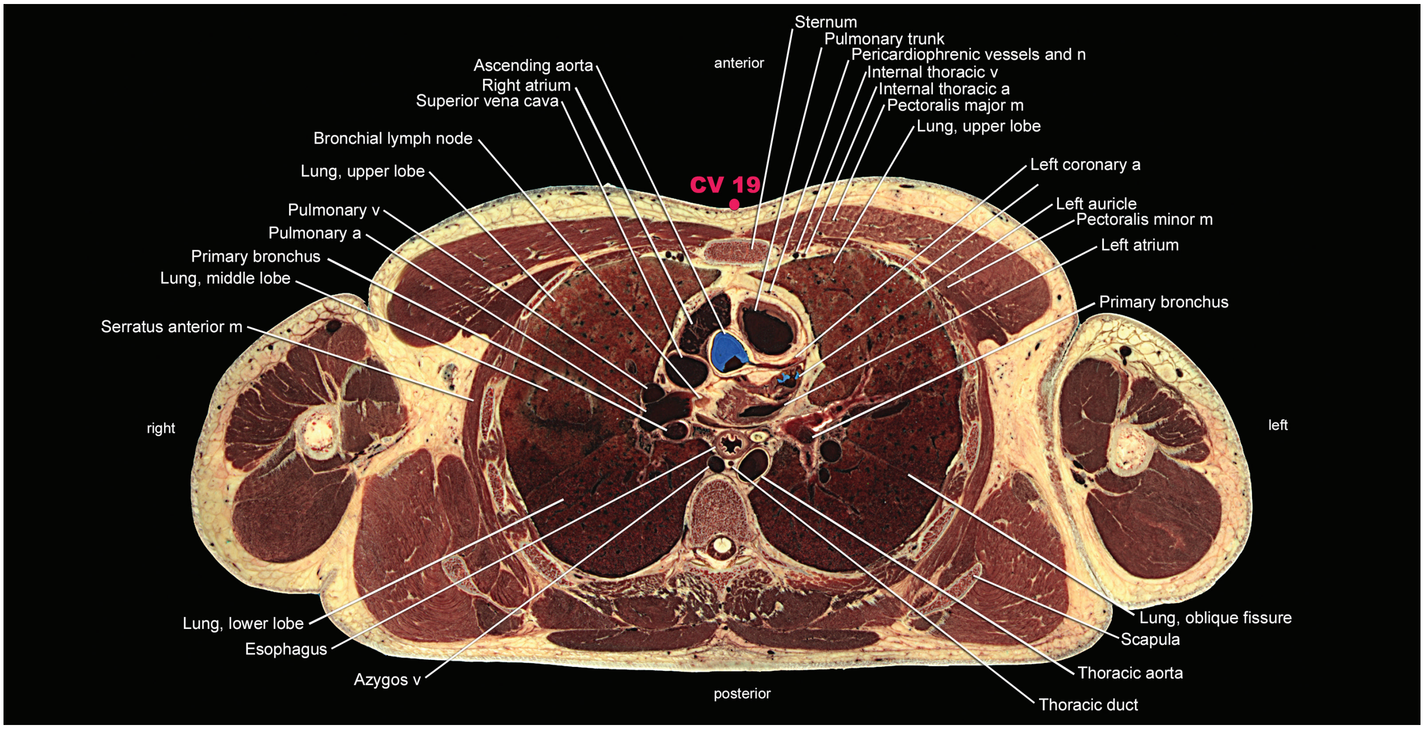

anterior
Sternum
Pulmonary trunk
Pericardiophrenic vessels and n
Internal thoracic v
Internal thoracic a
Pectoralis major m
Lung, upper lobe
Ascending aorta
Right atrium
Superior vena cava
Bronchial lymph node
Lung, upper lobe
CV 19
Pulmonary v
Pulmonary a
Primary bronchus
Lung, middle lobe
Serratus anterior m
right
Left coronary a
Left auricle
Pectoralis minor m
Left atrium
Primary bronchus
left
Lung, lower lobe
Esophagus
Azygos v
posterior
Lung, oblique fissure
Scapula
Thoracic aorta
Thoracic duct

Figure 13-45. "Purple Palace", the alternate name for CV 19, describes the blood-filled heart and major vessels that ancient anatomists would have found at this level. Furthermore, in keeping with the astrological allusions once finds in Chinese medicine, a star named "Purple Palace" exists in the "Celestial Emperor" Constellation.

as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and connect deep to the xiphoid process.[7] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[8]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Deep substernal pain and occasional soreness over the sternum:** Consider referred pain from the sternalis muscle. Address local trigger points such as KI 25 and KI 26. Add KI 27 and CV 19 if tender to palpation.
- **Pleuritis, cough, tracheitis, dyspnea, bronchitis:** CV 19, CV 17, CV 22, LU 1, LU 2, ST 36.
- **Anxiety:** Palpate for tender locations on the CV line over the sternum, such as CV 19, CV 18, and CV 17. Consider adding HT 7, ST 36, LR 3, and/or GV 20.
- **Dysphagia:** Acupressure at CV 19, CV 17, and CV 22 as needed.
- **Esophageal motility issues:** Acupressure along sternal midline, including CV 19 and 18, as well as local points in the epigastrium and CV 22.

Evidence-Based Applications

- Acupuncture at ST 30, ST 36, SP 4, SP 6, LR 3, KI 3, LI 4, and PC 6, plus moxibustion at BL 13, BL 22, BL 23, BL 52, CV 3, CV 4, CV 5, CV 6, CV 19, LU 9, and LR 14 significantly increased the percentage of normal sperm in patients with **idiopathic oligoasthenoteratozoospermia (OAT syndrome).**[3]

References

1. Halvorsen, T B, et al. Fatal cardiac tamponade after acupuncture through congenital sternal foramen. 1995; 345(8958):1175-1175.
2. McCormick WF. Sternal foramina in man. *Am J Forensic Med Pathol.* 1981;2:249-252.
3. Gurfinkel E, Cedenho AP, Yamamura Y, and Srougi M. Effects of acupuncture and moxa treatment in patients with semen abnormalities. *Asian Journal of Andrology.* 2003;5:345-348.

4. Watkins R 4th, Watkins R 3rd, Williams L, et al. Stability provided by the sternum and rib cage in the thoracic spine. *Spine.* 2005;30(11):1283-1286.
5. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
6. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology*. 2011;58(6):654.
7. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol.* 2007;66(1):25-32.
8. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

CV 20

Hua Gai "Magnificent Canopy"

"Florid Canopy"

On the ventral midline at the manubriosternal synchondrosis (sternal angle), approximately at the caudal extent of the 1st intercostal space or adjacent to the 2nd rib.

Caution: Do not needle deeply. Should an incomplete synchondrosis exist at CV 20, deep needling may injure contents of the mediastinum.[1] Examine the relationship between CV 20, the vena cava, and the aortic arch in Figure 13-48.

Synchondrosis

- **Sternal angle (Angle of Louis):** The level where the trachea bifurcates into the right and left bronchi. The azygous vein meets the superior vena cava at this level, the aortic arch expresses its convexity and the pulmonary bifurcation usually lands caudal to this level, at T5-6.

Clinical Relevance: The sternal angle most commonly coincides with the T4/5 intervertebral disk space in males and the T4 vertebra in females. However, the potential range of planar coincidence spans from the caudal half of T2 to that of T6.[2] The sternal angle thus serves as a landmark not only for CV 20, but also other structures of anatomic importance.

Nerves

- **1st intercostal nerve:** Supplies the skin.

Clinical Relevance: Like other CV points, CV 20 confers its benefits through somatic afferent stimulation of bilateral intercostal nerves. These ventral rami supply strips of muscle and skin around the trunk. Somatic afferent stimulation at CV points interact with interneurons in the gray matter of the spinal cord, affecting organs innervated by the same spinal cord segments.

Heart surgery (coronary grafting, with or without concurrent aortic valve replacement) may produce chronic pain syndromes such as postcardiotomy syndrome, brachial plexopathy, and post-sternotomy neuralgia.[3] The latter arises from two potential pathologies: trigger points along the parasternal "corridor" (the last segment of the KI channel) and/or scar-entrapped neuromas of the ventral rami of the first 4-6 intercostal nerves that meet along the CV channel. The neuromas typically appear on the left intercostal spaces and arise where sternal wires were inserted. Tension on the wires may incite a strong wound healing reaction, more commonly on the left because, perhaps, surgeons tie the wires on the left. While the painful areas do appear to respond to local anesthetic or neurolytic injection, treatment with acupuncture and related techniques such as laser therapy would be worthwhile to try before a more invasive mode of therapy.

Both somatic and visceral sources of dysfunction can cause tenderness to palpation along the parasternal "corridor" demarcated by the KI channel from KI 22 to KI 27 as well as the sternum itself, from CV 16 to CV 21. These problems include costochondritis, physical trauma, upper thoracic somatic dysfunction, cardiac or pulmonary conditions (e.g., angina, myocardial ischemia, bronchial disorders), digestive problems (e.g., gastroesophageal reflux disorder, acid reflux, dyspepsia, hiatal hernia), and emotional upset (panic attack, stress, loss). Etiopathogenesis involves somato-somatic and viscerosomatic reflexes as well as irritation of the intercostal nerves themselves. Neuromodulation addresses peripheral nerve irritation as well as upper thoracic spinal cord "wind-up" secondary to nociceptive

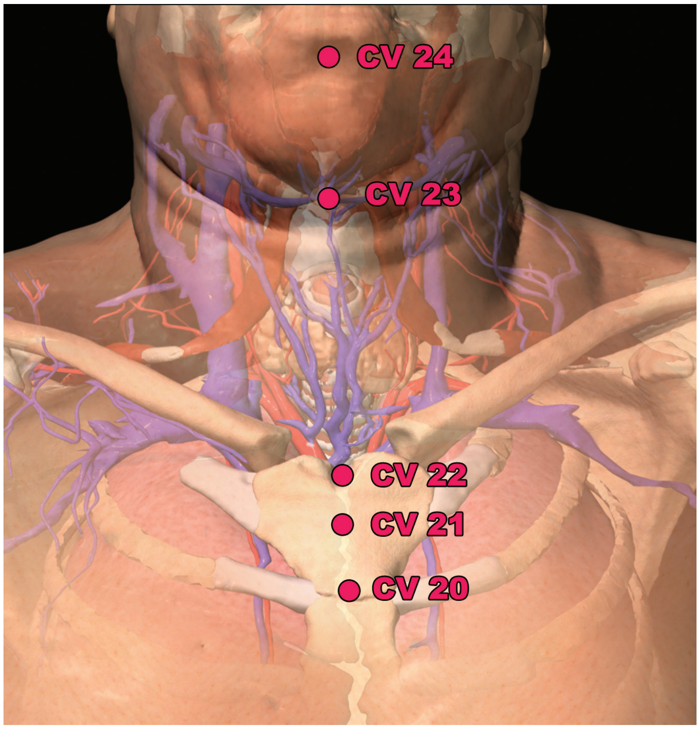


Figure 13-46. CV 20 sits at the sternal angle, as shown in this image. "Florid Canopy" may refer to the canopy of vessels draped over the neck and shoulders.

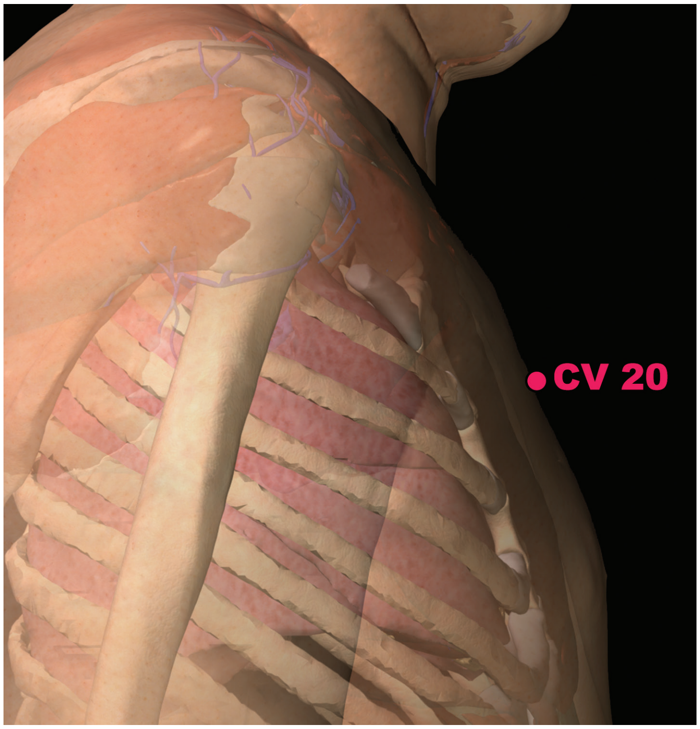


Figure 13-47. The "Magnificent Canopy" associated with CV 20 may describe the way the lungs drape over the heart as a canopy, similar to the umbrella that shaded the emperor's wagon when he toured the countryside.

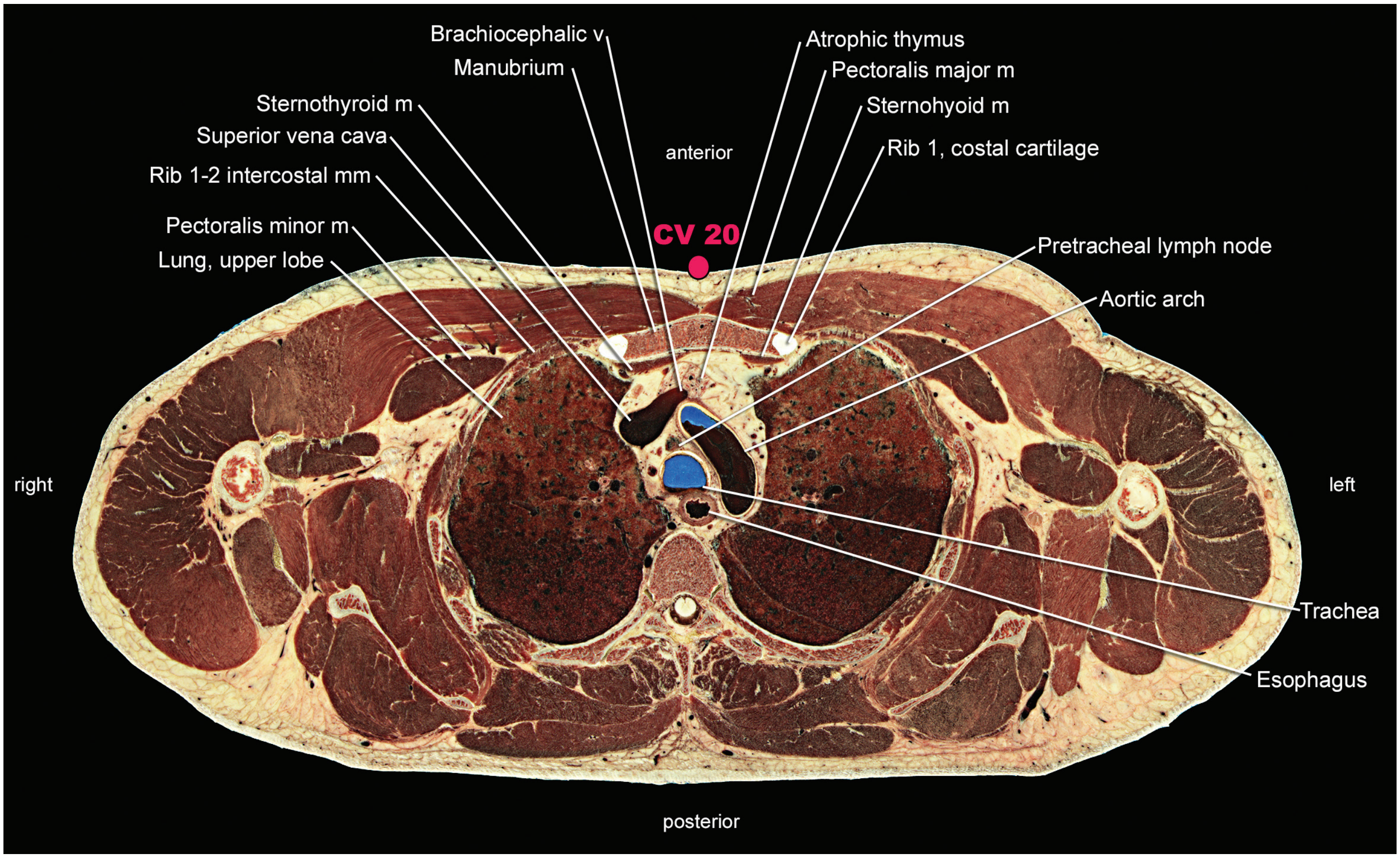


Figure 13-48. CV 20 exists on the same horizontal plane as structures associated with its clinical indications. These include the lungs (lower respiratory problems), trachea (cough, tracheal irritation), and chest wall pain (pectoralis major muscle).

afferent bombardment by nerves ferrying neural traffic from dysfunctional organs, muscles, tendons, or nearby tissues.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax dorsal to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in a caudal direction dorsal to the cranial six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[4]
- **Internal thoracic vein:** The internal thoracic veins develop as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and connect deep to the xiphoid process.[5] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[6]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Deep substernal pain and occasional soreness over the**

sternum: Rule out cardiac origin. Consider referred pain from the sternalis muscle. Address local trigger points such as KI 25 and KI 26. Add KI 27 and CV 20 if tender to palpation.

- **Pleuritis, cough, tracheitis, dyspnea, bronchitis:** CV 20, CV 22, CV 17, LU 1, LU 2, ST 36. Consider acupressure at CV points.
- **Dysphagia:** Acupressure at CV 20, CV 17, and CV 22 as needed.
- **Esophageal motility issues:** Acupressure along sternal midline, at points that ease the disorder from CV 20 to CV 21.
- **Anxiety:** Palpate for tender locations on the CV line over the sternum, such as CV 20, CV 18, and CV 17. Consider adding HT 7, ST 36, LR 3, and/or GV 20.

References

1. Halvorsen, T B, et al. Fatal cardiac tamponade after acupuncture through congenital sternal foramen. 1995; 345(8958):1175-1175.
2. Mirjalili SA, McFadden SL, Buchenham T, et al. Anatomical planes: are we teaching accurate surface anatomy? *Clin Anat.* 2012;25(7):819-826.
3. Defalque RJ and Bromley JJ. Poststernotomy neuralgia: a new pain syndrome. *Anesth Analg.* 1989;69:81-82.
4. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology.* 2011;58(6):654.
5. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol.* 2007;66(1):25-32.
6. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg.* 2006;43:707-713.

CV 21

Xuan Ji "Jade Pivot"

On the ventral midline, in the center of the manubrium, approximately midway between CV 20 and CV 22.

Bones

- **Manubrium:** A triangular bone that is the thickest and widest part of the sternum (like the handle of the sword, with the sternal body as the blade). Evaluation of the morphogenesis of the human manubrium reveals that the bone develops in a complex manner as an intersection between derivatives of the neural crest, the lateral plate, and elements of the related somite.[2]

Clinical Relevance: While trigger point injections are usually considered safe, serious complications can happen. These include epidural abscess, necrotizing fasciitis, gas gangrene, and osteomyelitis.[3] Trigger point injections in the vicinity of KI 27 for conditions such as dystonia risk causing pneumothorax and retrosternal abscess.[4] Based on the image in Figure 13-50, one can see that the manubrium creates a barrier that prohibits a needle at CV 21 from entering the mediastinum unless a congenital or acquired defect disrupts the integrity of the manubrium.

Nerves

- **Medial supraclavicular nerves (C3, C4):** Supplies the skin of the neck. The supraclavicular nerve is purely sensory and arises as one of the four branches of the superficial cervical plexus. The medial branches courses along the dorsal border clavicular head of the sternomastoid muscle; it then pierces the platysma and supplies sensation to the sternal notch at CV 22. Anatomic variants of the supraclavicular nerve are not uncommon because of the complexity of its morphogenesis.

Clinical Relevance: Supraclavicular nerve entrapment syndrome can cause shoulder pain in the anterior shoulder; it often arises as a consequence of anatomic variants such as osseous anomalies, fibrous bands, and muscle or tendon pressure.[5]

Supraclavicular nerve entrapment can follow clavicular fracture; portions of the nerve may become entrapped within the fracture callus.[6] Occasionally, painful neuromas develop. Treatment of neuropathic supraclavicular nerves with acupuncture and related techniques would likely involve ST 12 and ST 13 along with ST 11, KI 27, and CV 21.

Vessels

- **Internal thoracic artery:** The internal thoracic arteries arise from the subclavian arteries and descend into the thorax dorsal to the clavicle and 1st costal cartilage. The internal thoracic arteries run slightly lateral to the sternum on the internal surface of the thoracic cavity. The internal thoracic arteries continue in a caudal direction dorsal to the cranial six costal cartilages and their respective internal intercostal muscles. At the level of the 6th intercostal space, the internal thoracic arteries divide into the superior epigastric and musculophrenic arteries. The internal thoracic artery provides a collateral arterial pathway to the pelvic limbs in the event of vaso-occlusive disease. When both common iliac arteries obstruct, the internal thoracic arteries transmit blood to the epigastric arteries and then on to the limbs.[7]
- **Internal thoracic vein:** The internal thoracic veins develop as venae comitantes of the internal thoracic arteries; they are frequently paired either unilaterally or bilaterally. The internal thoracic veins may form a single or double arch at CV 16 and

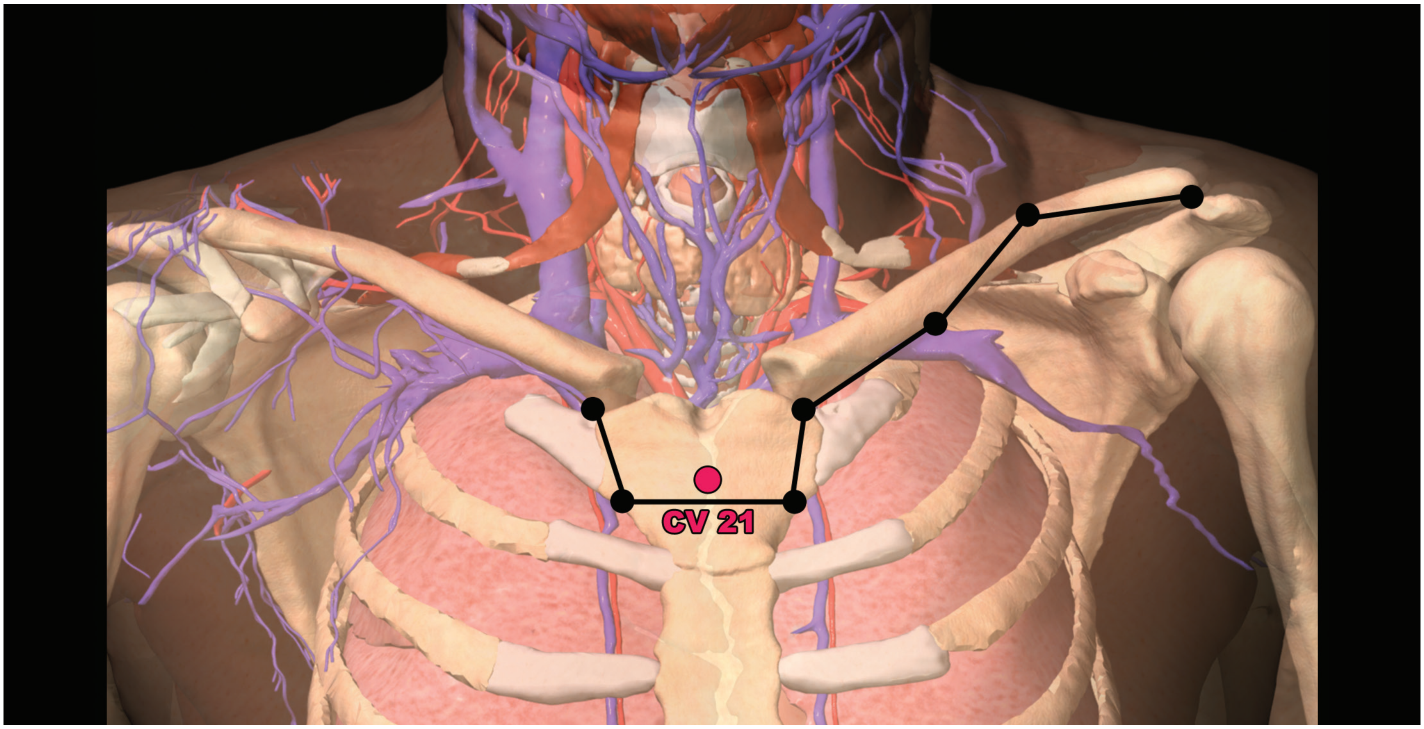


Figure 13-49. Like CV 19 (Purple Palace) and CV 20 (Florid Canopy), the Chinese name for CV 21 (Xuan Ji) carries astrological connotations. Stars the Chinese called Xuan and Ji occupy the second and third stars (i.e., the bottom) in the bowl of the Big Dipper constellation. In addition, the term "Jade Pivot" or "Jade Swivel" speaks of the way in which the neck rotates atop the thorax.

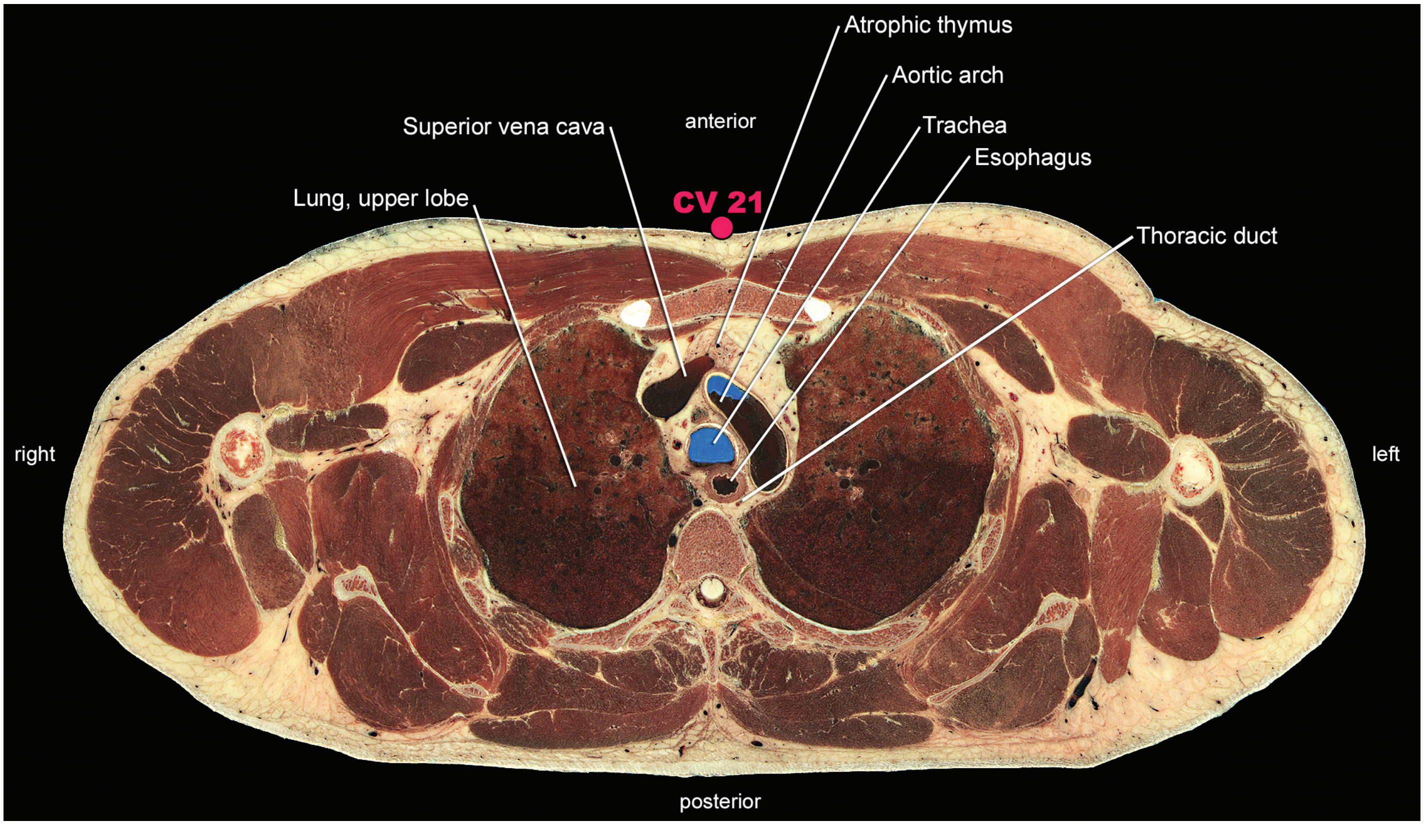


Figure 13-50. The effects of treating CV 21 with acupuncture and related techniques on the thymus, trachea, esophagus, thoracic duct, and major vessels may result from spinal segmental; i.e., somatovisceral, reflexes and/or relaxation of the cranial thorax following release of tension in the manubrial and mediastinal fascia.

connect deep to the xiphoid process.[8] The anterior intercostal veins serve as tributaries of the internal thoracic veins.

Clinical Relevance: Microvascular transfers involving the internal thoracic vessels offer rich opportunities for tissue transfer, but require consideration of the unique anatomy of each patient in order to avoid serious complications. Should such difficulties occur, acupuncture and laser therapy may aid in the recovery of circulation to the site, as appropriate.

The internal thoracic vessels (formerly known as the internal mammary vessels) connect to the superior epigastric vessels. At each intercostal space, the internal thoracic vessels connect to the intercostal arteries and veins. In addition, perforating branches extend mediad to the sternum (CV line). By dint of their connection with the epigastric channels, the internal thoracic vessels provide collateral flow in the event of aorto-iliac obstruction or ligation.[9]

Patients requiring coronary artery bypass graft (CABG) could also have common iliac artery occlusion. That is, many are at high risk of associated atherosclerotic arterial disease affecting peripheral vessels. Thus, these patients are at risk of developing severe ischemia of the pelvic limb if the surgeon selects the internal thoracic artery as a replacement vessel. Thus, preoperative assessment should be performed prior to CABG to evaluate whether the internal thoracic artery has already been recruited to participate in the internal thoracic artery – inferior epigastric artery collateral supply. Interrupting this collateral pathway threatens the limb, especially in conjunction with hemodynamic compromise such as insufficient perfusion during bypass and low cardiac output after surgery.

Indications and Potential Point Combinations

- **Deep substernal pain and occasional soreness over the sternum; rule out cardiac origin:** Consider referred pain from the sternalis muscle. Address local trigger points such as KI 25 and KI 26. Add KI 27 and CV 21 if tender to palpation.
- **Pleuritis, cough, tracheitis, dyspnea, bronchitis:** CV 21, CV 17, CV 22, LU 1, LU 2, ST 36. Consider acupressure at CV points.
- **Dysphagia:** Acupressure at CV 21, CV 17, and CV 22 as needed.
- **Gastroesophageal reflux disease (GERD), esophageal motility disorders:** CV 21, CV 22, CV 14, CV 12, ST 36, LR 3.
- **Esophageal motility issues:** Acupressure along sternal midline, at points that ease the disorder from CV 20 to CV 21.
- **Tonsillitis, pharyngitis:** CV 20, ST 9, ST 10, LI 4, LI 11, LU 7. Acupressure at CV 21 and CV 22.

Anxiety before public speaking or an interview: Palpate for tender locations on the CV line over the sternum, such as CV 21, CV 20, CV 18, and CV 17. If performing acupressure on oneself, realize that treatment of these sites just before the speaking engagement may reveal erythema to the audience or interviewer. As such, one may reserve this form of self-relaxation for times when wearing apparel that will cover the treatment zone.

Evidence-Based Applications

- LI 4, CV 21, and CV 22 improved **cancer-related breathlessness.**[1]

References

1. Filshie J, Penn K, Ashley S, and Davis CL. Acupuncture for the relief of cancer-related breathlessness. *Palliative Medicine*. 1996;10:145-150.

2. Rodriguez-Vazquez RF, Verdugo-Lopez S, Garrido JM, et al. Morphogenesis of the manubrium of sternum in human embryos: a new concept. *The Anatomical Record*. 2013;296:279-289.

3. Usman F, Bajwa A, Shujaat A, et al. Retrosternal abscess after trigger point injections in a pregnant woman: a case report. *Journal of Medical Case Reports*. 2011;5:403.

4. Usman F, Bajwa A, Shujaat A, et al. Retrosternal abscess after trigger point injections in a pregnant woman: a case report. *Journal of Medical Case Reports*. 2011;5:403.

5. Douchamps F, Courtois A-C, Bruyere P-J, et al. Supraclavicular nerve entrapment syndrome. *Joint Bone Spine*. 2012;79:88-89.

6. O'Neill K, Stutz C, Duvernay M, et al. Supraclavicular nerve entrapment and clavicular fracture. *J Orthop Trauma*. 2012;26(6):e63-e65.

7. Tada H, Tsubokawa T, Konno T, et al. Impact of bilateral internal thoracic-to-epigastric artery communications on salvaging total lower limb ischemia. *Journal of the American College of Cardiology*. 2011;58(6):654.

8. Loukas M, Tobola MS, Tubbs RS, et al. The clinical anatomy of the internal thoracic veins. *Folia Morphol*. 2007;66(1):25-32.

9. Yurdakul M, Tola M, Ozdemir E, et al. Internal thoracic artery-inferior epigastric artery as a collateral pathway in aortoiliac occlusive disease. *J Vasc Surg*. 2006;43:707-713.

CV 22

Tian Tu

“Celestial Chimney”

On the ventral midline, just cranial to the jugular (suprasternal) notch.

HIGH RISK POINT!

Potential complications: Tracheal or aortic arch puncture, pneumothorax, bleeding from jugular venous arch puncture with deep needing. Review the local anatomy in Figure 13-52.

Avoid local needling in cases of thyroid cancer.

Viscera

- **Trachea:** A fibrocartilaginous tube supported by cartilaginous, incomplete tracheal rings. The brachiocephalic trunk resides on the right side of the trachea.

Clinical Relevance: The urge to cough stems from tracheal, laryngeal, or bronchial stimulation of mechanoreceptors attached to A-delta fibers or or chemoreceptor activation connected to C fibers.[3] Afferent vagal pathways create the urge to cough as reflexes occur in the Botzinger ventral respiratory locus of the brainstem. Efferent motor nerves cause contractions in the glottis, thoracic diaphragm, and abdominal muscles. A cough results. Sensitization of the afferent vagal nerve endings within the trachea accentuates the urge to cough. Acupuncture and related techniques applied to CV 22 and other relevant points may dampen the irritability of the cough reflex.

Glands

- **Thymus gland:** In the superior mediastinum, in the space between the trachea and manubrium. Following puberty, the gland involutes and fat replaces much of the glandular tissue. While remnants of the atrophic thymus remain in the cross section at this level (see Figure 13-52), it shows more clearly in Figure 13-50. In 20% to 25% of humans, islands of thymic tissue occur in the tympanic cavity, neck, mediastinum, or lung. These “extra-thymic” loci relate to its development and origin in the endoderm of the third and possibly 4th branchial pouches early in gestation.[4]

Clinical Relevance: Although no evidence indicates that acupuncture or related techniques impact thymic function, local and somatovisceral reflexes engendered by somatic afferent stimulation at CV 22 may influence nerve signals and circulation to and from the thymus.

Nerves

- **Vagus nerve (CN X):** A branch of the vagus nerve innervates the thymus gland. The vagus nerve exits from the jugular foramen, passes between the internal jugular vein (IJV) and the common carotid artery inside the carotid sheath. The right vagus nerve passes anterior to the subclavian artery and posterior to the brachiocephalic vein and sternoclavicular joint, on its way to the thorax. The left vagus nerve passes between the left common carotid artery and left subclavian artery, entering the thorax posterior to the sternoclavicular joint. The right and left recurrent laryngeal nerves branch from the vagus in the inferior part of the neck. Some cardiac branches also arise in the neck.
- **Sympathetic fibers:** Sympathetic fibers innervate the thymus gland. Sympathetic trunks derive presynaptic fibers from the superior thoracic spinal nerves. Branches destined to cervical viscera and the head course with the arteries, particularly the vertebral and carotid arteries.
- **Phrenic nerve (C3, C4, C5):** Provides sensation to the thymus gland capsule. The phrenic nerve contains sensory, motor, and sympathetic fibers. It provides the only motor input to the diaphragm and carries sensory fibers from the central part of the diaphragm. The phrenic nerve also supplies the pericardium and mediastinal pleura.
- **Medial supraclavicular nerves (C3, C4):** The supraclavicular nerves send branches to the neck to supply the skin. The medial branches course along the dorsal border clavicular head of the sternocleidomastoid muscle; they then pierce the platysma and supply sensation to the sternal notch at CV 22. Anatomic variants of the supraclavicular nerve are not uncommon because of the complexity of its morphogenesis.

Clinical Relevance: Several nerves contribute branches to the thymus. These include the descending vagus, phrenic, hypoglossal, and sometimes the recurrent laryngeal.[5] Whether acupuncture-based neuromodulation of these nerves could affect thymic function is unknown at this time.

Vessels

- **Anterior intercostal arteries:** Supply the thymus gland.
- **Anterior mediastinal branches of the internal thoracic arteries:** Supply the thymus gland.
- **Jugular venous arch:** The right and left anterior jugular veins may unite in the suprasternal space, superior to the manubrium, to form the jugular venous arch.
- **Thyroid ima artery:** In some cases, the brachiocephalic trunk gives off a small, unpaired thyroid ima artery, otherwise known as the lowest thyroid artery. The thyroid ima artery ascends anterior to the trachea, supplying the trachea along its course

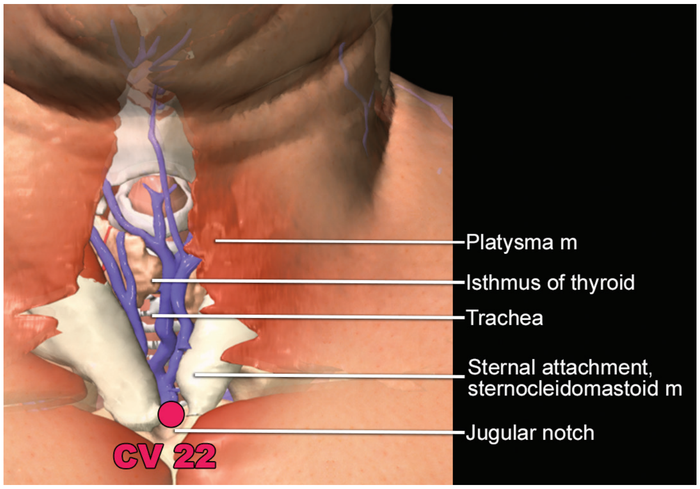


Figure 13-51. The term “Celestial Chimney” for CV 22 describes the proximity of the trachea to the point, as shown here.

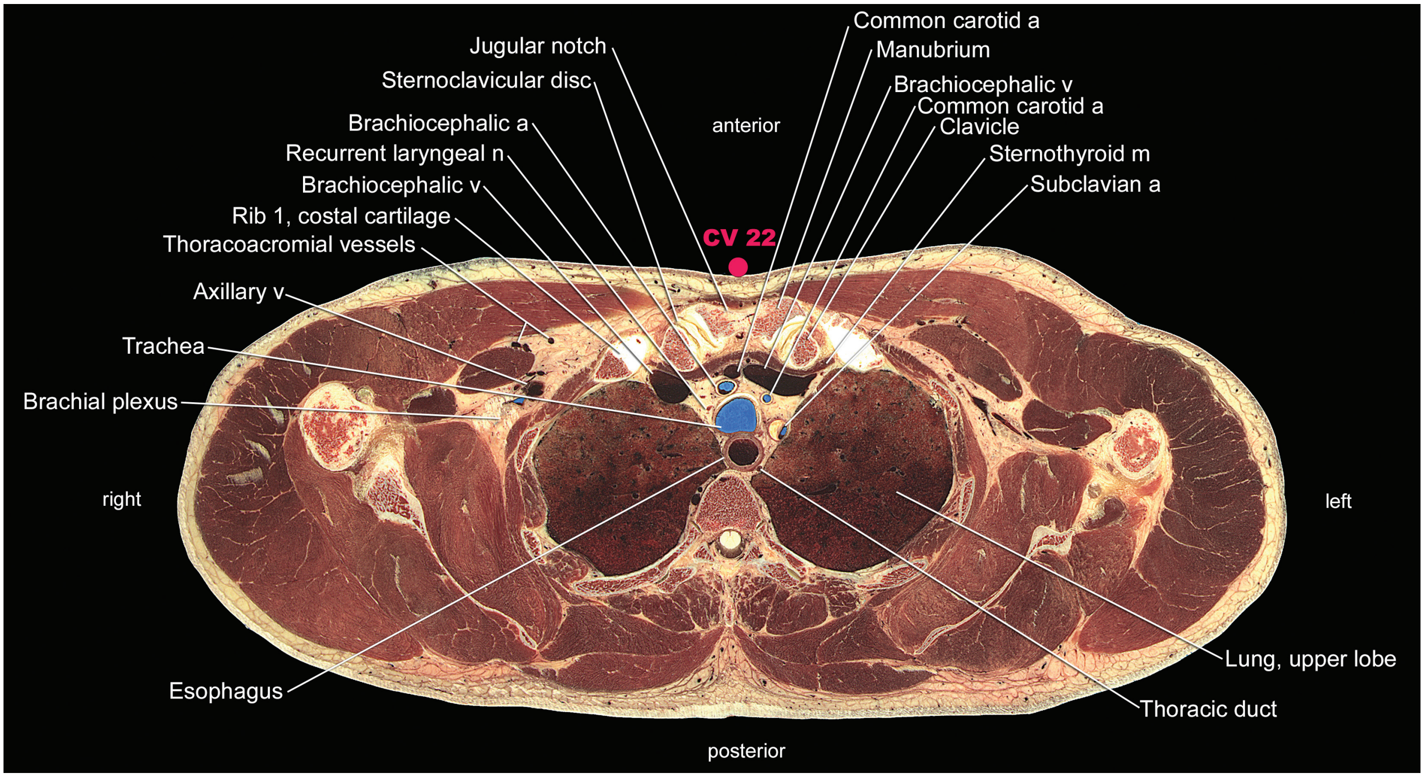


Figure 13-52. This image portrays the proximity of major vessels to CV 22, thereby depicting the dangers of deep needling at this point.

with branches. Variations in ventral cervical vascular anatomy can link the thyroid ima artery to arterial supply for the thymus.[6]

- **Anterior jugular vein:** Begins near the hyoid bone as several superficial veins from the submaxillary region converge. The anterior jugular vein descends between the midline and the ventral border of the sternocleidomastoid muscle. The anterior jugular vein dives deep to the sternal attachment of the sternocleidomastoid muscle and empties into either the external jugular or the subclavian vein. At CV 22, cranial to the manubrium, the right and left anterior jugular veins anastomose by means of a transverse trunk called the venous jugular arch. This venous communication pathway also receives tributaries from the inferior thyroid veins. Each of the inferior thyroid veins communicates with the internal jugular. As such, CV 22 represents a site of venous blood interchange between right and left sides as well as the internal and external jugular venous pathways.
- **Inferior thyroid vein(s):** Drain(s) the inferior poles of the thyroid. As many as four inferior thyroid veins arise from the venous plexus of the thyroid and communicate with the superior and middle thyroid veins. The superior and middle thyroid veins drain into the internal jugular while they inferior thyroid drains into the brachiocephalic vein.
- **Veins of the thymus gland:** Drain into the left brachiocephalic vein, the internal thoracic vein, and the inferior thyroid veins. The venous drainage of the thymus gland does not parallel its arterial supply. Whereas the thymus derives its blood from all local arteries, its three principle sources include the inferior thyroid arteries, the middle thyroid arteries, and the internal thoracic arteries. Venous drainage, on the other hand, empties into the inferior thyroid vein, the superior cava, or the thyroid ima vein.

Clinical Relevance: Thyroid artery variations affect the distribution of autonomic nerve supply by means of nervi vasorum.[7] Damage or surgical removal of an artery may alter the circulation and ability to modulate blood flow due to absence of fibers from the cervical sympathetic chain and its nerves to the thyroid. Neuromodulation with acupuncture and related techniques may aid in supporting recovery of these nerves and restoration of a more healthful level of blood flow.

Levels of thyroglobulin, a product of the thyroid gland, in the inferior-superior thyroid veins measure higher than do those from the antecubital vein.[8] Patients with differentiated thyroid carcinoma that persists or recurs may exhibit a higher ratio of thyroglobulin levels in the internal jugular compared to the antecubital vein.[9] Venous sampling of proteins or peptides secreted by endocrine tumors such as those affecting the thyroid gland can aid in localizing tumors when conventional imaging studies fail to do so. The finding that substances secreted from the thyroid exhibit a higher concentration in local veins than distal ones suggests that acupuncture and related techniques applied to CV 22 may improve distribution of glandular secretions to the systemic circulation.

Indications and Potential Point Combinations

- **Tongue, thyroid, and throat problems:** CV 22, CV 23, ST 9; consider SI 17, LI 4, GV 14, and GV 20.
- **Thoracic problems: cough, asthma, chest congestion, laryngitis, tonsillitis, tracheitis, emphysema, pharyngitis, hiccoughs:** CV 22, LU 5, BL 12, BL 23, LI 4.
- **Vomiting, nausea, dyspepsia:** CV 22, CV 12, PC 6, ST 36, BL 21.

Evidence-Based Applications

- LI 4, CV 21, and CV 22 improved **cancer-related breathlessness.**[1]
- Acupuncture at LI 4, ST 36, PC 6, LR 3, CV 12, CV 17, and CV 22 successfully **treated sleep-related laryngospasm with gastroesophageal reflux,** refractory to current medical treatment; results were maintained at a 1-year follow-up assessment, and no evidence of reflux was detected upon repeated upper gastrointestinal study.[2]

References

1. Filshie J, Penn K, Ashley S, and Davis CL. Acupuncture for the relief of cancer-related breathlessness. *Palliative Medicine*. 1996;10:145-150.
2. Schiff F, Oliven A, and Odeh M. Acupuncture therapy for sleep-related laryngospasm. *Am J Med Sci*. 2003;326(2):107-109.
3. Brooks SM. Perspective on the human cough reflex. *Cough*. 2011;7:10.
4. Safieddine N and Keshavjee S. Anatomy of the thymus gland. *Thoracic Surgery Clinics*. 2011;21(2):191-195, viii.
5. Safieddine N and Keshavjee S. Anatomy of the thymus gland. *Thoracic Surgery Clinics*. 2011;21(2):191-195, viii.
6. Banneheka S, Chiba S, Fukazawa M, et al. Middle thymothyroid artery arising from the common carotid artery: case report of a rare variation. *Anat Sci Int*. 2010;85:241-244.
7. Toni R, Delia Casa C, Mosca S, et al. Anthropological variations in the anatomy of the human thyroid arteries. *Thyroid*. 2003;13(2):183-192.
8. Kutun S, Ay AA, Celik A, et al. The importance of inferior-superior thyroid veins sampling in the diagnosis of thyroid carcinomas. *Endokrynol Pol*. 2012;63(3):202-205.
9. Kebebew E and Reiff E. Patients with differentiated thyroid cancer have a venous gradient in thyroglobulin levels. *Cancer*. 2007;109(6):1078-1081.

CV 23

Lian Quan "Corner Spring" "Ridge Spring" "Pure Spring"

On the ventral midline at the throat, in a depression immediately cranial to the hyoid bone. Locate by gently running a finger under the chin and toward the throat until it enters a deep hollow in ventral to the hyoid bone.

Caution: Do not needle into a swelling on the floor of the mouth, as it could represent a ranula (i.e., collection of extravasated mucus), a mucus retention cyst from a salivary gland, or a thyroglossal duct cyst, branchial cleft cyst, cystic hygroma, thyroid disease, intramuscular hemangioma, or submandibular sialadenitis.[3]

Muscles

- **Platysma muscle:** The platysma muscle arises in the fascia covering the deltoid and pectoralis major muscles. These fibers sweep over the clavicle to insert on the inferior border of the mandible. Cutaneous nerves pierce the platysma muscle. Conveys expressions of tension, stress, or grimace.
- **Mylohyoid muscle:** Originates on the mylohyoid line of the mandible and inserts onto the hyoid bone. Elevates the hyoid bone and provides a stable but mobile floor to the mouth and muscular sling which lies inferior to the tongue. Raises the tongue during speaking and swallowing. The middle and anterior fibers of the mylohyoid insert onto the median fibrous raphe that extends from the symphysis menti to the hyoid bone (see Figure 13-54).
- **Geniohyoid muscles:** These muscles are superior to the mylohyoid muscles; in this location they reinforce and shorten the floor of the mouth. Originate on the inferior mental spine of the mandible and insert onto the hyoid bone. Pull the hyoid bone in an anterior and superior direction and widen the pharynx.
- **Genioglossus muscle:** Originates on a short tendon from the superior part of the mental spine of the mandible. Inserts on the body of the hyoid bone and the entire dorsum of the tongue. This fan-shaped muscle contributes most of the bulk to the tongue muscle, extending from chin to tongue. The genioglossus muscle depresses the tongue; it creates a central furrow or groove when acting bilaterally. "Wags" or deviates the tongue when acting unilaterally.

Clinical Relevance: Plastic surgeons consider neck contour the "cornerstone" of the face-lift.[4] That is, landmarks establishing a youthful appearance include delineation of the edge of the mandible and chin, a well-defined cervicomental angle, and visible laryngeal cartilage and SCM muscles.[5] The thyroid cartilage constitutes the most prominent structure on the ventromedial neck.

Features that aging produces include laxity of the soft tissues on the ventral neck and loss of the cervicomental angle.[6] This can occur due to loss of skin elasticity and deterioration of skin quality, loss of tone in the platysma muscle, and accumulation of submental (subplatysmal) fat. Ordinarily, the procedure of choice is cervicofacial rhytidectomy. However, cervicofacial rhytidectomy poses unacceptable risks for some patients, leading to a range of alternate approaches. Thus, one must weigh the risk of complications from more invasive procedures against the possibility of providing only marginal results from less invasive methods.[7] A novel technique that creates a "corset" of the anterior digastric muscles draws the two together and anchors them onto the mylohyoid (i.e., the muscle that creates the "floor" of the mouth), producing striking changes in appearance.[8]

"Beauty" Tip: Performing the yoga posture known as the "Lion Pose", or Simhasana, strengthens many soft tissues involved in maintaining a more youthful cervicomental angle. It activates the platysma and genioglossus when contracting the superficial neck and upper body along with markedly protruding the tongue. To identify the changes this pose causes in the submental tissues, perform the pose and palpate the submental region. You will find a furrow appear beneath the mandible, capable of countering submental tissue sag with regular practice.

Flabby facial and cervical musculature can cause more than aesthetic problems. For sleep apnea patients, excessive relaxation of the genioglossus and geniohyoid muscles during REM sleep has been implicated in obstructive sleep apnea. Treatment at CV 23 with acupuncture and related techniques may improve muscle tone throughout the day and night. Patients can be taught to perform the lion pose (i.e., the forementioned yoga asana) to improve muscle tone in the neck and throat.

Deglutition disorders may arise from impaired action of the geniohyoid, mylohyoid, and digastric muscles that need to act in concert to escort food from the mouth into the pharynx. In cases of nerve entrapment or history of trauma, freeing fascia of the ventral neck reduces pressure on nerves such as fibers from C1 that travel with the hypoglossal nerve to the geniohyoid. Acupuncture and related techniques may then improve nerve communication and muscular coordination, thereby reducing symptoms of dysphagia.

"Pharyngocise" to Improve Swallowing Function: Patients who receive external beam radiotherapy for oropharyngeal cancer are at risk of developing swallowing dysfunction from deep tissue fibrosis.[9] Considering the concomitant problems of dry mouth (xerostomia), mucositis, and edema, patients avoid swallowing even more. In order to counter disuse atrophy, patients who perform swallowing exercises reduce the occurrence of dysphagia-related complications. Research suggests that muscles involved in swallowing, i.e., the genioglossus, hyoglossus, and mylohyoid, deteriorate less with pharyngocise; functional swallowing, mouth opening, salivation rate, and chemosensory acuity are maintained better in patients who performed pharyngocise than those who do not.

Nerves

- **Mylohyoid nerve (CN V_3):** Innervates the mylohyoid muscle.
- **C1, via the hypoglossal nerve:** Innervates the geniohyoid muscle.
- **Hypoglossal nerve (CN XII):** Supplies all of the tongue muscles except for the palatoglossus muscle.
- **Cervical branch of the facial nerve (CN VII):** Innervates the platysma muscle.

Clinical Relevance: The nerves supplying sensation and motor function to the tissues at and near CV 23 participate in defining the cervicomental angle aesthetically as well as producing speech and deglutition functionally. Neuromodulation applied to this area by means of acupuncture and related techniques along

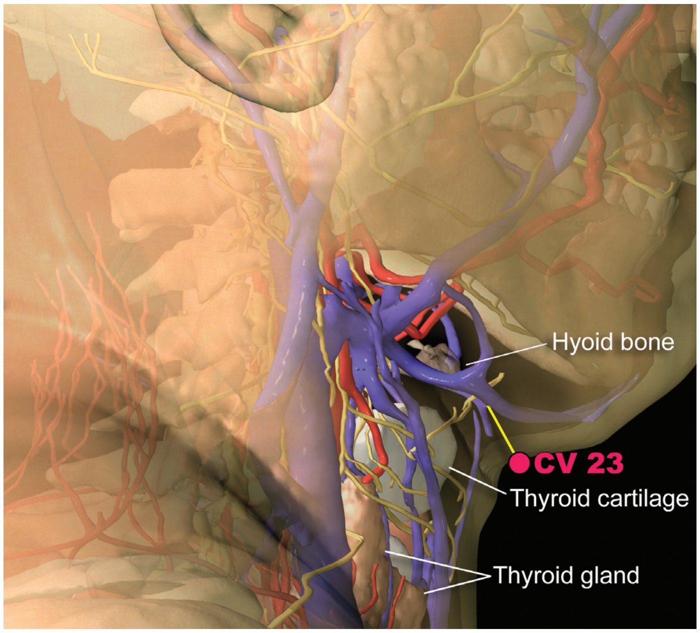

Hyoid bone
CV 23
Thyroid cartilage
Thyroid gland

Figure 13-53A. This lateral view of the neck depicts the relationship of CV 23 to the hyoid bone. The yellow line shows the angle one might need to needle CV 23.

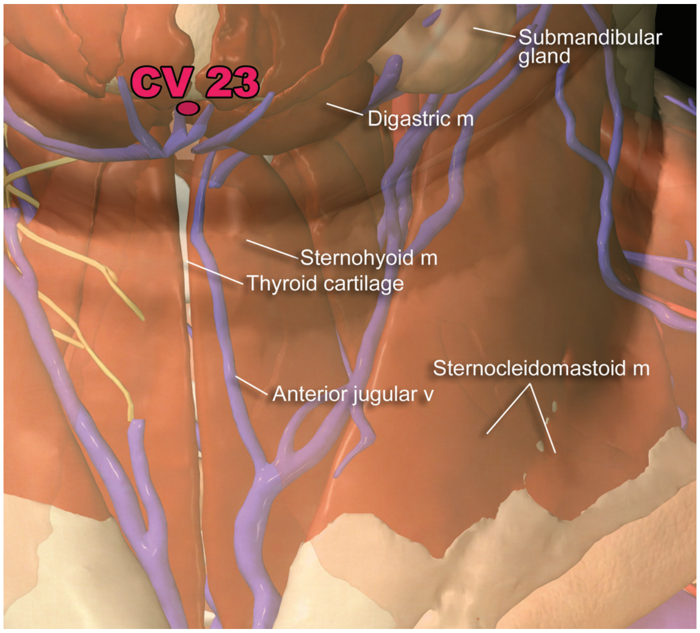

Submandibular gland
CV 23
Digastric m
Sternohyoid m
Thyroid cartilage
Sternocleidomastoid m
Anterior jugular v

Figure 13-53B. "Ridge Spring" refers to the submental vessels ("spring") near the hyoid bone, or "ridge". "Pure Spring" connotes saliva emanating from the sublingual and submandibular salivary glands. "Corner Spring" alludes to the various fluids circulating at the cervicomental angle.

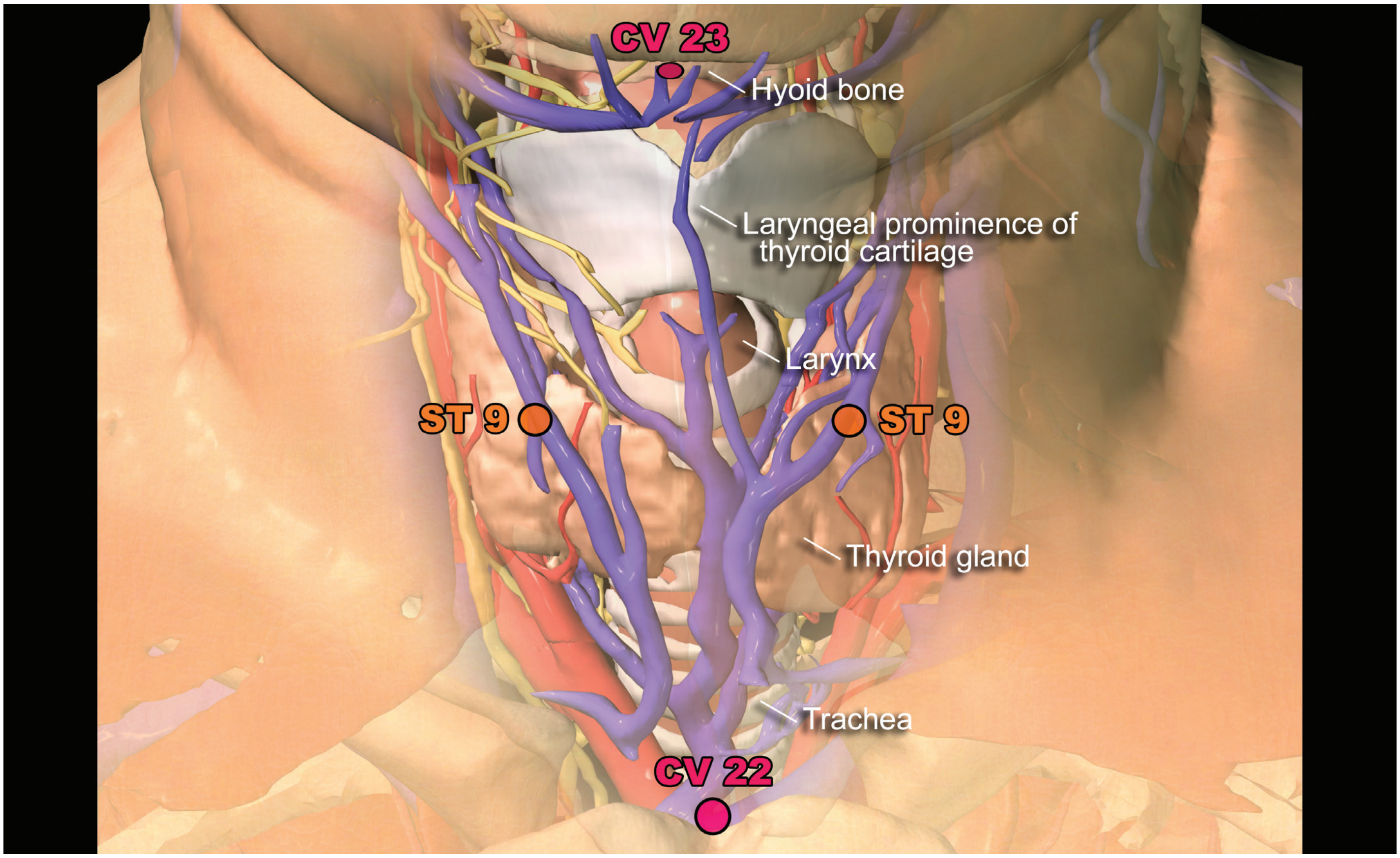

CV 23
Hyoid bone
Laryngeal prominence of thyroid cartilage
Larynx
ST 9
ST 9
Thyroid gland
Trachea
CV 22

Figure 13-53C. This frontal view shows CV 23 in relation to the hyoid bone, the thyroid cartilage and its laryngeal prominence, and the trachea. CV 23 frequently appears in formulae for thyroid disorders, along with CV 22 and ST 9 (bilateral). In that these four points surround the larynx and pharynx as well, they comprise a common group for both laryngeal and pharyngeal dysfunction.

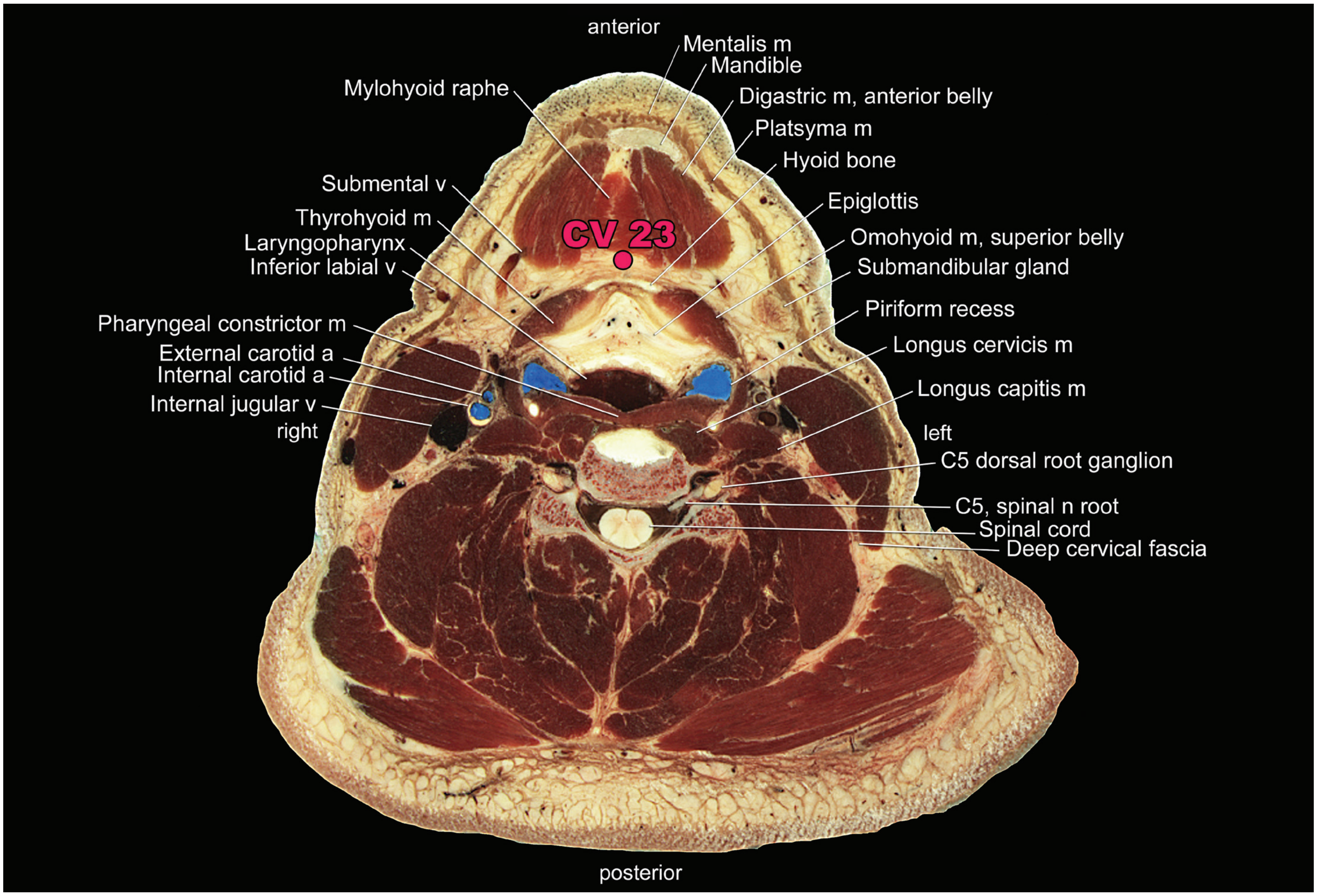

anterior
Mentalis m
Mandible
Mylohyoid raphe
Digastric m, anterior belly
Platsyma m
Hyoid bone
Submental v
Epiglottis
Thyrohyoid m
CV 23
Omohyoid m, superior belly
Laryngopharynx
Inferior labial v
Submandibular gland
Piriform recess
Pharyngeal constrictor m
Longus cervicis m
External carotid a
Internal carotid a
Longus capitis m
Internal jugular v
right
left
C5 dorsal root ganglion
C5, spinal n root
Spinal cord
Deep cervical fascia
posterior

Figure 13-54. This cross-section views CV 23 from the inside, just cranial to where a needle would enter the skin. Note the proximity of CV 23 to the mylohyoid raphe, i.e., the section of tissue that connects the right and left mylohyoid muscles. This area tends to sag in the aging neck, calling for a "corset" of juxtaposed anterior digastric muscles, as is done in certain surgical approaches.

with active, intentional, contraction of local structures, helps facilitate recovery and improves appearance. Treatments called the "acupuncture face lift" work by relaxing muscles that create wrinkles, toning tissues that allow sag, improving circulation and lymphatic drainage, and balancing nerve function for proper proprioception and reduced tension. The acupuncture face lift need not require adopting belief systems as some may claim, insisting that practitioners be "certified" to perform the treatment. Instead, tailor the approach to the individual's face. Identify, by means of observation and light palpation, areas of tension and those requiring toning. Consider introducing laser therapy and massage for in-clinic and home treatment, respectively.

Branches of the caudal division of the mandibular nerve (CN V_3) include the lingual, inferior alveolar, and auriculotemporal nerves.[10] These nerves transmit taste sensation and provide motor supply for mastication, salivation, and speech. Variations in branching patterns can cause unexpected inadequacy of anesthesia from local nerve blocks. In the vicinity of CV 23, communicating branches may link the mylohyoid and lingual nerves. Failure to block all nerve supplying an area allows sensation to continue.

Unilateral, extracranial injury of the hypoglossal nerve results in deviation of the tongue to the damaged side because it removes the protrusive action of the ipsilateral genioglossus muscle that, when bilaterally activated, pushes the tongue straight out.

Vessels

- **Lingual artery:** Arises from the external carotid artery. Branches into 1) the dorsal lingual arteries, which provide circulation to the posterior part of the tongue, and which send tonsillar branches to the palatine tonsils; 2) the deep lingual arteries, which supply the anterior portion of the tongue, and 3) the sublingual arteries, which provide circulation to the sublingual salivary glands and the mouth floor. The only lingual arterial branches which communicate with each other are the dorsal lingual arteries, which do so near the tongue tip. The other lingual artery branches cannot communicate with each other because the fibrous lingual septum prevents them from doing so.
- **Lingual vein:** Tributaries of the lingual vein are the dorsal lingual veins, which accompany the lingual artery, and the deep lingual veins, which begin at the tip of the tongue and course alongside the lingual frenulum until they join the sublingual vein The deep lingual veins are visible through the mucosa on the underside of the tongue. Ultimately, all of the venous drainage of the tongue empties into the internal jugular vein.

Clinical Relevance: Muscles, skin, fascia, and nerves that participate in speech, swallowing, and facial features require sufficient circulation to maintain healthy tissue. Acupuncture and related techniques improve local circulation and tissue repair.

Indications and Potential Point Combinations

- **Glossitis, glossalgia, problems moving the tongue:** CV 23, CV 22, ST 9, LI 18, SI 17.
- **Aphonia, laryngitis, pharyngitis, tonsillitis:** CV 23, CV 22, ST 9, LU 7, LI 4, BL 10.
- **Dry mouth or excessive thirst, hypersalivation (ptyalism), sialorrhea:** CV 23, CV 22, ST 6, ST 7, SI 17, SI 19, ST 36.
- **Cough:** CV 23, CV 22, LU 2, LU 5, BL 12, BL 13.
- **Thyroid, swallowing, and throat problems:** CV 22, CV 23, ST 9, LI 4. (See Figure 13-51C.)
- **Acupuncture "Face Lift":** CV 23, BL 2, GB 1, Yintang (GV 24.5), LI 4, LU 7, GV 20. Add local points as indicated by the individual's unique presentation and aging changes.

Evidence-Based Applications

- A case series indicated that LU 5 and CV 23 effectively treated **pseudobulbar paralysis.**[1]
- Tactile stimulation of the cervical skin triggers strap muscle contraction in dogs via a reflex arc. Somatic afferent stimulation of cervical cutaneous nerves through acupuncture may bolster glottic closure and restore **deglutition.**[2]
- The most frequently chosen acupuncture points for rehabilitation of **aphasia after stroke** include CV 23, Jinjin, Yuye, HT 5, GB 20, PC 6, GV 20, SP 6, GV 15, and scalp acupuncture points Nos. 1, 2, and 3 in the language sections.[11]
- Acupressure applied to CV 23 and TH 17 weekly for four weeks improved salivary flow rates and reduced thirst intensity in patients receiving hemodialysis who often complain of **dry mouth and excessive thirst.**[12]

References

1. Wang C, Du S, Li H, and Ding Z. 120 cases of pseudobulbar paralysis treated by needling Lianquan and Chize. *Journal of Traditional Chinese Medicine.* 1998;18(2):96-98.
2. Ilyes LA, Jacobs G, Stepnick DW, et al. Artificial reflex arc: a potential solution for chronic aspiration I. Neck skin stimulation triggering strap muscle contraction in the canine. *Laryngoscope.* 1987;97(Pt 1):331-333.
3. Sheikhi M, Jalalian F, Rashidipoor R, et al. Plunging ranula of the submandibular area. *Dent Res J (Isfahan).* 2011;8 (Suppl 1):S114-S118.
4. Cruz RS, O'Reilly EB, and Rohrich RJ. The platysma window: an anatomically safe, efficient, and easily reproducible approach to neck contour in the face lift. *Plast Reconstr Surg.* 2012;129(5):1169-1172.
5. Labbe D, Giot J-P, and Kaluzinski E. Submental area rejuvenation by digastric corset: anatomical study and clinical application in 20 cases. *Aesth Plast Surg.* 2013;37:222-231.
6. Barbarino SC, Wu AY, and Morrow DM. Isolated neck-lifting procedure: isolated stork lift. *Aesthetic Plast Surg.* 2013;37(2):205-209.
7. Mueller GP, Leaf N, Aston SJ, et al. The percutaneous trampoline platysmaplasty: technique and experience with 105 consecutive patients. *Aesthet Surg J.* 2012; 32(1):11-24.
8. Labbe D, Giot J-P, and Kaluzinski E. Submental area rejuvenation by digastric corset: anatomical study and clinical application in 20 cases. *Aesth Plast Surg.* 2013;37:222-231.
9. Carnaby-Mann G, Crary MA, Schmalfuss I, et al. "Pharngocise": randomized controlled trial of preventative exercises to maintain muscle structure and swallowing function during head-and-neck chemoradiotherapy. *Int J Radiat Oncol Biol Phys.* 2012;83(1):210-219.
10. Thotakura B, Rajendran SS, Gnanasundaram V, et al. Variations in the posterior division branches of the mandibular nerve in human cadavers. *Singapore Med J.* 2013;54(3):149-151.
11. Sun Y, Xue SA, and Zuo Z. Acupuncture therapy on apoplectic aphasia rehabilitation. *J Tradit Chin Med.* 2012; 32(3):314-321.
12. Yang L-Y, Yates P, Chin C-C, et al. Effect of acupressure on thirst in hemodialysis patients. *Kidney Blood Press Res.* 2010;33:260-265.

CV 24

Cheng Jiang "Sauce Receptacle"

At the midline of the chin, in a groove called the mentolabial sulcus below the lower lip.

Muscles

- **Right and left mentalis muscles:** Ascend to the chin from the mandible and raise the chin as when one expresses doubt.
- **Right and left depressor labii inferioris muscles:** Originate on the mandible, lateral to the mentalis muscles, and merge with each other as well as the orbicularis oris muscle. Draw the lower lip in an inferior and lateral direction, as in the expression of impatience.
- **Orbicularis oris muscle:** The sphincter of the mouth, works to close the mouth. Important during speech. Works with the tongue to hold food between the teeth during chewing.

Clinical Relevance: Fibers from the muscles of the chin intermingle at their borders.[3] This finding emphasizes the need for a regional approach to muscle dysfunction affecting this region. Thus, consider acupressure, acupuncture, and laser therapy not only at CV 24, but also surrounding locales.

Failed augmentation mentoplasty sometimes leads to mentalis muscle dysfunction.[4] This results in dimpling of the skin over the chin and ptosis of soft tissue. Acupuncture and related techniques applied to CV 24 and other regional points elevate tissue health and may restore a more normal appearance.

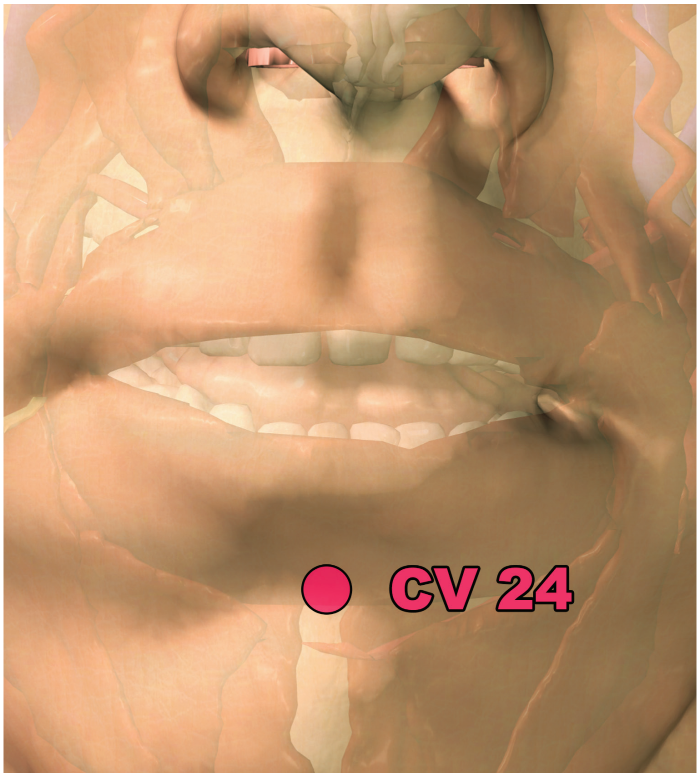


Figure 13-55A. CV 24, "Sauce Receptacle", resides in a depression called the mentolabial sulcus, where sauce or saliva could accumulate in a patient with facial paralysis or oral dysfunction; hence the name.

Nerves

- **Right and left mental nerves:** Terminal branches of the inferior alveolar nerve (from CN V_3). Emerge from the mandibular canal through the mental foramen (see Figure 13-55C). Supply sensation to the skin of the chin, the lower lip, and the lower lip mucosa.
- Right and left marginal mandibular branches of facial nerve (CN VII): Provide motor control to the risorius muscle and to muscles of the lower lip and chin.

Clinical Relevance: Clinical conditions such as sialorrhea (excess salivation) or incompetence of the oral sphincter from facial nerve paralysis could cause "dribbling", i.e., the accumulation of fluid at this point. CV 24 receives innervation from bilateral facial nerve branches supplying the orbicularis oris (i.e., the buccal branch of the facial nerve, CN VII) and the mentalis muscle (via the marginal mandibular branch of CN VII). This explains its value for facial nerve paralysis or injury. Buccal branches from the facial nerve join with filaments from the buccinator branch of the mandibular nerve (CN V_3) and assist with mastication. The mandibular branch of the facial nerve communicates with the mental branch of the inferior alveolar nerve (CN V_3), arguing for the relevance of CV 24 in dental analgesia. In dental anesthesia, Inferior alveolar nerve block is employed in order to numb the lower lip, teeth, and gingivae of the mandible. As such, neuromodulation of the same nerve by means of acupuncture and related techniques may also in producing analgesia.

Acupuncture at CV 24 blunts or eliminates severe gag reflex during dental procedures. This suggests that treatment at CV 24 neuromodulates cranial nerve reflexes. The gag reflex starts with either somatic or psychogenic stimuli. Somatic sites associated with gagging vary but often include the lateral border of the tongue and places on the palate. Psychogenic gagging, mediated by supraspinal centers, can occur in susceptible individuals at merely the thought of dental treatment. The mechanism by which nerves supplying CV 24 aid in controlling the gag reflex likely involves neuromodulation of reflexes between cranial nerves V (trigeminal), XI (glossopharyngeal), and X (vagus). In addition, beta-endorphin release confers anti-emetic effects, thereby reducing the nausea component of the gag reflex.

Vessels

- **Anastomosis between branches of right and left inferior labial arteries:** Branches of the facial arteries anastomose with each other and with the superior labial arteries to encircle the oral cavity.
- **Anastomosis between branches of the mental arteries:** Terminal branches of the inferior alveolar arteries emerge from the mental foramen to supply the facial muscles and chin skin.
- **Anastomosis of the right and left inferior labial veins:** These tributaries of the facial vein drain the lower lip area.
- **Anastomosis of right and left submental veins:** The submental veins drain the chin and merge with the facial vein.

Clinical Relevance: CV 24 relates to the inferior labial and horizontal labiomental artery. Both vessels ordinarily branch off of the facial artery.[5] Vertical labiomental arterial branches from the submental artery converge with descending branches from

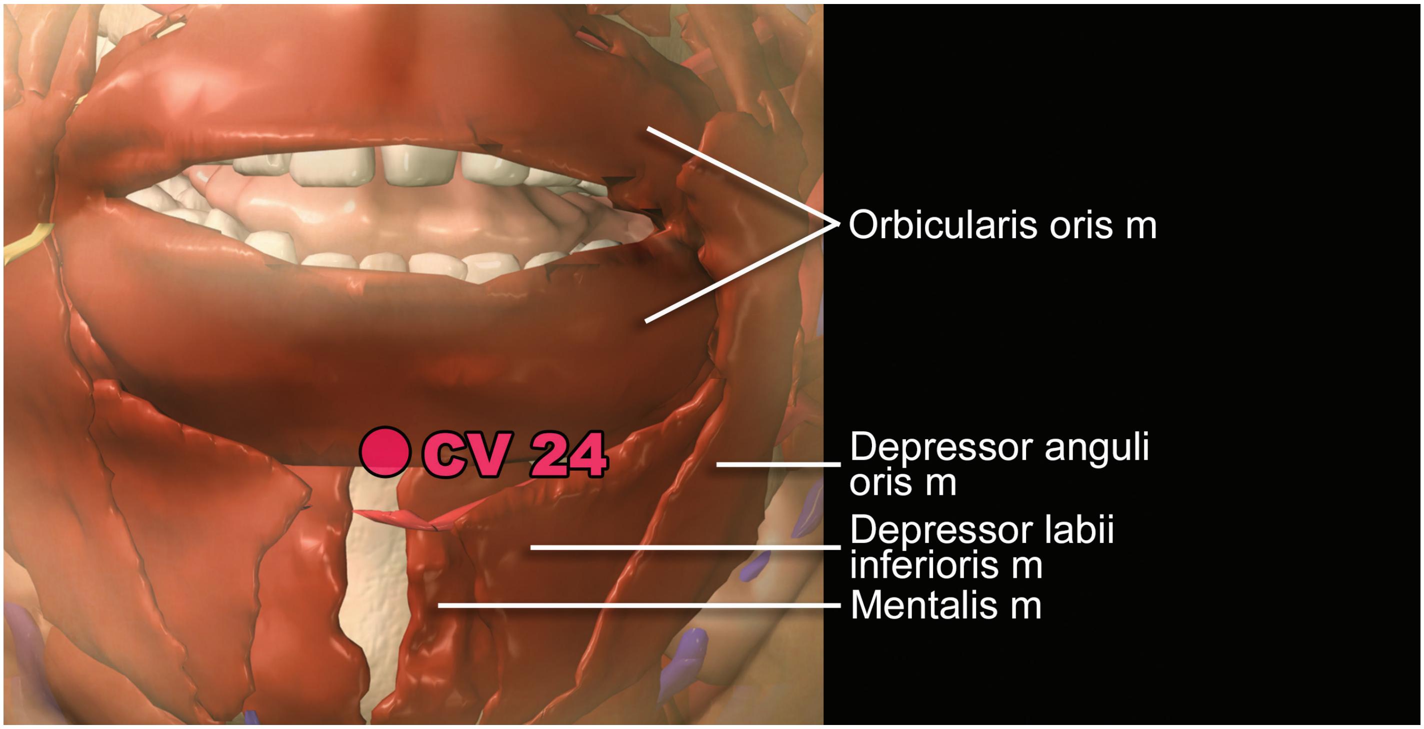


Figure 13-55B. This image reveals the way in which CV 24 denotes the intersection of the lip and chin. It also illustrates how the vessel inferior to CV 24 emerges from behind the depressor labii inferior muscle. This suggests that it may be the horizontal labiomental artery instead of the inferior labial artery.[14] However, facial vascularization varies between and even within individuals from right to left sides. According to some, symmetrical facial vasculature may not exist.[15] The horizontal labiomental artery is rarely mentioned in anatomical descriptions of lower lip and chin anatomy; it could be considered by some authors to be the inferior labial artery, destined to terminate in a "T" at about the level of CV 24 where it branches to supply the lower lip.[16]

the inferior labial artery. Considering the anastomoses between arteries and vessels at this site, CV 24 represents an important locus for potentially improving circulation to the chin and lower lip.

Variations in blood supply to the lips pose challenges to plastic surgeons planning reconstruction. Should a procedure iatrogenically compromise circulation, laser therapy, acupuncture, and massage may aid in restoring proper blood flow to the site.

A condition known as a "prominent inferior labial artery" denotes the presence of a pulsating papule in the lower vermilion border, one or two centimeters from the labial commissure (corner of the mouth). While it may resemble a tumor, it can represent a tortuous segment of the inferior labial artery.[6]

Indications and Potential Point Combinations

- **Coma, stroke, with difficulty speaking:** CV 24, ST 4, CV 23.
- **Facial nerve paralysis affecting function of the mouth and lips:** CV 24, ST 4, ST 6, TH 17.
- **Dental pain, lower arcade:** CV 24, ST 6, LI 4, LU 7.
- **Gingivitis, oral ulcers:** CV 24, ST 7, ST 6, LI 4.
- **Trismus:** CV 26, ST 6, ST 7, GB 3, GB 4, tender trigger points in the temporalis and masseter muscles.
- **Sialorrhea:** CV 24, ST 4, ST 7.
- **TMJ pain:** CV 24, GB 3, GB 2, TH 21, SI 19, tender trigger points in the temporalis, masseter muscle, trapezius, and cervical strap muscles. Integrate laser therapy and massage.
- **Gag reflex:** CV 24,[7] PC 6,[8] auricular acupuncture points.[9]

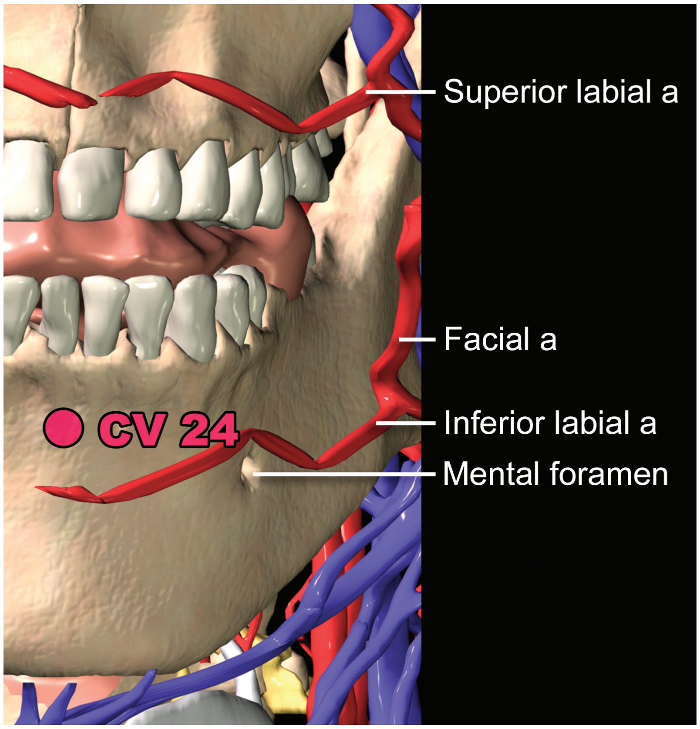


Figure 13-55C. CV 24 relates to the inferior labial and, if present, the horizontal labiomental artery, both usually offshoots of the facial artery.[17] Vertical labiomental arterial branches from the submental artery converge with descending branches from the inferior labial artery. Considering the rich anastomoses at CV 24, circulation to the chin and lower lip can improve following treatment at this site.

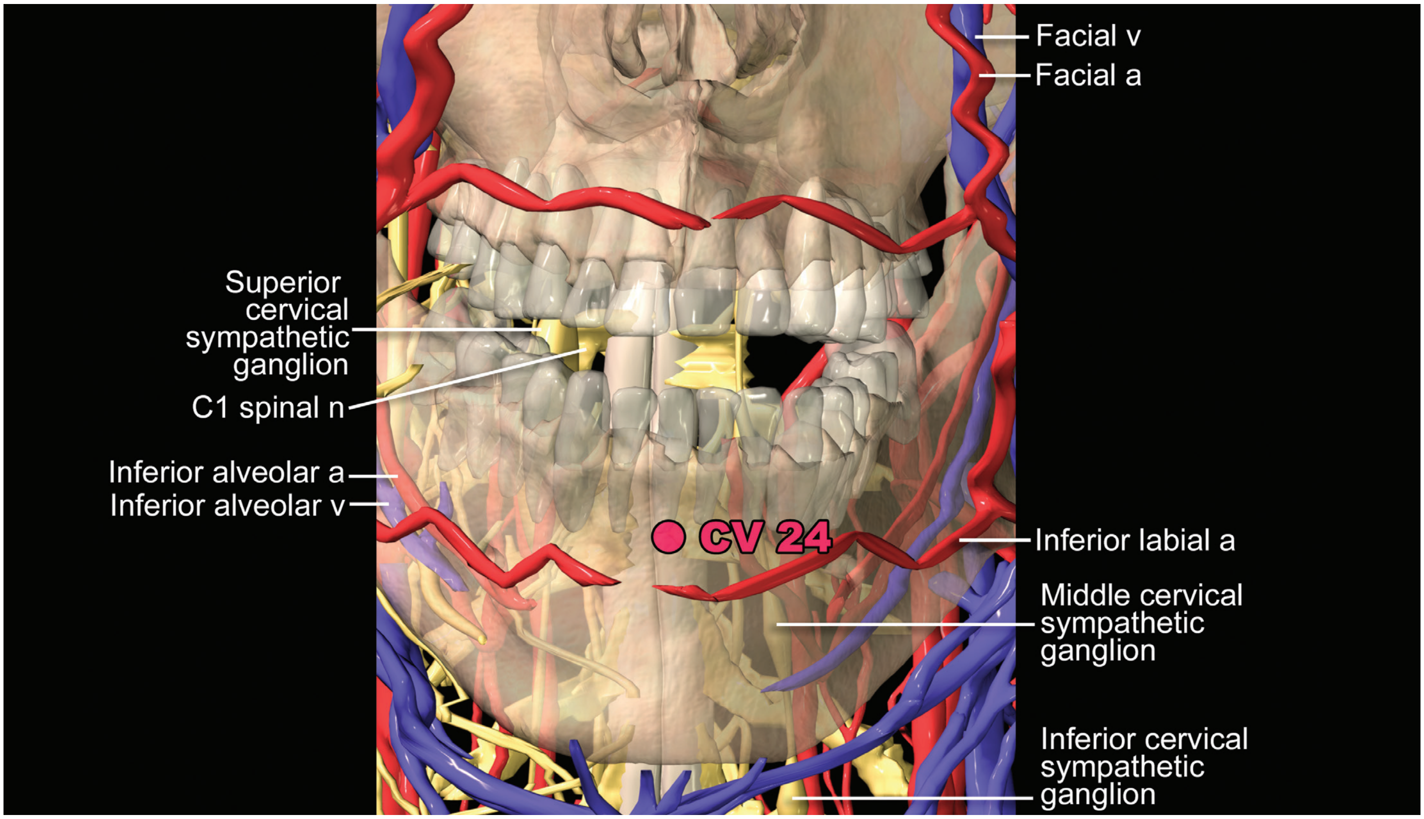

Facial v
Facial a
Superior cervical sympathetic ganglion
C1 spinal n
Inferior alveolar a
Inferior alveolar v
CV 24
Inferior labial a
Middle cervical sympathetic ganglion
Inferior cervical sympathetic ganglion

Figure 13-55D. This view provides an "inside view" of CV 24 in relation to the roots of the lower incisor teeth. It also shows anatomical features not often seen in a frontal view, including the three cervical sympathetic ganglia, the upper cervical spinal cord, and various vessels. In this depiction, the inferior alveolar vessels end where that branching would have taken place. The inferior alveolar artery and vein normally divide into two branches, the incisor and mental branches, proximal to the mental foramen at the first premolar tooth. Although not shown, the inferior alveolar nerve accompanies its vascular companions, giving off the mental nerve that emerges with the vessels through the mental foramen to supply the chin.

Evidence-Based Applications

- **Reduces gag reflex** during trans-esophageal echocardiography.[1]
- **Controlled severe gag reflex** in patients requiring an upper alginate impression.[10]
- Acupuncture-like transcutaneous nerve stimulation at SP 6, ST 36, LI 4, and CV 24 improves whole saliva production in patients with **radiation-induced xerostomia** in head-and-neck cancer patients treated with radical radiotherapy.[2]
- Treatment of **primary trigeminal neuralgia** with deep needling at ST 7 outperformed superficial needling. Additional points included CV 24, BL 2, ST 2, LI 4, and LR 3.[11]
- "Best", or at least commonly selected, point options for **peripheral facial paralysis** include CV 24, ST 4, ST 7, ST 6, LI 20, SI 18, TH 17, GB 14, ST 2, GB 20, GV 26, Yuyao, and LI 4.[12]
- Neuromodulation at CV 24, ST 4, and ST 3 may benefit patients with **temporomandibular dysfunction** by reducing activity in the temporalis muscle.[13] Inhibitory impulses from activation of CV 24 might also reduce sensory transmission in trigeminal pathways and help patients with **trigeminal neuralgia.**

References

1. Rösler A, Otto B, Schreiber-Dietrich D, Steinmetz H, and Kessler KR. Single-needle acupuncture alleviates gag reflex during transesophageal echocardiography: a blinded, randomized, controlled pilot trial. *Journal of Alternative and Complementary Medicine.* 2003;9(6):847-849.
2. Wong RKW, Jones GW, Sagar SM, Babjak A-F, and Whelan T. A Phase I-II study in the use of acupuncture-like transcutaneous nerve stimulation in the treatment of radiation-induced xerostomia in head-and-neck cancer patients treated with radical radiotherapy. *Int J Radiation Oncology Biol Phys.* 2003;57(2):472-480.
3. Hur MS, Kim HJ, Choi BY, et al. Morphology of the mentalis muscle and its relationship with the orbicularis oris and incisivus labii inferioris muscles. *J Craniofac Surg.* 2013;24(2):602-604.
4. Papel ID and Capone RB. Botulinum toxin A for mentalis muscle dysfunction. *Arch Facial Plast Surg.* 2001;3(4):268-269.
5. Kawai K, Imanishi N, Nakajima H, et al. Arterial anatomy of the lower lip. *Scand J Plast Reconstr Surg Hand Surg.* 2004;38:135-139.
6. Howell JB and Freeman RG. Prominent inferior labial artery. *Arch Dermatol.* 1973;107(3):386-387.
7. Rosted P, Bundgaard M, Fiske J, et al. The use of acupuncture in controlling the gag reflex in patients requiring an upper alginate impression: an audit. *British Dental Journal.* 2006;201:721-725.
8. Lu D P, Lu G P, Reed J P. Acupuncture/acupressure to treat gagging dental patients. A clinical study of anti gagging effects. *Gen Dent.* 2000; 48: 446–452.
9. Fiske J, Dickinson C M. The role of acupuncture in controlling the gagging reflex using a review of ten cases. Br Dent J. 2001; 190: 611–613.
10. Rosted P, Bundgaard M, Fiske J, et al. The use of acupuncture in controlling the gag reflex in patients requiring an upper alginate impression: an audit. *British Dental Journal.* 2006;201:721-725.
11. He L and Zhang XM. Clinical effect of sphenopalatine ganglion needling in treating primary trigeminal neuralgia of Liver-yang upsurge syndrome type. *Chin J Integr Med.* 2012;18(3):214-218.
12. Zheng H, Li Y, and Chen M. Evidence based acupuncture practice recommendations for peripheral facial paralysis. *Am J Chin Med.* 2009;37(1):35-43.
13. Wang M, Loo WTY, and Chou JWK. Electromyographic responses from the stimulation of the temporalis muscle through facial acupuncture points. *Journal of Chiropractic Medicine.* 2007;6:146-152.
14. Kawai K, Imanishi N, Nakajima H, et al. Arterial anatomy of the lower lip. *Scand J Plast Reconstr Surg Hand Surg.* 2004;38:135-139.
15. Crouzet C, Fournier H, Papon X, et al. Anatomy of the arterial vascularization of the lips. *Surg Radiol Anat.* 1998;20(4):273-278.
16. Crouzet C, Fournier H, Papon X, et al. Anatomy of the arterial vascularization of the lips. *Surg Radiol Anat.* 1998;20(4):273-278.
17. Kawai K, Imanishi N, Nakajima H, et al. Arterial anatomy of the lower lip. *Scand J Plast Reconstr Surg Hand Surg.* 2004;38:135-139.

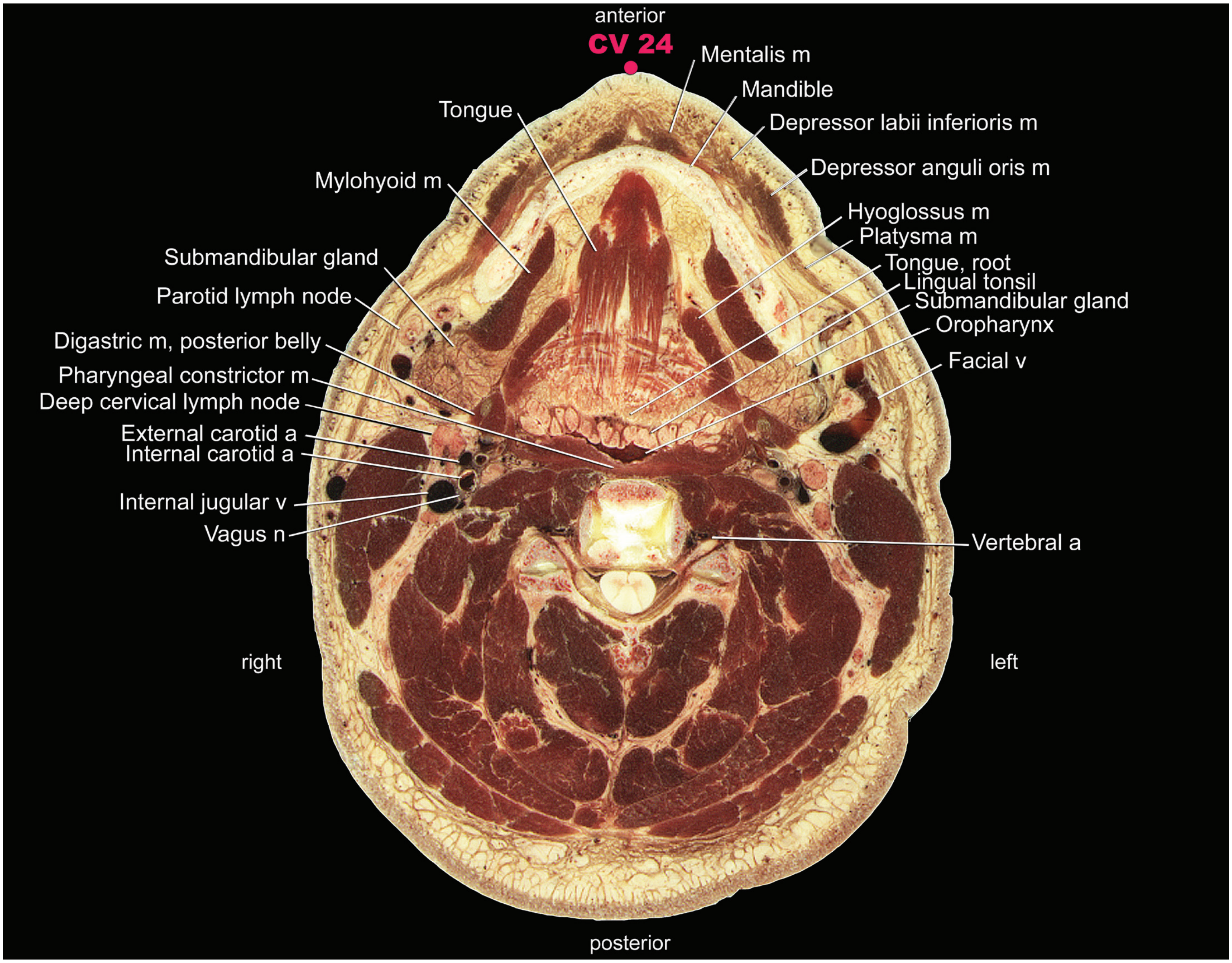
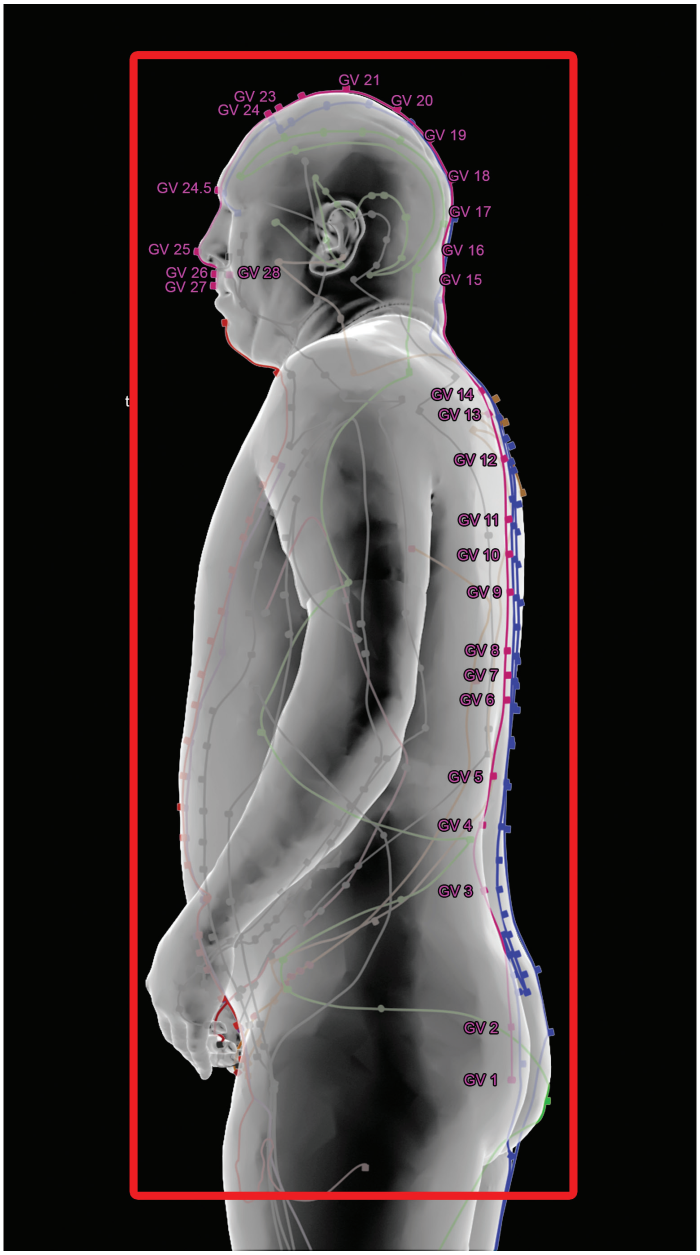
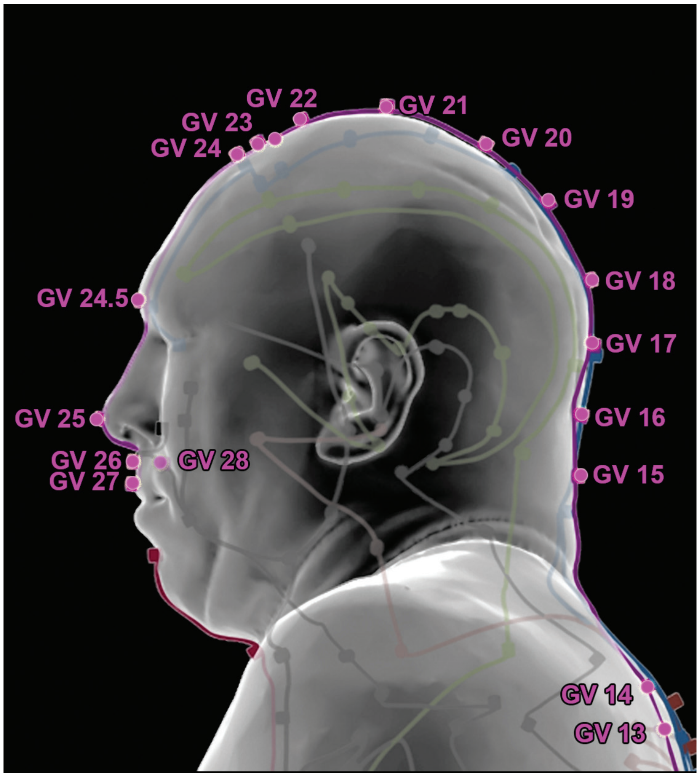

anterior
CV 24
Mentalis m
Mandible
Depressor labii inferioris m
Depressor anguli oris m
Tongue
Mylohyoid m
Hyoglossus m
Platysma m
Tongue, root
Lingual tonsil
Submandibular gland
Oropharynx
Facial v
Submandibular gland
Parotid lymph node
Digastric m, posterior belly
Pharyngeal constrictor m
Deep cervical lymph node
External carotid a
Internal carotid a
Internal jugular v
Vagus n
Vertebral a
right
left
posterior

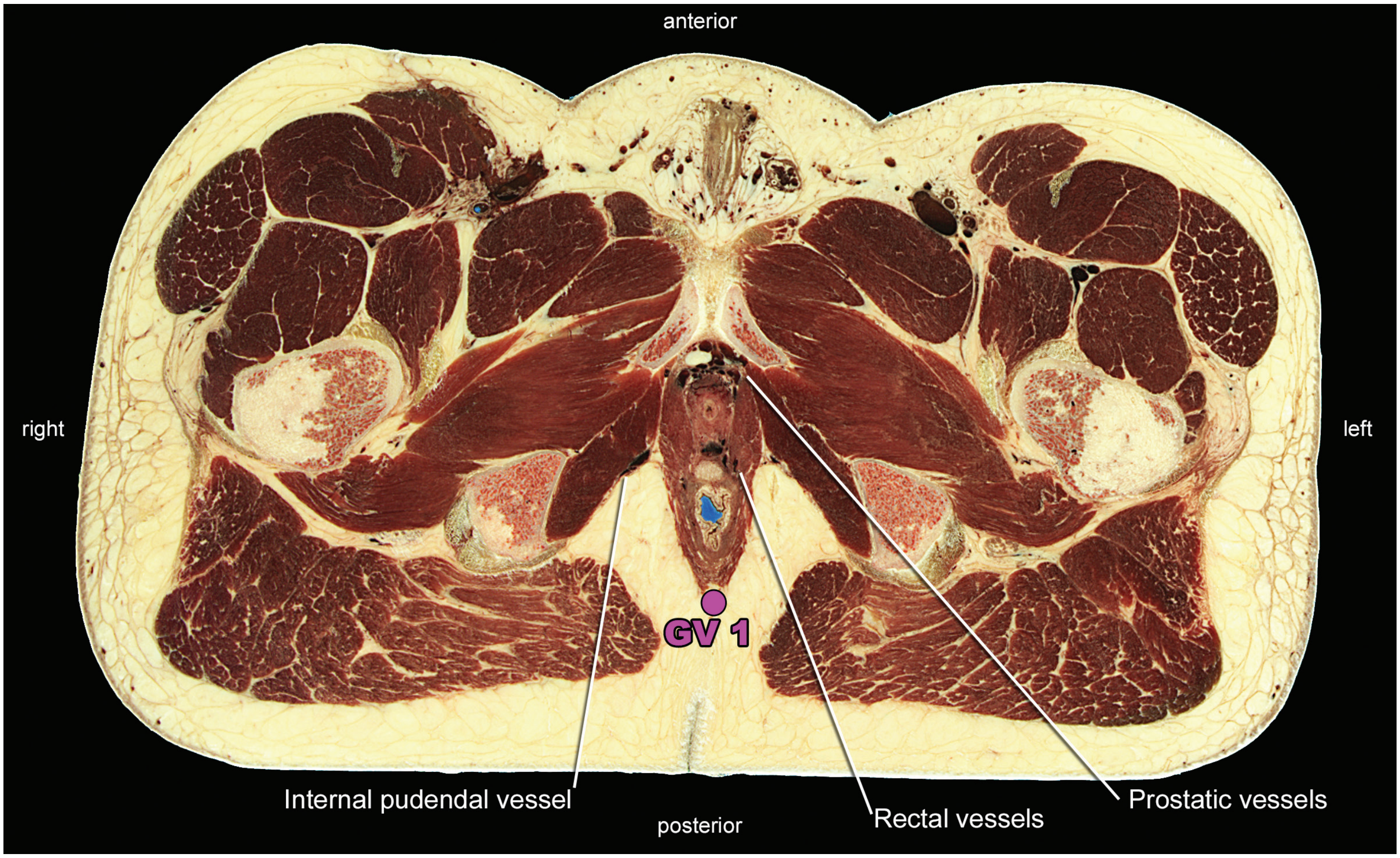
Figure 13-56. This cross section visually describes the intermingling fibers of the chin, belonging to the mentalis, depressor labii inferioris, and depressor anguli oris muscles. Make a pouting expression with your face to put these structures into motion. Also, note how the long, muscular tendrils of the tongue reach to its root. Finally, find the mylohyoid muscle that associated closely with CV 23 caudal to this level. See how it hugs the inner border of the mandible at its more rostral extend and abuts the submandibular gland at its other end. Might there be a connection between mylohyoid muscle contraction and saliva production? Another somatovisceral connection!

Channel 14:: The Governor Vessel (GV)

The GV channel begins at the anococcygeal junction. It ascends the dorsal midline and travels up and over the calvarium. It then descends the forehead, travels over the nose, and loops around the philtrum, ending at the upper labial frenulum inside the mouth.


GV 21
GV 23
GV 24
GV 20
GV 19
GV 18
GV 24.5
GV 17
GV 25
GV 16
GV 26
GV 27
GV 28
GV 15
GV 14
GV 13
GV 12
GV 11
GV 10
GV 9
GV 8
GV 7
GV 6
GV 5
GV 4
GV 3
GV 2
GV 1


GV 22
GV 21
GV 23
GV 24
GV 20
GV 19
GV 18
GV 24.5
GV 17
GV 25
GV 16
GV 26
GV 27
GV 28
GV 15
GV 14
GV 13



The CSVS, i.e., the venous expression of the GV channel, begins in the pelvis, linking the rectal, prostatic, and internal pudendal veins.

GV and CV as "Singular Vessels"

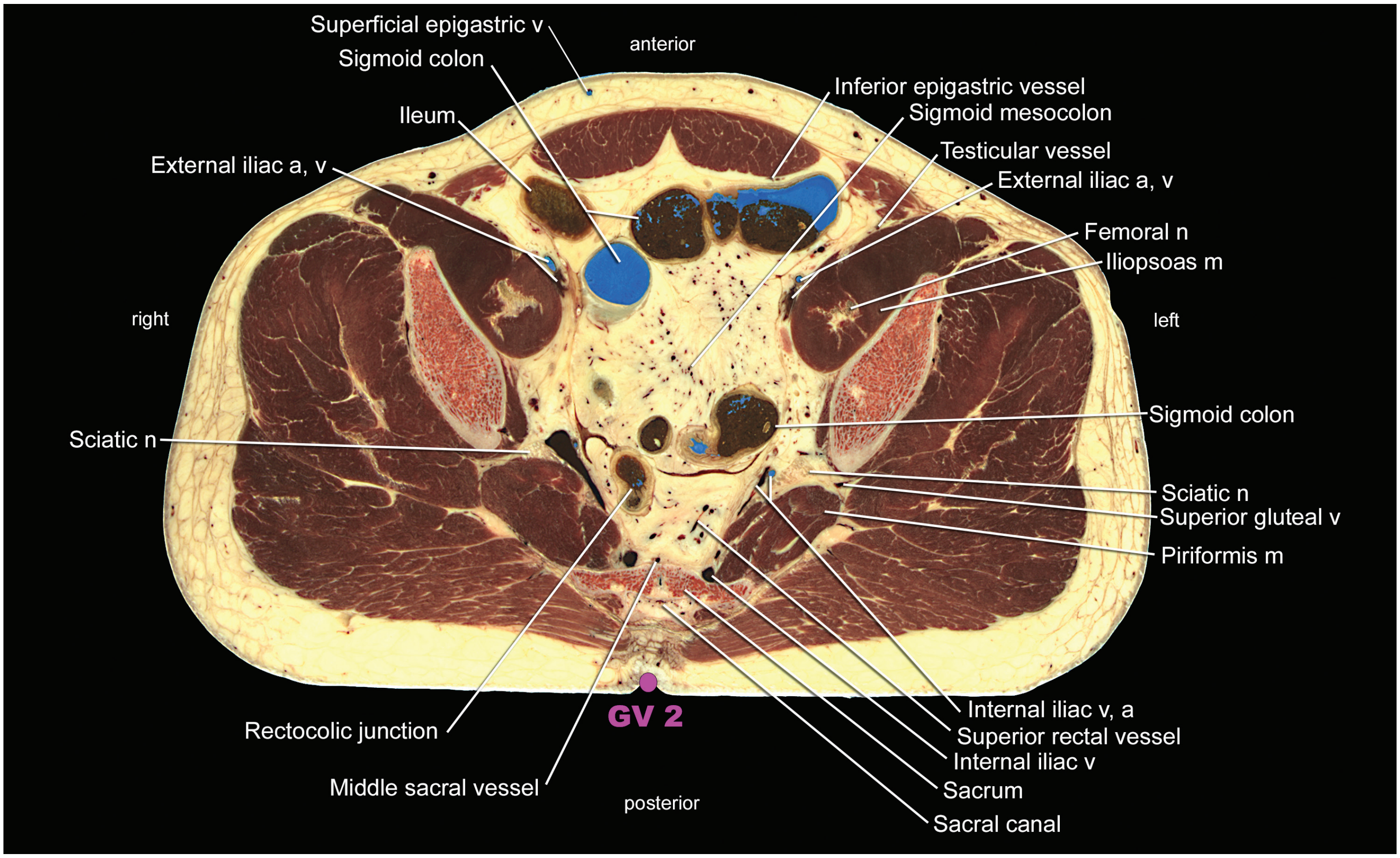
As indicated previously, GV and its ventral counterpart, CV, constitute "singular vessels", i.e., two pathways in the system of eight that relate to unique vascular routes that, by definition, differ from the standard, paired channels of LU, LI, SP, ST, etc.

The venous system that originally defined the GV channel embodies a circulatory system unmatched by any other in the body, ferrying blood from nose to "tail" and back again. That is, instead of draining blood in a one-way direction as outlined by Harvey and demonstrated by systemic veins and arteries, blood within the mostly valveless veins of the GV pathway, within the cerebrospinal venous system (CSVS), ebbs and flows as pressure dictates. Bidirectional flow provides for auto-regulation of intracranial pressure as one changes posture letting more blood in when needed and shunting it out when not. On the flip side, the CSVS allows tumor cells, infection, or emboli to gain direct vascular access to the brain and spine from the pelvis or anywhere along its route.

The veins belonging to GV supply collateral drainage routes in the event of vena caval obstruction. These alternate pathways provide another avenue to the heart for blood return from the pelvic limbs, similar in many ways to collateral vessels on the abdominal wall, paralleling the KI, ST, and SP channels.

The Cerebrospinal Venous System as the GV Channel

By identifying the GV as a singular vessel, early Chinese anatomists may have recognized the interconnectedness of the CSVS centuries, if not millennia, before modern scientists. As Batson (of "Batson's plexus") noted, "It seems incredible that a great functional complex of veins would escape recognition as a system until 1940… In the first decades of the last century, our knowledge of the vertebral veins was developed and then almost forgotten." Similarly, with acupuncture, the energy-meridian concept of the 20th century took acupuncture on a winding detour through metaphysics from which it is only now emerging.


Superficial epigastric v
Sigmoid colon
anterior
Inferior epigastric vessel
Sigmoid mesocolon
Ileum
Testicular vessel
External iliac a, v
External iliac a, v
Femoral n
Iliopsoas m
right
left
Sigmoid colon
Sciatic n
Sciatic n
Superior gluteal v
Piriformis m
Internal iliac v, a
GV 2
Superior rectal vessel
Rectocolic junction
Internal iliac v
Sacrum
Middle sacral vessel
posterior
Sacral canal

Veins draining pelvic organs blend with those from the spinal system, seen in this cross section as middle sacral vessels.

The Pelvic Portion of the GV Channel and Its Associated Venous Network

GV 1 begins at the anorectal junction where the CSVS is beginning to form from several venous plexuses, including the rectal, vesical, and prostatic (in males) or uterine and vaginal (in females). This means that blood from the genitalia makes its way to the brain, as verified by imaging studies.

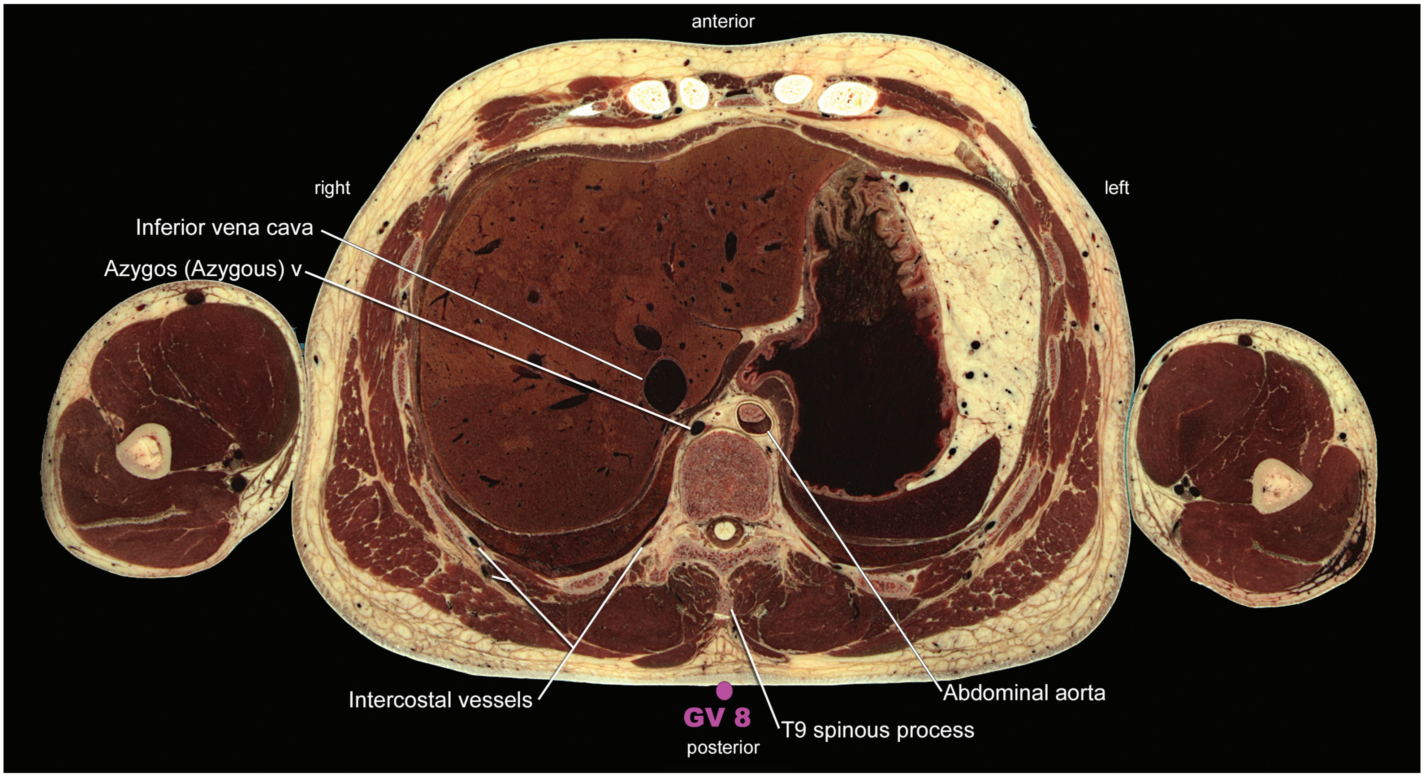
GV Venous Network of the Spine

As the GV channel ascends, it morphs the internal and external vertebral venous plexuses and vertebrobasilar veins. The CSVS connects with the azygous (or azygos), hemiazygous (or hemiazygos), and ascending lumbar veins as well. The figure at the top of the following page illustrates the relationship between the azygous vein and posterior intercostal vessels that drain blood from the dorsal body wall. Both the azygous and hemiazygous veins receive blood from the back, depending on the spinal level and whether it is the right or left side, respectively.

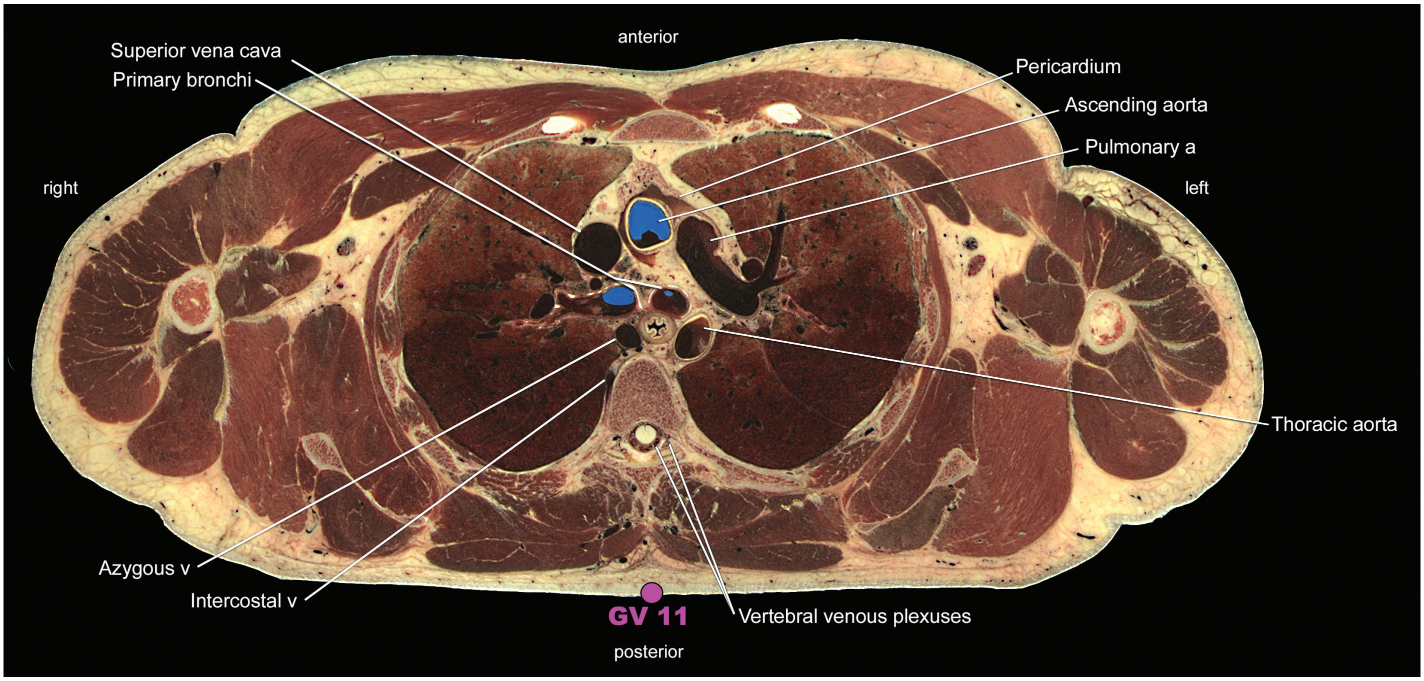
Radicular veins follow the dorsal and ventral nerve roots of the spinal cord. They comprise a dynamic reflux-regulating system capable of responding to pressure changes by diameter adjustment. They confer protection against venous “hyperpression” that would negatively affect the spinal cord by producing harmful venous pressure waves. Venous reflux through the radicular veins may also help with selective cooling of the spinal cord, analogous to the way in which dural venous sinuses aid in lowering brain temperature.

GV Venous Network of the Head

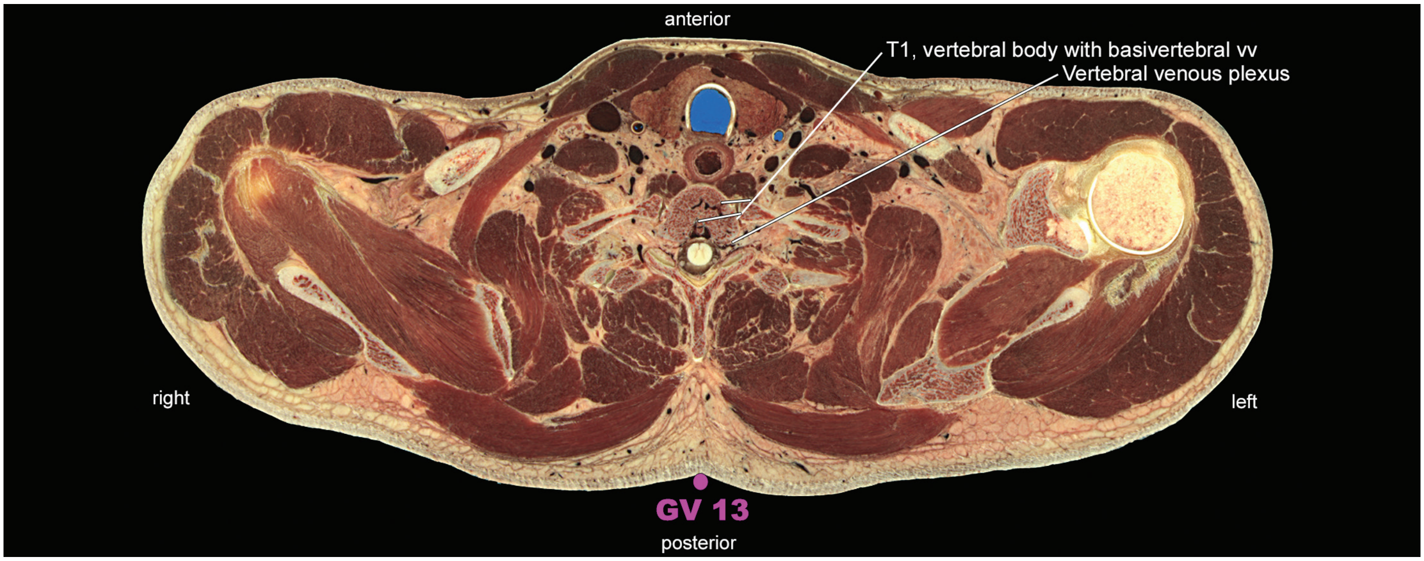
At its rostral limit, the GV channel that “descends along the midline of the head to the bridge of the nose”. That is, the superior sagittal sinus links to a nasal emissary vein that emerges through the foramen cecum, an opening near the anterior end of the crista galli. This establishes a connection between the intracranial superior sagittal venous sinus and the extracranial veins of the nasal cavity, although it is not always present in an adult.


anterior
right
left
Inferior vena cava
Azygos (Azygous) v
Intercostal vessels
Abdominal aorta
GV 8
T9 spinous process
posterior

In Chinese medicine, CV and GV are considered "paired" pathways. This cross-section conveys the spatial arrangement of the inferior vena cava (venous basis for the CV channel) and the azygous vein (for the GV).


anterior
Superior vena cava
Primary bronchi
Pericardium
Ascending aorta
Pulmonary a
right
left
Thoracic aorta
Azygous v
Intercostal v
GV 11
Vertebral venous plexuses
posterior

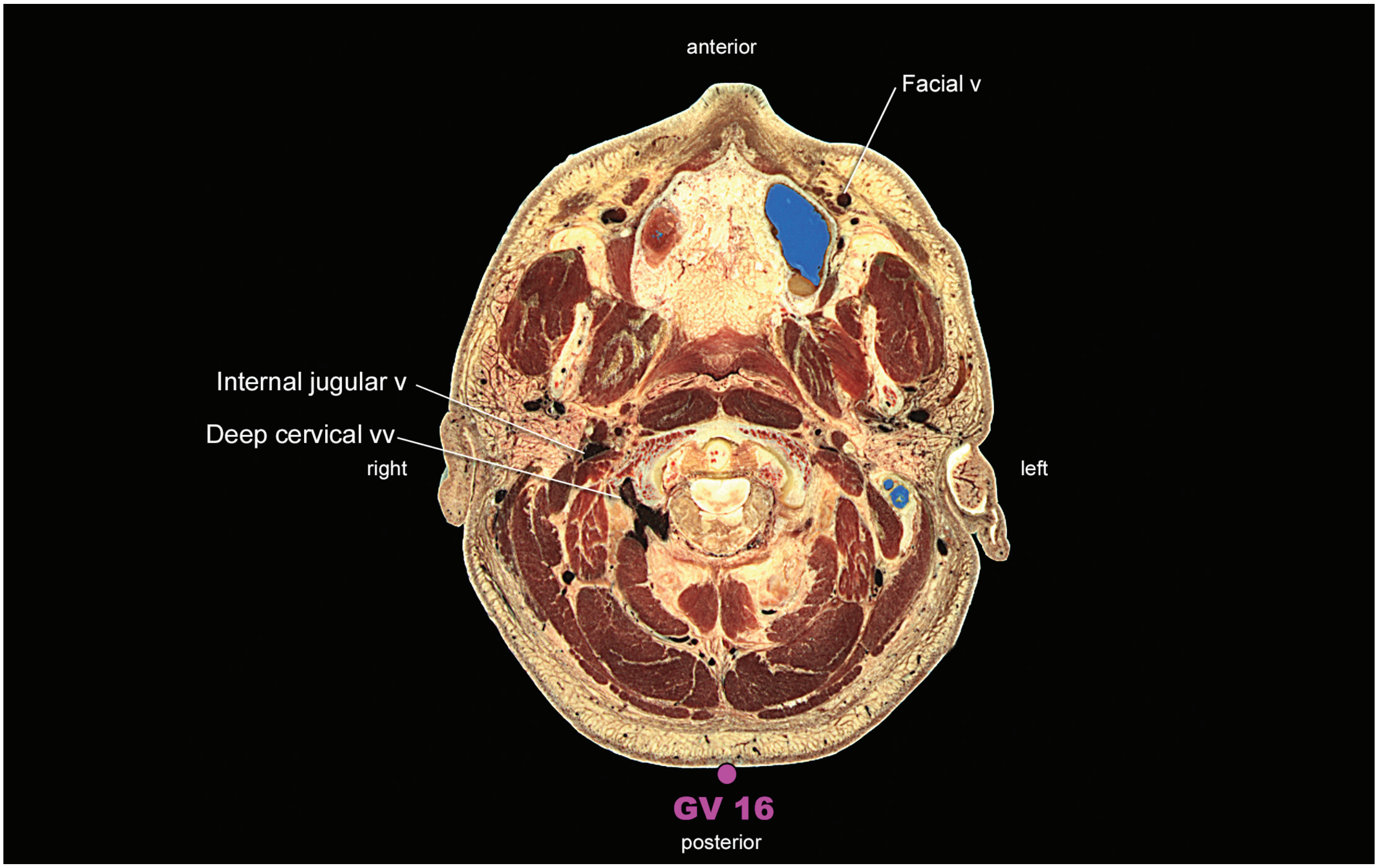
This level catches an intercostal vessel interfacing with the azygous vein. The vertebral venous plexuses are also becoming more pronounced, as are the many veins traveling among the paraspinal muscles. The GV channel encompasses all of these veins. Also appearing are the superior vena cava (CV) and the thoracic aorta (i.e., the Chong Mai).


anterior
T1, vertebral body with basivertebral vv
Vertebral venous plexus
right
left
GV 13
posterior

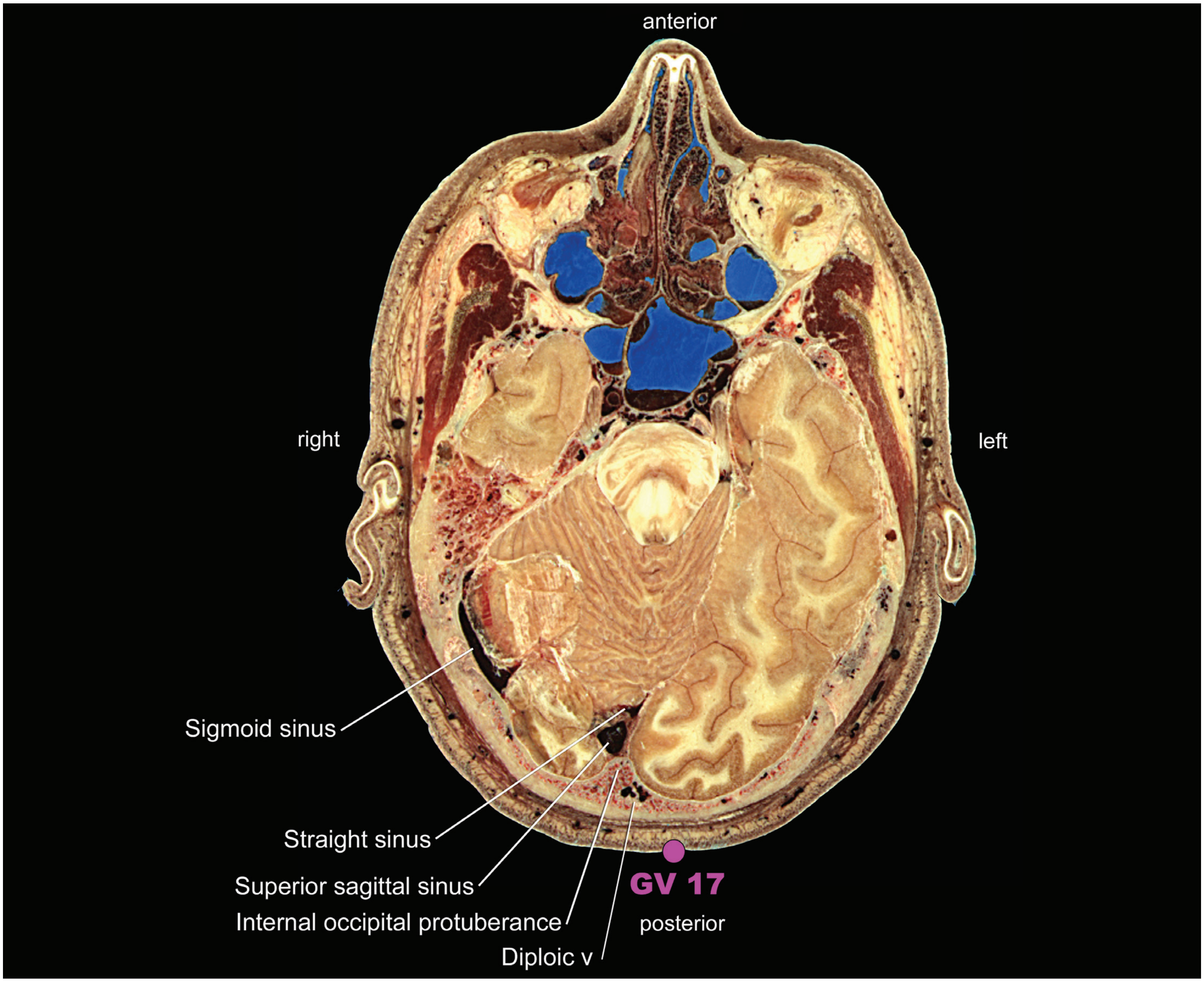
The CSVS includes the basivertebral veins, i.e., vessels that live within the vertebral body and empty into the vertebral venous plexuses. The basivertebral veins are structural analogues of the diploic veins of the skull.

The Neurologic Component of the GV Pathway

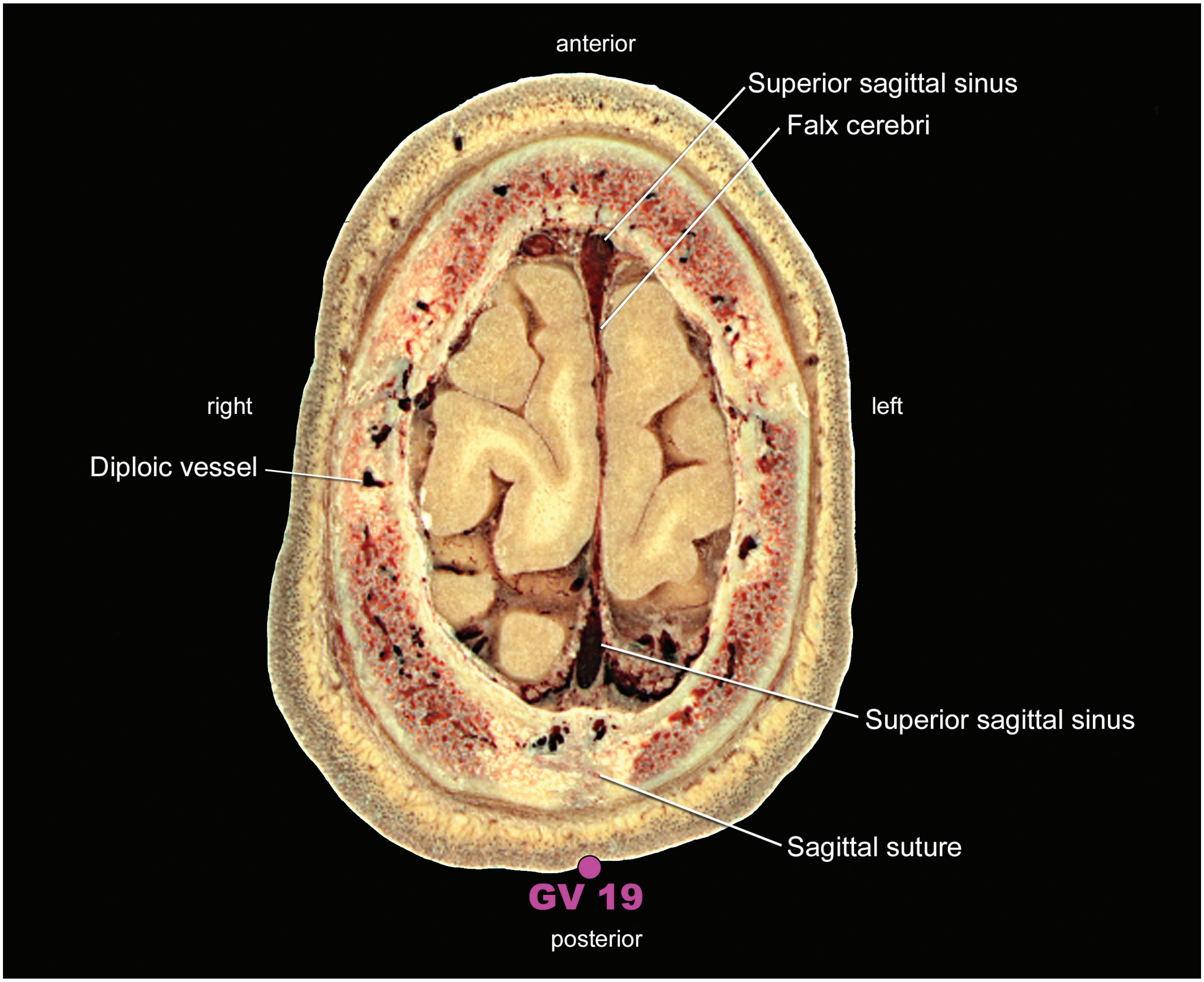
Historically, acupuncturists viewed the GV channel as a network of veins as just described. However, modern science shows that neuromodulation at GV points influences nerve function that can influence blood distribution patterns within the CSVS. As such, despite its status as a singular vessel, the GV pathway represents an avenue for impacting brain and spinal cord function at least as much as the blood that bathes them. The preceding images and those that follow explore connections between GV points and the nervous system which are as, if not more, important to the clinical outcome resulting from treating these sites.


anterior
Facial v
Internal jugular v
Deep cervical vv
right
left
GV 16
posterior

Near GV 16, the vertebral venous plexus blends with the dural venous sinus system. Direct functional communications result from connections between the suboccipital cavernous sinus, condylar veins, and hypoglossal plexus. Communications also take place between the intracranial venous network and veins of the face, scalp, and skull, involving the internal cerebral, facial, ophthalmic, and orbital veins. The cavernous sinus, another aspect of the CSVS, surrounds the pituitary gland. From here, blood drains into the petrosal sinus, sigmoid sinus, and finally into the internal jugular vein.


anterior
right
left
Sigmoid sinus
Straight sinus
Superior sagittal sinus
Internal occipital protuberance
Diploic v
GV 17
posterior

As the vertebrobasilar veins drained blood from the spongy bone of the vertebrae, diploic veins drain the spongy bone of the calvarium.


anterior
Superior sagittal sinus
Falx cerebri
right
left
Diploic vessel
Superior sagittal sinus
Sagittal suture
GV 19
posterior

Just as radicular veins of the back allow heat from the spinal cord to dissipate, the dural sinuses help cool the brain. This may explain why points along the GV channel, including and especially GV 20, feel warm to the touch during headache. Ice and cooling treatments on GV 20 lessen the pain. Brain cooling may aid in treating seizures and stroke as well, emphasizing the value of GV points for these conditions.

GV 1

Chang Qiang "Long Strong"

On the anal triangle, midway between the anus and the tip of the coccyx.

Avoid needling GV 1 and CV 1 in the presence of anogenital warts. Warty tissue is fragile and bleeds easily.[4] Always follow hygienic practice, but especially for palpating and treating CV 1 and GV 1, wear gloves.

Connective Tissues

- **Anococcygeal ligament:** A firm, musculotendinous structure that extends from the posterior aspect of the anal canal to the coccyx and fuses together the insertions of the gluteus muscles, the ischiococcygeus, the pubococcygeus, and the puborectalis muscles.

Clinical Relevance: The anococcygeal ligament displays two layers – a thick ventral layer attached to the presacral fascia and a thin dorsal layer connected to the coccyx and external anal sphincter. Considering its attachments to local blood supply, neuromodulatory techniques applied to GV 1 may improve local circulation and repair of damaged tissue.

Muscles

- **Puborectalis muscle:** Part of the pelvic floor, the puborectalis muscle acts as a sling adjoining the pubic bone to the anorectal ring. Its cranioventral tug creates the "anorectal angle". Composed of skeletal muscle, the puborectalis falls under voluntary control. As an individual contracts the puborectalis, the anorectal angle increases; this keeps stool from moving from its storage site in the sigmoid colon to the rectum for elimination. "Potty training" thus educates one in intentionally contracting the puborectalis until the opportunity for socially acceptable defecation arises. In contrast, squatting reduces the anorectal angle, allowing for easier passage of stool.
- **Pubococcygeus muscle:** A hammock-shaped muscle that stretches from pubis and the anterior obturator fascia to the coccyx and possibly the caudal sacrum. At about GV 1, both right and left pubococcygeus muscles join to form a fibromuscular layer atop the anococcygeal raphe formed by the iliococcygeus muscles.

The pubococcygeus muscle thus serves as part of the pelvic floor and thereby supports pelvic organs, as part of the levator ani muscle group. It functions to control urine flow and participates in parturition and core stability. The pubococcygeus muscle contracts during orgasm. It is activated perineal contraction when one performs Kegel exercises, along with the ischiocavernosus, bulbocavernosus, and cremaster (in men) muscles.

- **External anal sphincter:** Whereas the internal anal sphincter is composed of smooth muscle, the external anal sphincter contains skeletal muscle. This means that external sphincter contraction is under voluntary control, whereas the internal sphincter is not. Nevertheless, the internal anal sphincter contributes to resting tone of the anal canal until it becomes

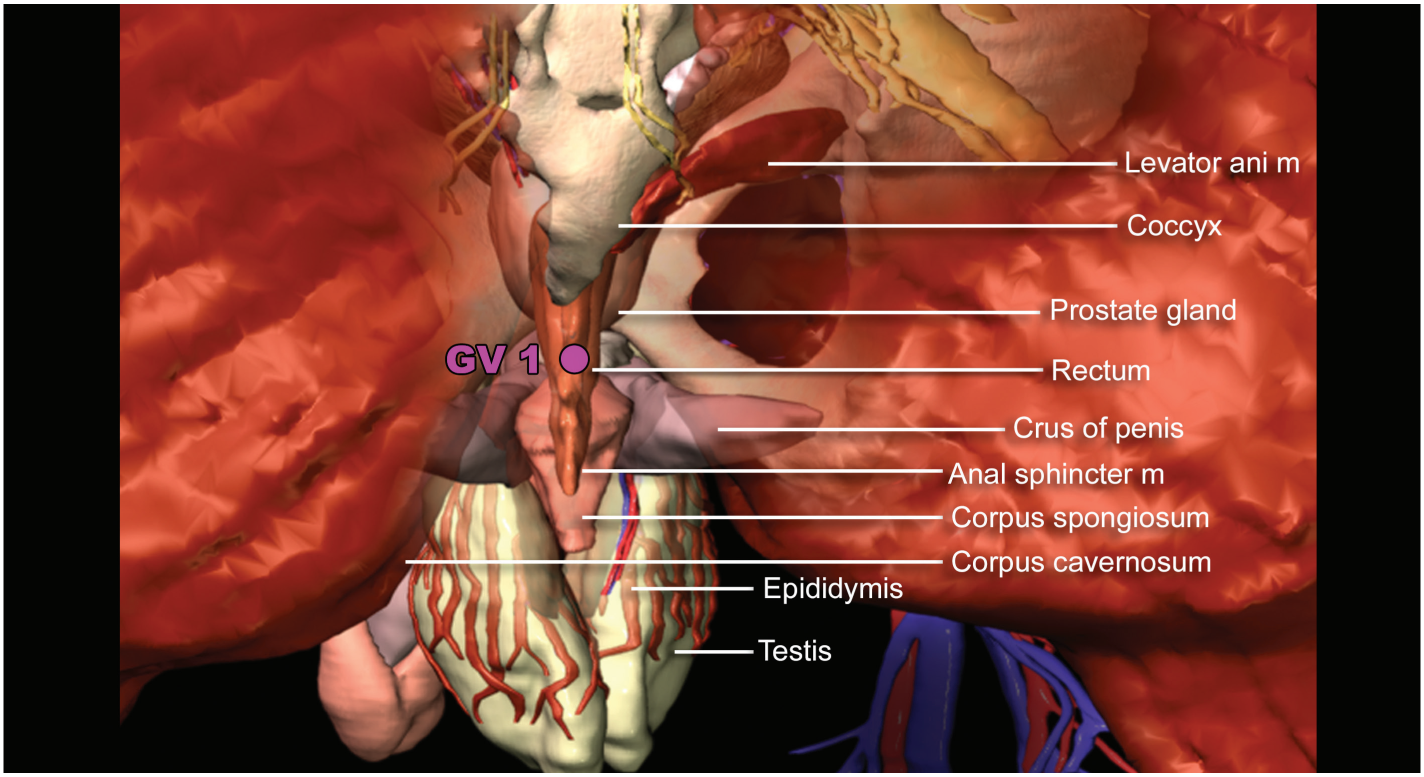


Figure 14-1. GV 1, "Long Strong" appears between the tip of the coccyx and the anus. The name may allude to influence of the point on the function of male genitalia; i.e., the neuromodulatory impact of stimulating GV 1 on reproductive performance. Many colorful, alternate names supplied for GV 1 connote its locus on the tip of the coccyx, below the sacrum. They include: Peg Bone, End Bone, Sacral Bone, End of Sacral Spine, Sacrum Above, Hollow Below the Tailbone, Tail Kingfisher Bone, Tail Maggot Bone, Fish Tail, Tortoise Tail, Tortoise Tail Long Border, Tail Palm, and "That's It!".[14] This dorsal perspective of the sacrum and genitalia peers through semitransparent gluteus maximus muscles to examine the anatomic relationships of GV 1 and nearby structures.

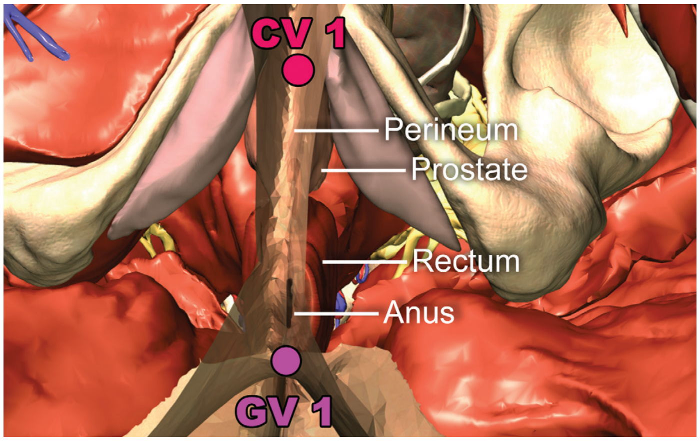


Figure 14-2. The GV and CV channels begin and end on either side of the anus and mouth. This perspective of the perineum depicts the relationship of GV 1 and CV 1 to pelvic structures; it reveals the closer connection of CV 1 to reproductive organs and GV 1 to eliminative.

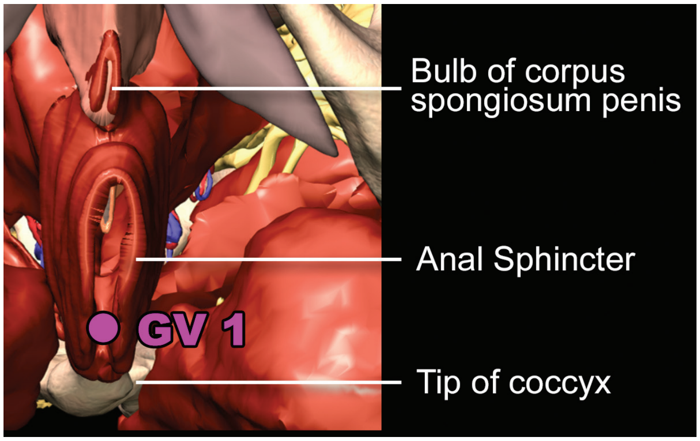


Figure 14-3. GV 1 lands midway between the anus and tip of the coccyx, as shown here. Its proximity to the anal sphincter suggests its value for anal sphincter dysfunction and hemorrhoidal pain. The point is located at the intersection of the S4 and S5 dermatomes, with possible overlap of the Co 1 zone.

time to defecate. The presence of stool normally instigates a rectoanal inhibitory response that relaxes the internal anal sphincter relaxation. Initially, the rectoanal inhibitory response causes external sphincter contraction that pushes stool from the anal canal back to the rectum. When the brain sends signals for defecation to proceed, abdominal muscles contract to raise intra-abdominal pressure. At this time, muscles of the pelvic floor should relax and descend. This allows the anorectal angle to "unbend" and for the relaxation of the external sphincter. Peristalsis begins within the rectum, forcing stool outward.

Clinical Relevance: Structures of the pelvic floor contain striated and smooth muscle, connective tissue, and neurovascular elements. Specifically, the female pelvic floor comprises endopelvic fascia, the levator ani muscle, obturator internus muscle, rectum, urethra, and vagina. A layered pelvic floor that integrates specialized regions of endopelvic fascia creates a three-dimensional support system.

GV 1 relates to muscles of the pelvic floor including the pubococccygeus and puborectalis muscles. (See Figure 14-5.) These associations explain the value of GV 1 for pelvic organ prolapse. Pelvic floor dysfunction in women can cause organ prolapse and stress urinary incontinence in 10% of women.[5] The female pelvic floor comprises three anatomically differentiable compartments with unique structures and functions. Therefore, the symptoms associated with pelvic floor dysfunction depend on the anatomy involved. When dysfunction affects the posterior pelvic floor in the region of GV 1, it may lead to obstructed defecation syndrome (ODS).[6] The pathogenesis of ODS can arise from mucosal prolapse, paradoxical contraction or non-relaxation of the puborectalis muscle, rectocele, intussusception, and enterocele or sigmoidocele. Factors associated with ODS may include changes in anal canal anatomy, degeneration of the internal anal sphincter, and/or atrophy of the external anal sphincter, all of which worsen with aging.

Anismus, otherwise known as dyssynergic defecation, refers to the way in which pelvic floor musculature fails to relax during attempted defecation. It is a functional defecation disorder and constitutes a type of rectal outlet obstruction. Failure of relaxation of the puborectalis muscle, or its paradoxical contraction, can cause anismus, and is worsened by psychological distress. If the puborectalis cannot "let go", it maintains the anorectal angle and inhibits the passage of stool. Paradoxical contraction of the puborectalis may, in fact, make the anorectal angle more acute and further obstruct fecal evacuation.

Patients may complain that they "forgot" how to push stool correctly, but the problem can occur anywhere between brain and anus. If the puborectalis muscle hypertrophies or becomes fibrotic, voluntary control over its function becomes even more challenging. A history of sexual abuse can predispose a person to develop anismus. Parkinson's disease, an extrapyramidal motor disorder, can also lead to anismus.

Over time, failure to fully evacuate stool incurs fecal loading. Eventually, impaction of hard stool follows. Fecoliths may form. In such cases, liquid stool may leak around the retained fecal mass, producing paradoxical diarrhea (called encopresis in children) or fecal leakage in adults.

Biofeedback training may provide some support for patients with anismus, but physical medicine (including rectal retraining) and neuromodulation with acupuncture and related techniques can also aid patients with voiding dysfunction.

Relevance of the pubococcygeus muscle at GV 1: Active contraction of the pubococcygeus muscle is involved in Kegel exercises, designed to strengthen the pelvic floor and support continence of urine. Paroxysmal contraction of the pubococcygeus muscle can lead to vaginismus, similar to the way in which paradoxical contraction of the puborectalis causes anismus.

Myofascial trigger point pathology of the pelvic floor in men: Men who have chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) often exhibit painful trigger point pathology in tissues of the pelvic floor.[7] In addition to pain, these patients may complain of genitourinary dysfunction. Palpation reveals myofascial trigger points in the puborectalis, pubococcygeus, and often the rectus abdominis; pressure on these sites reproduces the pain in over 75% of individuals. Myofascial palpation of trigger points in the external oblique muscles elicit pain in over 80% of patients; pain referral patterns extend to the suprapubic, testicular, and groin regions. Finding a myofascial component of CP/CPPS opens the door to a host of neuromodulatory and manual therapy interventions that may aid patients with this

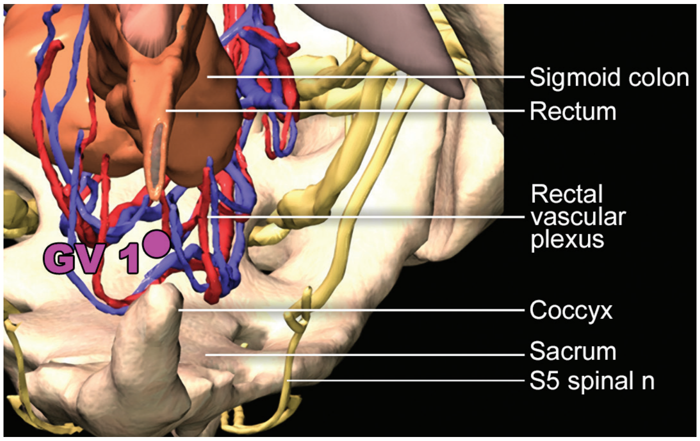


Figure 14-4. The proximity of GV 1 to the plexus of rectal vessels provides a visual display of the reason GV 1 appears in treatment formulae for hemorrhoids.

potentially disabling and frustrating problem that, in many cases, becomes chronic and refractory.

Nerves

- **Anococcygeal nerves from coccygeal plexus (S4, S5 and the coccygeal nerves):** Provide cutaneous sensation to the coccygeal region. The coccygeal plexus forms within the ischiococcygeus muscle from the ventral rami of S4-Co1. It receives input from the sacral sympathetic trunk. The coccygeal plexus supplies the anococcygeal nerve that innervates subcutaneous tissue overlying the dorsal coccyx; some branches pass ventral to the coccyx.[8] These nerves supply the skin of the anococcygeal region and likely contribute to the innervation of the coccygeal ligaments, periosteum, and the sacrospinous ligament and ischiococcygeus muscle.
- **Pudendal nerve (S2-S4):** Innervates perineal structures, providing sensation to the genitalia, and motor control to the perineal muscles, the external urethral sphincter, and the external anal sphincter.
- **Nerves to the levator ani and coccygeus muscles (S3, S4, S5):** Provide motor control to the levator ani and coccygeus muscles.

Clinical Relevance: Coccydynia has several causes; one may stem from neuropathic pain mediated by the coccygeal plexus. Trigger point pathology in the ischiococcygeus muscle may compress the coccygeal plexus and exacerbate coccydynia. Coccydynia frequently worsens with sitting, standing, and even walking. Etiologies include instability of the sacrococcygeal or intercoccygeal joints and/or entrapment neuropathy or traumatic irritation of the coccygeal plexus. While coccygectomy may prove curative, treatment with acupuncture and related techniques as conservative measures should ideally be tried before surgery.

In postmenopausal women, pelvic organ prolapse may impair genital sensation.[9] Treatment of CV 1 and GV 1 with acupuncture and related techniques may aid in the restoration of more normal nerve communication.

Vessels

- **Inferior rectal arteries:** Arise from the internal pudendal artery and supply the distal part of the anal canal and skin.
- **Inferior rectal veins:** Drain the area that the inferior rectal arteries (outlined above) supply.

Clinical Relevance: Engorgement and distention of hemorrhoidal (inferior rectal) vessels may precede thrombosis, presenting as a mass in the vessel associated with persistent and severe pain.[10] Passage of hard stool worsens pain, as does straining to defecate. Eventually, the thrombus may ulcerate through the skin and extrude as a clot. Medical treatment involves bed rest, increased fiber and fluid intake, warm baths, analgesics, and stool softeners. Treatment of GV 1 with acupuncture may not be tolerated or advised; transcutaneous electrical nerve stimulation (TENS) and/or laser would likely be preferred. Ultimately, surgery may be required if the problem does not respond adequately to non-surgical treatment.

Dilation of the inferior rectal vessels causes the familiar condition known as “hemorrhoids”. In severe cases, dearterialization and mucopexy may be required to control bleeding and hemorrhoidal prolapse upon defecation that does not respond to medical therapy.[11] However patients may experience transient rectal pain and tenesmus following surgery. Neuromodulation at GV 1, and GV 2 may aid in their recovery. In some cases after circumferential excisional hemorrhoidectomy, anal stricture may result unless weekly anorectal digital examinations follow the procedure, along with adequate postoperative analgesia.[12]

The degree to which hemorrhoids protrude or interfere with defecation does not necessarily correlate with associated problems with prolapse, including bleeding, itching, pain, and soiling of undergarments.[13]

Indications and Potential Point Combinations

- **Hemorrhoids, hemorrhoidal pain:** GV 1, BL 57.
- **Anal fistula:** GV 1, GV 2.
- **Rectal prolapse:** GV 1, GV 2, BL 31, BL 32, BL 35.
- **Erectile dysfunction:** GV 1, BL 34, BL 31, BL 28, BL 23, GV 20.
- **Prostate problems:** GV 1, GV 2, BL 35.
- **Premature ejaculation:** GV 1, GV 2, BL 35.
- **Fecal incontinence:** GV 1, BL 39, BL 57, BL 35, BL 31, BL 28, BL 27.
- **Coccydynia:** GV 1, GV 2, BL 35.
- **Diarrhea, constipation:** GV 1, ST 36, BL 25, BL 27.

Evidence-Based Applications

- Neuroanatomically, GV 1 may enhance **sexual performance** through its influence on sexual muscle function and its relationship to autonomic centers.[1]
- Acupuncture at GV 1 significantly **reduced colonic motility** and inflammation in rats with colitis, presumably through an opioid pathway.[2]
- Electroacupuncture at GV 1 and BL 57 in a dense disperse stimulation mode (2/100 Hz) reduced pain in patients with **hemorrhoids** in a Chinese clinical trial.[3]

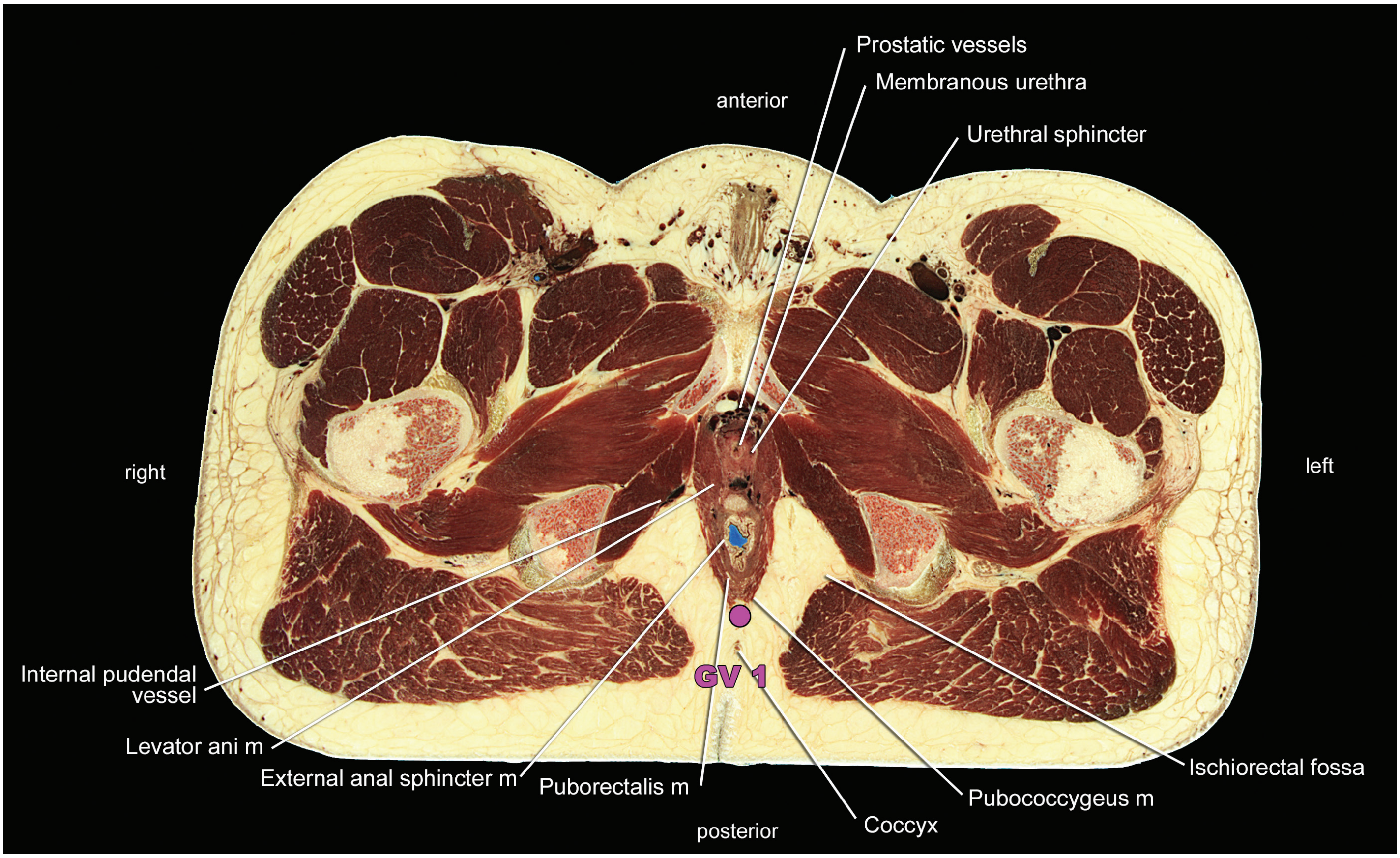


Figure 14-5. GV 1 relates to muscles of the pelvic floor, including the pubococccygeus and puborectalis muscles. Along with the iliococcygeus muscle, these three create the "levator ani" group. Note, too, the presence of prostatic and pudendal vessels, indicating the start of the cerebrospinal venous system (CSVS).

References

1. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture*. (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05

2. Kim h-Y, Hahm D-H, Pyun K-H, Lee S-K, Lee H-J, Nam T-C, and Shim I. Effects of acupuncture at GV01 on experimentally induced colitis in rats: possible involvement of the opioid system. *Japanese Journal of Physiology*. 2005;55:205-210.

3. Li N, He HB, Wang CW, et al. Observation on therapeutic effect of electroacupuncture at Chengsan (BL 57) and Zhangqiang (GV 1) on hemorrhoidal pain. (In Chinese). *Zhongguo Zhen Jiu*. 2008;28(11):792-794.

4. Mlakar B. Proctoscopy should be mandatory in men that have sex with men with external anogenital warts. *Acta Dermatovenerol Alp Panonica Adriat*. 2009;18(1):7-11.

5. DeLancey JOL. The hidden epidemic of pelvic floor dysfunction: Achievable goals for improved prevention and treatment. *Am J Obstet Gynecol*. 2005;192:1488-1495.

6. Murad-Regadas SM, Rodrigues LV, Furtado DC, et al. The influence of age on posterior pelvic floor dysfunction in women with obstructed defecation syndrome. *Tech Coloproctol*. 2012;16:227-232.

7. Anderson RU, Sawyer T, Wise D, et al. Painful myofascial trigger points and pain sites in men with chronic prostatitis/chronic pelvic pain syndrome. *J Urol*. 2009;182(6):2753-2758.

8. Woon JTK and Stringer MD. Redefining the coccygeal plexus. *Clinical Anatomy*. 2014; 27(2):254-260.

9. North CE, Creighton SM, and Smith ARB. A comparison of genital sensory and motor innervation in women with pelvic organ prolapse and normal controls including a pilot study on the effect of vaginal prolapse surgery on genital sensation: a prospective study. *BJOG: an International Journal of Obstetrics and Gynaecology*. 2013;120(2):193-199.

10. Greenspon J, Williams JB, Young HA, et al. Thrombosed external hemorrhoids: outcome after conservative or surgical management. *Dis Colon Rectum*. 2004;47(9):1493-1498.

11. Ratto C, Parello A, Donisi L, et al. Anorectal physiology is not changed following transanal haemorrhoidal dearterialization for haemorrhoidal disease: clinical, manometric and endosonographic features. *Colorectal Dis*. 2011;13(8):e243-e245.

12. Mukhashavria GA and Qarabaki MA. Surgical technique tailored to advanced haemorrhoids. *Tech Coloproctol*. 2009;13:151-155.

13. Gerjy R, Lindhoff-Larson A, and Nystrom PO. Grade of prolapse and symptoms of haemorrhoids are poorly correlated: result of a classification algorithm in 270 patients. *Colorectal Dis*. 2008;10(7):694-700.

14. Ellis A, Wiseman N, and Boss K. *Grasping the Wind*. Brookline, MA: Paradigm Publications, 1989. Pp. 327-328.

GV 2

Yao Shu "Lumbar Shu"

On the dorsal midline of the sacrum at the sacral hiatus, or sacrococcygeal junction.

Bones

- **Sacral hiatus:** That part of the sacrum with an absence of laminae and spinous processes affecting the S5 vertebra and, sometimes, the S4 vertebra.

Clinical Relevance: As an anesthetic procedure, the sacral hiatus is a landmark for caudal epidural block.[6] The hiatus contains nerve roots from the sacral and coccygeal spinal segments as well as the filum terminale and fibrofatty tissue.

Patients with chronic low back pain and lumbar hypermobility may exhibit tender points on the sacrum such as at GV 2. Manual therapy, acupuncture, and laser therapy may aid in their resolution.[7]

Connective Tissues

- **Anterior and posterior sacrococcygeal ligaments:** Join the apex of the sacrum to the base of the coccyx, reinforcing the joints, in a similar manner as do the anterior and posterior longitudinal ligaments for the superior vertebrae.
- **Filum terminale externum:** The inferior extension of the dura mater below the end of the dural sac at S2, the filum terminale externum attaches to the coccyx and is also known as the coccygeal ligament.

Clinical Relevance: Needling GV 2 first encounters the skin, then the subcutaneous fatty layer and then the superficial dorsal sacrococcygeal ligament, also known as the sacrococcygeal membrane. In order to perform a caudal epidural block, one needs to pass through the membrane and enter the sacral canal with the tip of a hypodermic needle.[8] Acupuncture needling need not enter the canal so deeply.

Nerves

- **Coccygeal nerves, as part of the coccygeal plexus (which include S4 and S5):** Supply the skin near the coccyx, the coccygeus muscle, part of the levator ani muscle, and the sacrococcygeal joint. Anococcygeal nerves emanate from the coccygeal plexus, pierce the sacrotuberous ligament, and provide cutaneous sensation to the coccygeal region.

Clinical Relevance: The sacral hiatus at GV 2 provides an anatomic site where anesthesiologists can reliably and effectively block sacral nerves. This caudal epidural block provides anesthesia for obstetrical and orthopedic procedures.[9]

Invasive sacral neuromodulation with electrode implantation has been used for intractable pelvic pain, anorectal discomfort, fecal incontinence, and irritable bowel syndrome. However, the procedure requires anesthesia; also, it carries the risk of infection, anaphylaxis,[10] and lead migration.[11] Cryotherapy at GV 2 may aid in alleviating perineal neuralgia and coccydynia, as suggested by successful alleviation of pain through cryoanalgesic techniques.[12] GV 2 needling, laser, and manual therapy provide safe and relatively inexpensive neuromodulation for pain reduction and functional restoration of pelvic organs and their activities.

Acupuncture at GV 2 also impacts the cerebrospinal venous

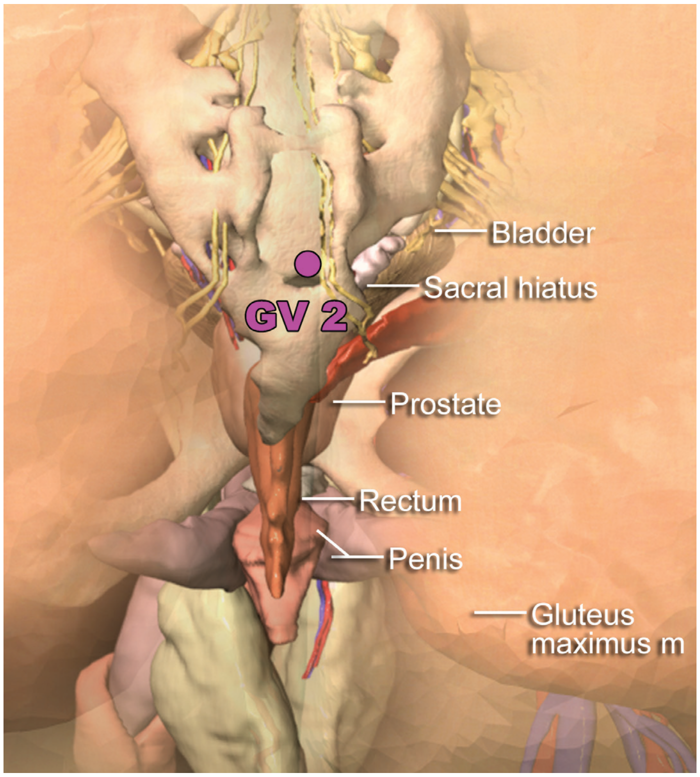


Figure 14-6. Sacral points such as GV 2 offer ample opportunities for neuromodulation of a variety of pelvic organ problems and pain.[15]

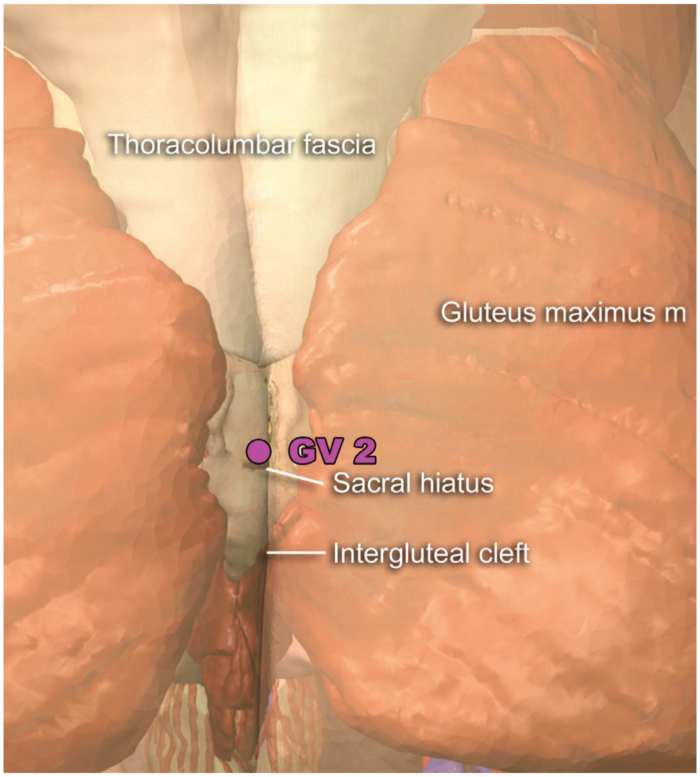


Figure 14-7. Find GV 2 along the intergluteal cleft in the center of the sacral hiatus. Pressure in this region can relieve rectal tenesmus and pain during defecation, thereby facilitating the passage of stool.

system (CSVS). The CSVS connects sacral,pelvic, and prostatic veins with those surrounding the brain and spinal cord. This large-capacity, valveless venous network affords a conduit for bidirectional flow, helping regulate intracranial pressure during postural changes and serving as a drainage ditch that accepts cerebral venous outflow.[13]

Vessels

- **Median (or Middle) sacral artery:** Arises from the dorsal abdominal aorta to provide blood supply to the caudal lumbar vertebrae, sacrum, and coccyx.
- **Median (or Middle) sacral vein:** Accompanies the median sacral artery on the ventral sacrum. The median sacral vein forms a single vein that drains either into the left common iliac vein or the junction of the two iliac veins.

Clinical Relevance: The CSVS, i.e., the cerebrospinal venous system, communicates freely with veins of the sacrum, pelvis, and prostate. This provides functional continuity between the veins of the head, face, pelvis, and body wall, as well as the opportunity for infection, tumor, and emboli to travel broadly and wreak havoc widely.

Indications and Potential Point Combinations

- **Pain in the lower lumbar region, coccyx, sacrum, or kidney:** GV 2, GV 3, GV 4, BL 23, BL 35, BL 60.
- **Tenesmus:** Acupressure/acupuncture at GV 2, GV 3, BL 34, BL 35.
- **Stiffness of the spine:** GV 2, BL 23, GV 4, tender myofascial trigger points, BL 62, SI 3.
- **Urogenital disorders:** GV 2, GV 1, CV 1, BL 31-BL 34, BL 23, KI 3, KI 10, SP 6.
- **Erectile dysfunction:** GV 2 acupressure prior to or during sexual activity.
- **Rectal prolapse:** GV 2, GV 1, BL 31-BL 34.
- **Hemorrhoids:** GV 2, GV 1, BL 35.
- **Seizures, epilepsy:** GV 2,GV 14, GV 20, GV 24.5 (Yintang), BL 10, ST 36, BL 7, BL 8.
- **Fatigue:** GV 2, GV 4, BL 23, GV 20
- **Paraplegia:** GV 2, BL (both inner and outer line) points cranial and caudal to the spinal cord lesion, Bafeng (web spaces between the toes), GV 20.

Evidence-Based Applications

- Electroacupuncture at GV 2, GV 14, and ST 36 markedly **suppressed cortical epileptiform discharges** in rats. Possible mechanisms involved include alterations of opioid, serotonin, and gamma-aminobutyric acid (GABA) levels and recurrent inhibition of the cortex and hippocampus.[1]
- EA at GV 2, GV 14, GV 20, GV 24.5, prevented tissue shrinkage of the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and perirhinal cortex. EA at ST 36 and SP 6 prevented tissue shrinkage in all of the aforementioned regions except for the dorsal hippocampus. EA to GV 2 + GV 14 + GV 20 + GV 24.5 or ST 36 +SP 6 reduced the cognitive deficits in **pilocarpine-epileptic** rats. Administration of p-chlorophenylalanine, a compound that depletes serotonin, negated the behavioral and some of the histologic changes due to EA. This suggests that the functional recovery exhibited by the rats may have been influenced through serotonergic pathways affected by acupuncture and subsequent neuroprotective benefits.[2]

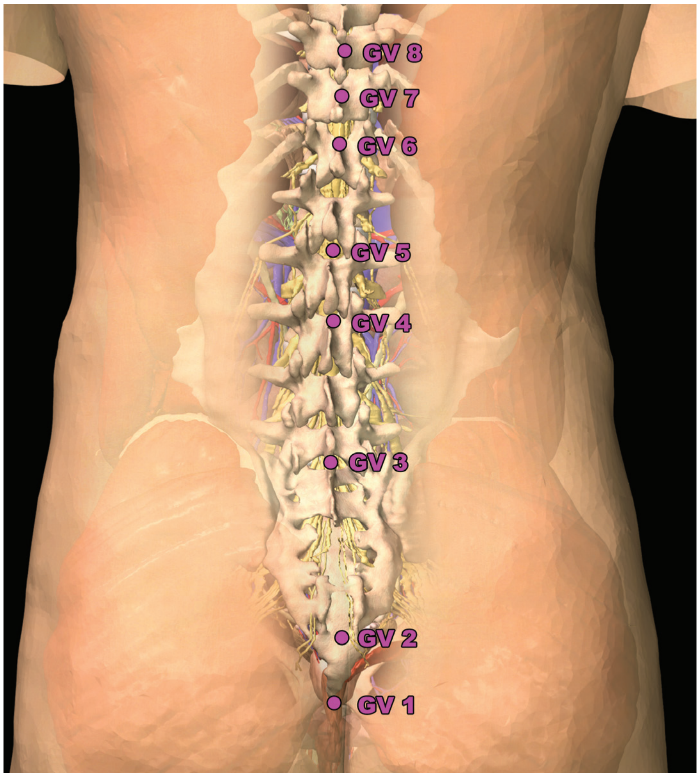


Figure 14-8. The name "Lumbar Transport" for GV 2 connotes its position at the base of the spine.

- Levels **neuronal nitric oxide synthase (nNOS) and nitric oxide (NO)** were consistently higher in acupuncture points and channels that demonstrated low electrical resistance. This study measured NO and nNOS from GV 2 to GV 14, CV 3 to CV 22, BL 36 to BL 57, and PC 2 to PC 6. NO constitutes one of the most important messenger molecules, akin to a neurotransmitter imparting broad influence in interneuronal communication. NO peripheral nervous system and increases sympathetic nervous system activity. Stimulation of sympathetic pathways in the skin lowers electrical resistance. Thus, NO may serve as a messenger for sympathetic nerve activation in dermal neurons. This may mediate acupuncture point functions.[3]
- A randomized, controlled study investigated the effectiveness of electroacupuncture at 2 Hz applied to GV 14, GV 2, and LR 13 for affecting healing of experimentally induced skin flaps in Wistar rats. **Skin flap survival** indices were significantly improved in the electroacupuncture group. This included reduced skin necrosis and preservation of flap integrity.[4]
- Neuromodulation changes the proportion of excitatory and inhibitory signals. This then alters the response of these pathways to physiologic input and adjusts the biologic response to these signals to resolve the dysfunction. Neuromodulation of sacral nerves improves problems related to **voiding dysfunction and fecal incontinence and anorectal sphincter competence.**[5]

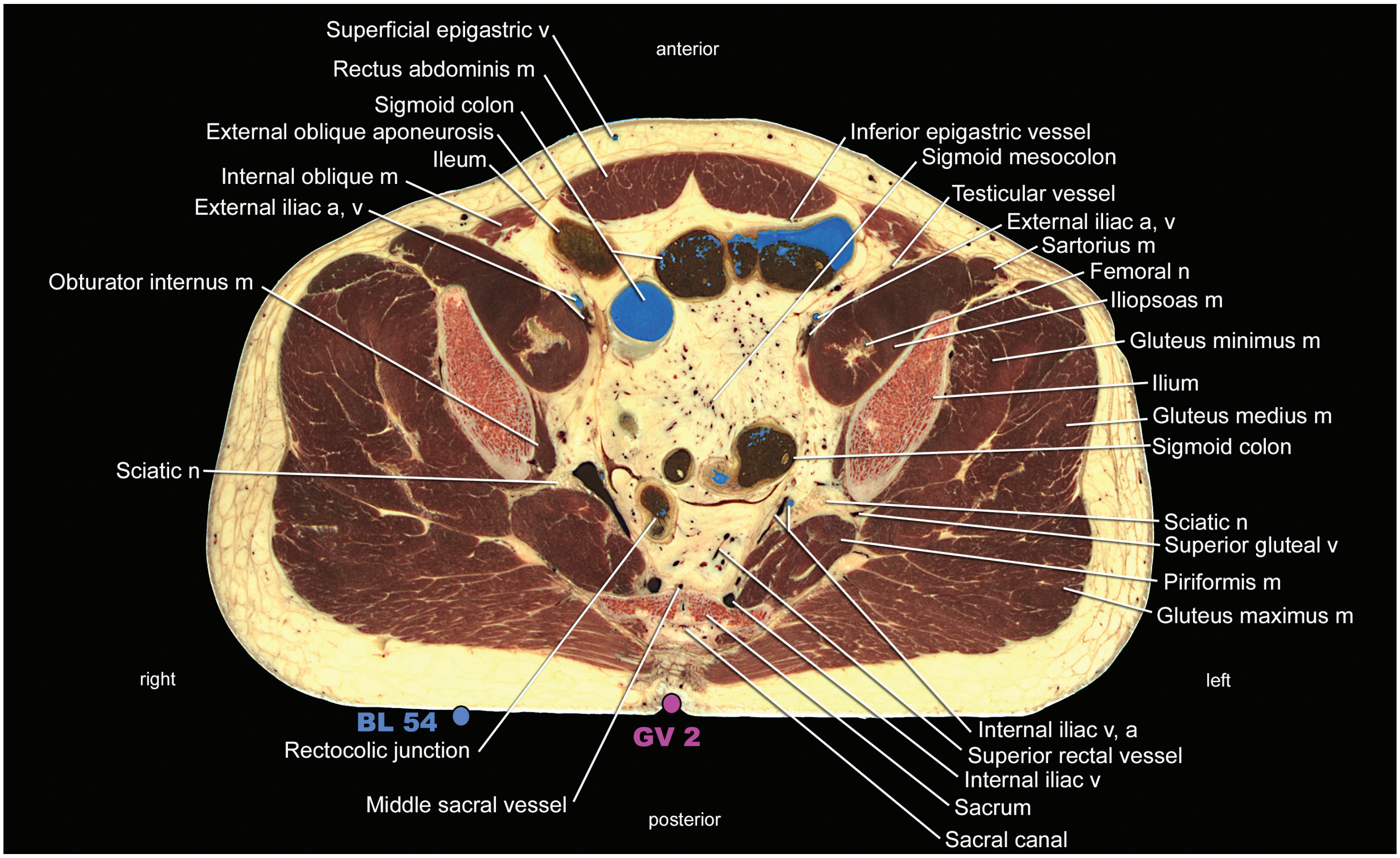

Superficial epigastric v
Rectus abdominis m
Sigmoid colon
External oblique aponeurosis
Ileum
Internal oblique m
External iliac a, v
Obturator internus m
Sciatic n
anterior
Inferior epigastric vessel
Sigmoid mesocolon
Testicular vessel
External iliac a, v
Sartorius m
Femoral n
Iliopsoas m
Gluteus minimus m
Ilium
Gluteus medius m
Sigmoid colon
Sciatic n
Superior gluteal v
Piriformis m
Gluteus maximus m
right
left
BL 54
GV 2
Rectocolic junction
Middle sacral vessel
posterior
Internal iliac v, a
Superior rectal vessel
Internal iliac v
Sacrum
Sacral canal

Figure 14-9. Vessels ventral to the sacrum multiply and magnify as they build the caudal component of the vast CSVS network.

- Moxibustion applied to heat-sensitive sites within the triangle defined by bilateral BL 25 and GV 2 provided relief of pain in patients with **lumbar disc herniation.**[14]

References

1. Wu D. Mechanism of acupuncture in suppressing epileptic seizures. *Journal of Traditional Chinese Medicine*. 1992;12(3):187-192.
2. Guilherme dos Santos Jr. J. Tabosa A, Hoffman Martins do Monte F, Blanco MM, de Oliveira Freire A, and Mello LE. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neuroscience Letters* 2005;384:234-238.
3. Ma S-X. Enhanced nitric oxide concentrations and expression of nitric oxide synthase in acupuncture points/meridians. *Journal of Alternative and Complementary Medicine*. 2003;9(2):207-215.
4. Uema D, Orlandi D, Freitas RR, et al. Effect of electroacupuncture on DU-14 (Dazhui), DU-2 (Yaoshu), and Liv-13 (Zhangmen) on the survival of Wistar rats' dorsal skin flaps. *J Burn Care Res*. 2008;29:353-357.
5. Scaglia M, Delaini G, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Auton Neurosci*. 2009;145(1-2):89-92.
6. Mustafa MS, Mahmoud OM, El Raouf HH, et al. Morphometric study of sacral hiatus in adult human Egyptian sacra: Their significance in caudal epidural anesthesia. *Saudi J Anaesth*. 2012;6(4):350-357.
7. Ramirez MA, Haman J, and Worth L. Low back pain: diagnosis by six newly discovered sacral tender points and treatment with counterstrain. *J Am Osteopath Assoc*. 1989;89(7):905-906 and 911-913.
8. Mustafa MS, Mahmoud OM, El Raouf HH, et al. Morphometric study of sacral hiatus in adult human Egyptian sacra: Their significance in caudal epidural anesthesia. *Saudi J Anaesth*. 2012;6(4):350-357.
9. Mustafa MS, Mahmoud OM, El Raouf HH, et al. Morphometric study of sacral hiatus in adult human Egyptian sacra: Their significance in caudal epidural anesthesia. *Saudi J Anaesth*. 2012;6(4):350-357.
10. Moran DE, Moynagh MR, Alzanki M, et al. Anaphylaxis at image-guided epidural pain block secondary to corticosteroid compound. *Skeletal Radiol*. 2012;41:1317-1318.
11. Park CH and Kim B II. Sacral nerve stimulation through the sacral hiatus. *Korean J Pain*. 2012;25:195-197.
12. Evans PJD, Lloyd JW, and Jack TM. Cryoanalgesia for intractable perineal pain. *J R Soc Med*. 1981; 804-809.
13. Tobinick E. The cerebrospinal venous system: anatomy, physiology, and clinical implications. *Medscape General Medicine*. 2006;8(1):53. Accessed at http://www.medscape.org/viewarticle/522597 on 05-13-13.
14. Chen M, Chen R, Xiong J, et al. Evaluation of different moxibustion doses for lumbar disc herniation: multicenter randomised controlled trial of heat-sensitive moxibustion therapy. *Acupunct Med*. 2012;30(4):266-272.
15. Shenot PJ and Moy LM. Update on neuromodulation for frequency, urgency, retention, and neurogenic voiding dysfunction. *Current Bladder Dysfunction Reports*. 2009;4:114-119.

GV 3

Yao Yang Guan "Lumbar Yang Gate" "Lumbar Yang Pass"

On the dorsal midline in the depression caudal to the spinous process of L4. Find L4 along a line connecting the highest point of each iliac crest.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. The ligamentum nuchae embodies the cephalad extension of the supraspinous ligament, acting as an important stabilizer of the cervical spine. Caudal to L4, the supraspinous ligament exhibits less organization and dissolves into the thoracolumbar fascia.[1] In the lumbar spine of the human, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments. In the upper thoracic spine, a different set of muscles contributes to midline ligament formation. That is, the trapezius, rhomboideus major, and splenius cervicis meld with deep fascia and in the midline produce the supraspinous ligament.[9]
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent a deep aspect of the thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that enclosed the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: The connective tissue structures outlined above form an integrated Complex that some refer to as the Interspinous-supraspinous-thoracolumbar (IST) ligamentous complex.[2] This complex has been likened to a connective tissue sleeve, or stocking, providing functional as well as anatomic connectivity. That is, the interspinous- supraspinous-thoracolumbar ligamentous complex may anchor major fascial planes of the back to the spinous processes and thereby stabilize the spine.

Structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, suggest opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Nerves

- **Dorsal rami of lumbar spinal nerves from L2 to L4:** Innervate the local skin, muscles, and ligaments.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 3 and the somatosomatic as well as somatovisceral reflex connections, neuromodulatory opportunities exist for treating lumbar back pain, paraparesis, sciatic pain, genitourinary conditions, and lower gastrointestinal disorders by means of acupuncture and related techniques.

Vessels

- **Posterior external vertebral venous plexus:** Venous circulation of the spine exists as a dense vertebral venous network that provides drainage for the vertebrae and for epidural and paraspinous tissues, including fat and muscle. The veins comprising this network, or plexus, are thin-walled and valveless. They drain venous blood from the marrow space within the vertebrae and from the capillaries of their cartilaginous endplates. Closely linked internal and external vertebral venous plexuses envelop the interior and exterior spinal column and freely communicate with one another. The internal vertebral venous plexus resides within the vertebral canal while the external plexus resides outside of the canal. Each plexus has anterior and posterior components. The posterior external vertebral venous plexus may receive venous drainage from the vertebral bodies themselves. Veins emanating from the network accompany the spinal nerves as intervertebral veins that exit the intervertebral foramina; these may serve as collateral generators of radicular pain.[3] Communications also exist between the veins of the spinal cord and the vertebral, posterior intercostal, lumbar, and lateral sacral veins.

The veins surrounding the spinal column have profound significance in terms of acupuncture anatomy. According to Kendall, the Nanjing (Difficulty 28) describes the GV channel as beginning "in front of the lowest part of the perineum, and from this area travels side-by-side up the interior part of the back (azygous and hemiazygous, and the ascending lumbar veins) to enter the

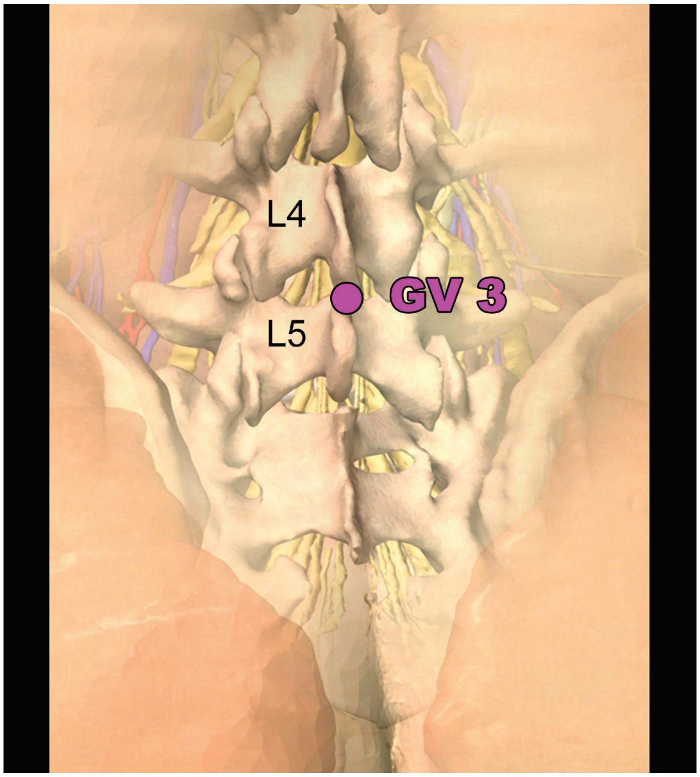


Figure 14-10. GV 3, "Lumbar Yang Gate" refers to this being a portal to neural activity coursing through the vertebral canal. Although the ancient Chinese likely did not perform lumbar punctures to access cerebrospinal fluid, the intervertebral space between L4 and L5 at GV 3 is one site where "spinal taps" are performed. As is visible between the vertebrae, the spinal cord has ended cranial to this level which is now inhabited by the cauda equina.

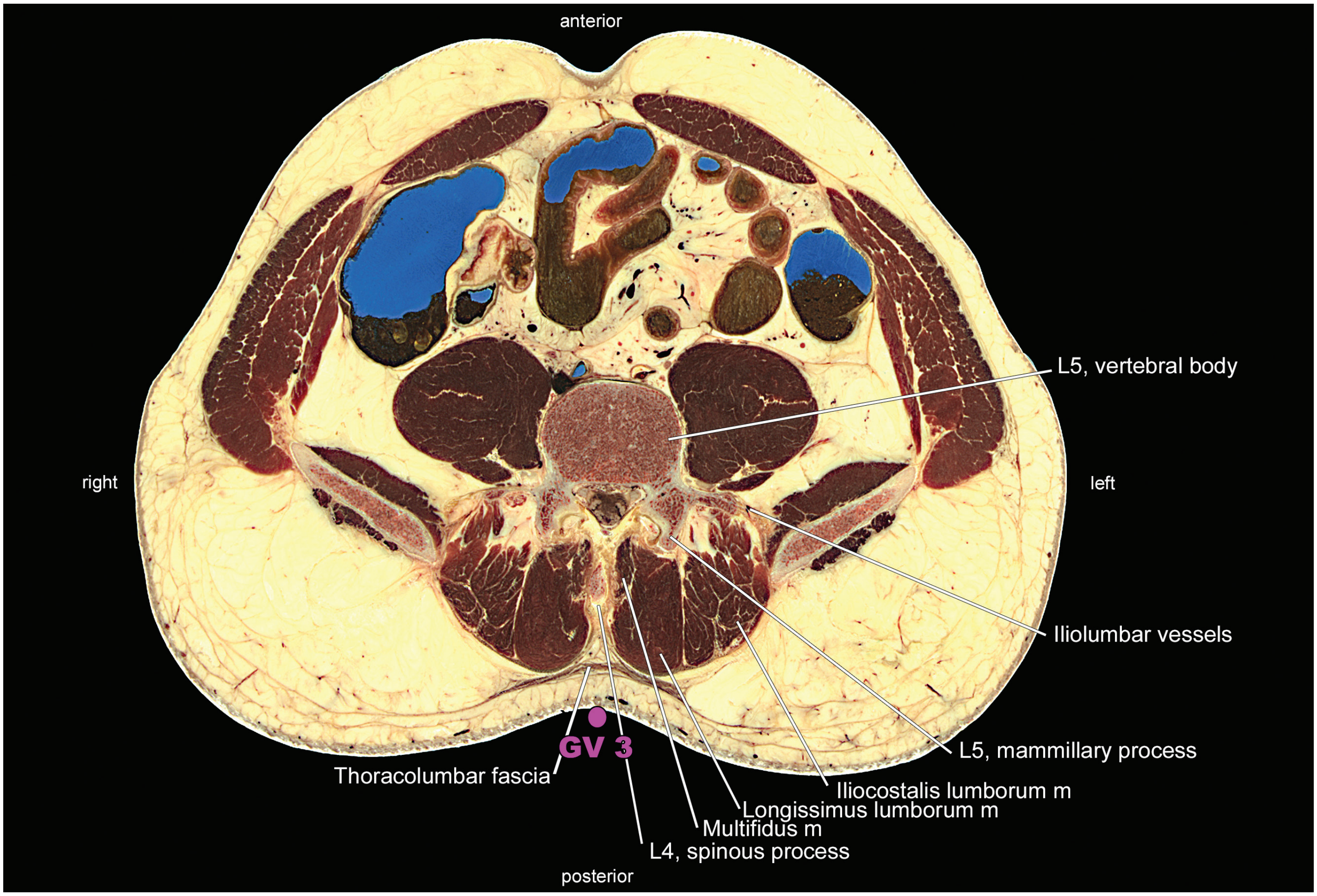


Figure 14-11. Note the heavy investment of connective tissue within and around the paraspinal muscles and how this contrasts with the homogeneity of the hypaxial muscles.

node Fengfu (DU 16 (GV 16)), where it connects with the brain."[6] Considering Deadman's descriptions of the primary pathway, three branches, and luo-connecting vessel of the Governor Vessel channel, the correspondence between the channel and its associated venous pathways becomes quite clear.

From an anatomic perspective, the internal vertebral venous plexus communicates with the occipital and basilar sinuses of the skull, at the foramen magnum (near GV 16). The azygous (or azygos) system of veins mentioned by Kendall drains blood from the posterior walls of the thorax and abdomen. It links the vertebral venous plexuses traversing the thoracic, lumbar, and sacral regions. The ascending lumbar veins arise from the sacral and lumbar veins. At the level of L1 or L2, the right ascending lumbar vein becomes the azygous vein. The azygous vein may also arise from the inferior vena cava or right renal vein. It enters the thorax through the aortic hiatus of the diaphragm and passes along the right side of the spine until it reaches T4, at which point it arches over the root of the right lung to end in the superior vena cava. The azygous vein receives the right subcostal and intercostal veins, the hemiazygous vein, several esophageal, mediastinal, and pericardial veins, as well as the right bronchial vein The left ascending lumbar vein becomes the hemiazygous vein, which exits the abdominal cavity through the left crus of the diaphragm and travels along the left side of the T12 to T8 thoracic vertebrae. At T8, the hemiazygous vein crosses the midline behind the aorta, thoracic duct, and esophagus to join with the azygous vein, into which it empties.

The hemiazygous vein receives the left subcostal vein and the lower four or five intercostal veins, as well as some esophageal and mediastinal veins.

An accessory hemiazygous vein assists the hemiazygous vein in draining structures on the left side. The accessory hemiazogous vein receives tributaries from the 4th through the 8th intercostal veins, and occasionally from the left bronchial veins. The azygous and hemiazygous veins provide one of the main avenues through which venous drainage from the thorax, abdomen, and back can continue in the face of caval obstruction, due to their extensive communications with the superior and inferior venae cavae, ascending lumbar veins, and many tributaries of the inferior vena cava.

- **Dorsal branches of right and left 4th lumbar arteries:** The lumbar arteries arise from the aorta, and embrace their respective vertebrae. Each lumbar artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. In addition, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors.[4] Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-homing factors.[5]

Indications and Potential Point Combinations

- **Lumbar pain and sciatica:** GV 3, BL 23, BL 24, local trigger points, GB 30, BL 40, BL 39, BL 60, KI 3.
- **Paresthesias, numbness, or cold feeling in the pelvic limbs:** GV 3, GB 25, BL 23, points associated with the involved neuropathic nerves and spinal cord segments, LR 3.
- **Erectile dysfunction:** GV 3, GV 2, BL 23, LR 5, CV 2, CV 3, GV 20.
- **Genitourinary problems:** GV 3, BL 23, BL 28, KI 3, SP 6, CV 3.

Evidence-Based Applications

- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[7]
- Electroacupuncture at BL 60, BL 54, and GV 3 in rats following experimental **spinal cord contusion** at T8 improved function and spared ventral horn neurons compared to control rats.[8]

Evidence-Based Applications

- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[7]
- Electroacupuncture at BL 60, BL 54, and GV 3 in rats following experimental **spinal cord contusion** at T8 improved function and spared ventral horn neurons compared to control rats.[8]

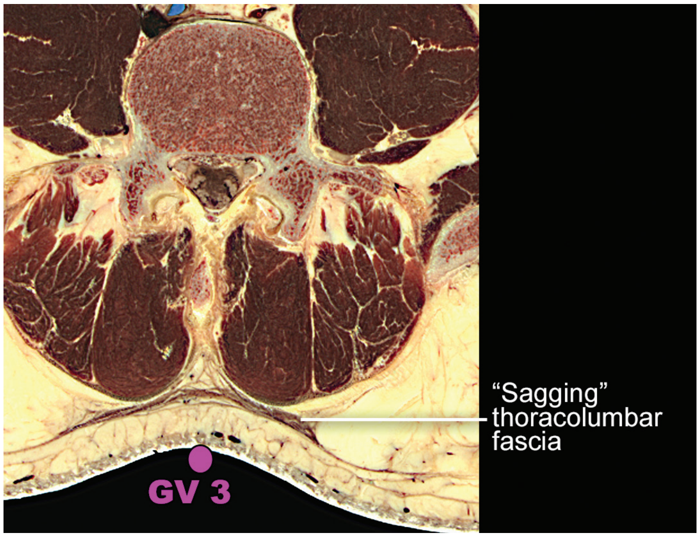


Figure 14-12. This close-up view of the spine at GV 3 reveals “sagging” in the thoracolumbar fascia, possibly indicating chronic spinal instability.[10]

References

1. Bogduk, Twomey LT. *Clinical Anatomy of the Lumbar Spine.* New York: Churchill Livingstone, 1991.
2. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. Movement, *Stability and Low Back Pain: The Essential Role of the Pelvis.* New York: Churchill Livingstone, 1997.
3. LeBan MM, Wilkins JC, Wesolowski DP, Bergeon B, and Szappanyos BJ. Paravertebral venous plexus distention (Batson’s): an inciting etiologic agent in lumbar radiculopathy as observed by venous angiography. *Am J Phys Med Rehabil.* 2001;80(2):129-133.
4. Geldof AA. Models for cancer skeletal metastasis: a reappraisal of Batson’s plexus. *Anticancer Research.* 1997;17(3A):1535-1539.
5. Yuh WTC, Quets JP, Lee HJ, Simonson TM, Michalson LS, Nguyen PT, Sato Y, Mayr NA, and Berbaum KS. Anatomic distribution of metastases in the vertebral body and modes of hematogenous spread. *Spine.* 1996;21(19):2243-2250.
6. Kendall DE. Dao of Chinese Medicine. *Understanding an Ancient Healing Art.* Hong Kong: Oxford University Press, 2002. Pp. 155-156.
7. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology.* 2003;42:1508-1517.
8. Politis MJ and Korchinski MA. Beneficial effects of acupuncture treatment following experimental spinal cord injury: a behavioral, morphological, and biochemical study. *Acupunct Electrother Res.* 1990;15(1):37-49.
9. Johnson GM and Zhang M. Regional differences within the human supraspinous and interspinous ligaments: a sheet plastination study. *Eur Spine J.* 2002;11:382-388
10. Jeong YM, Shin MJ, Lee SH, et al. Sagging posterior layer thoracolumbar fascia: can it be the cause or result of adjacent segment disease? *J Spinal Disord Tech.* 2013;26(4):E124-129.

GV 4

Ming Men "Life Gate"

On the dorsal midline, caudal to the spinous process of L2.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: The midline connective tissues can be viewed as an integrated complex, called the "interspinous-supraspinous-thoracolumbar (IST) ligamentous complex".[1] It has been likened to a connective tissue sleeve, or stocking, linking the thoracolumbar fascia to the anterior longitudinal ligament of the spine. This functional connectivity allows the various components to work in an organized manner.

Furthermore, structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Thoracolumbar fascia, in particular its dorsal (posterior) layer, facilitates load transfer between the spine, pelvis, and legs. Examine the connections it makes with major movers of the torso as shown in Figures 14-15 and 14-16. However, dysfunction within the thoracolumbar fascia potentially places excessive pull on its myriad muscular and osseous attachments, and can cause widespread, debilitating strain and pain. Interspinous locations, including GV points, from sacrum to mid-thorax denote anatomic sites where strain patterns from the right and left sides intersect and where response to treatment may prove valuable in alleviating maladaptive myofascial patterns.

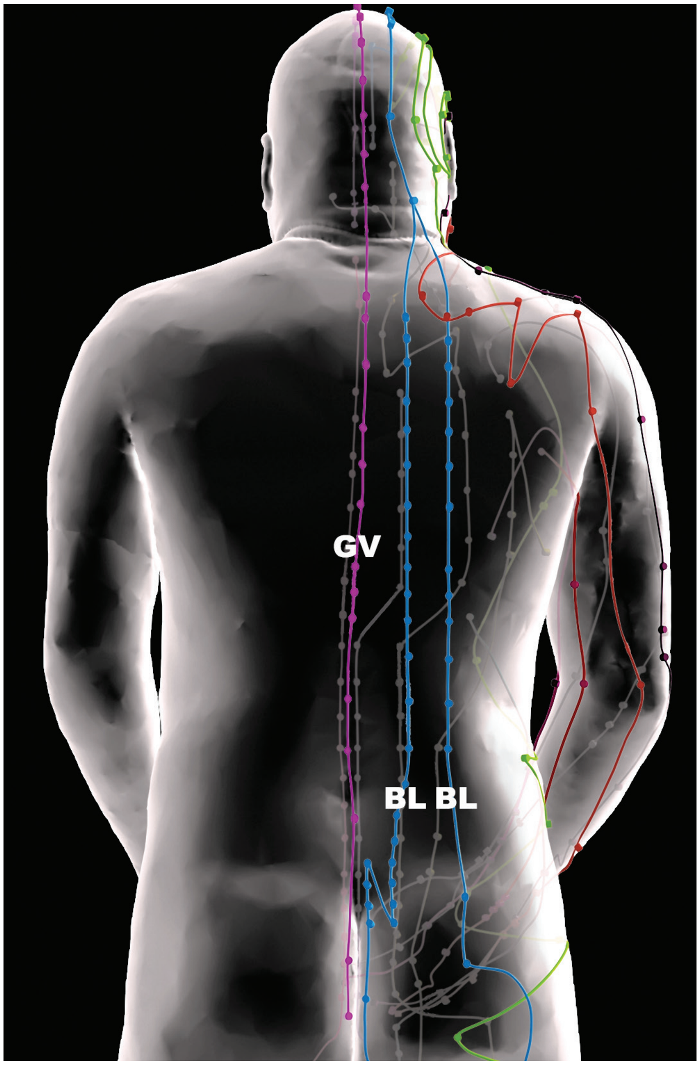


Figure 14-13. Even though the GV line lies directly over the spine, points on the BL channel may confer greater treatment benefit than most GV sites.

Nerves

- **Dorsal rami of lumbar spinal nerves from T12 to L2:** Innervate the local skin, muscles, and ligaments.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 4 and the somatosomatic as well as somatovisceral reflex connections, neuromodulatory opportunities exist for treating lumbar back pain, paraparesis, sciatic pain, genitourinary conditions, kidney problems, and lower gastrointestinal disorders by means of acupuncture and related techniques.

Sensory input from the kidney reaches the T10-T11 levels of the spinal cord, although the network of sympathetic preganglionic neurons actually spans a broader spinal segmental level, possibly extending into the cranial lumbar cord. Spinal cord segments ferrying sympathetic supply to the kidney become important targets for neuromodulation in patients with renal disease and hypertension. That is, neuromodulation of cranial lumbar spinal segments has the potential to reduce spinal cord sensitization and sympathetic overactivation. As such, the points GV 4, BL 23, and BL 52 constitute primary points for renal disease in that they fall within the T10-L2 dermatomes. One might also consider adding GB 25 for renal problems. See Figure 14-16 to view the placement of points in the "kidney tiara".

GV points act on midline anatomy and neuromodulate by means of the medial branch of the dorsal primary ramus of the related spinal nerve. The inner BL line has the capacity to influence both the medial and lateral branches of the dorsal primary rami, while the outer BL line impact predominantly the lateral branch. Even though they may send somatic afferent stimulation through different branches, the end clinical result often overlaps because the sensory fibers reach the same spinal nerves and spinal cord segments.

However, BL points interface with muscle tissue whereas GV

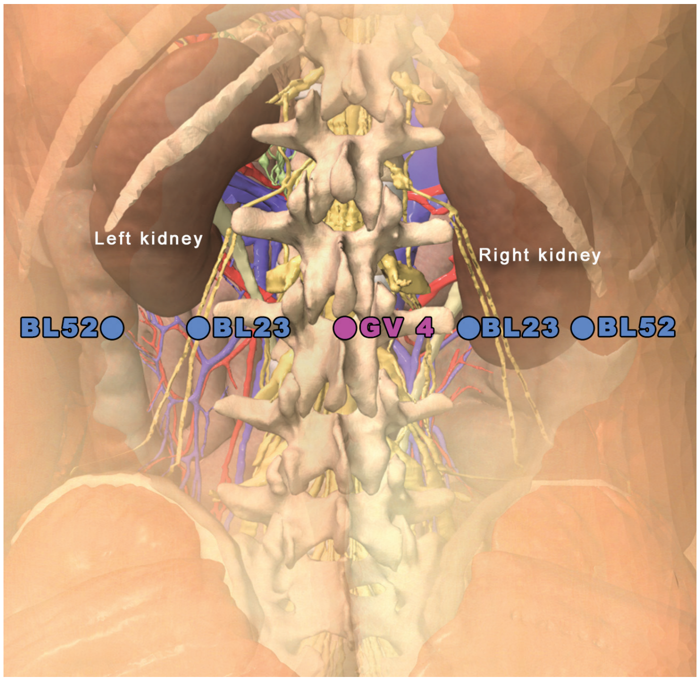


Figure 14-14. GV 4, BL 23, and BL 52 constitute the "kidney tiara"; i.e., a set of points indicated for renal dysfunction. One might also add GB 25 and CV 6.

points in the lumbar region do not. This translates into activating fewer types of nerve endings and mechanoreceptors with GV point stimulation, and less of a neuromodulatory impact than for BL points at the same level. Furthermore, myofascial trigger points are not part of the focus for GV points on the lumbar spine, whereas they are a key element of BL point activation.

A "compromise" point location, denoted by the Huatuojiaji points at each level, 0.5 cun from midline, targets both muscle tissue and potentially both medial and lateral branches of the dorsal primary ramus, depending on the level of the spine receiving treatment. Anatomically, as shown by Figure 14-16, Huatuojiaji points influence the multifidus muscle, i.e., part of the spinalis group, rather than the longissimus or iliocostalis band. Treating back pain effectively requires astute palpation to delineate which muscles, fascial layers, and trigger points are causing problems and targeting needling, manual therapy, and laser treatment to sources of disturbance. In other words, focusing on unaffected or less affected zones other than main problem may confer indirect benefit but leave the largest source of tension and myofascial pathology relatively untouched.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitutes part of the superior vena caval system. The azygous system links various venous segments throughout the thoracic, lumbar, and sacral regions.

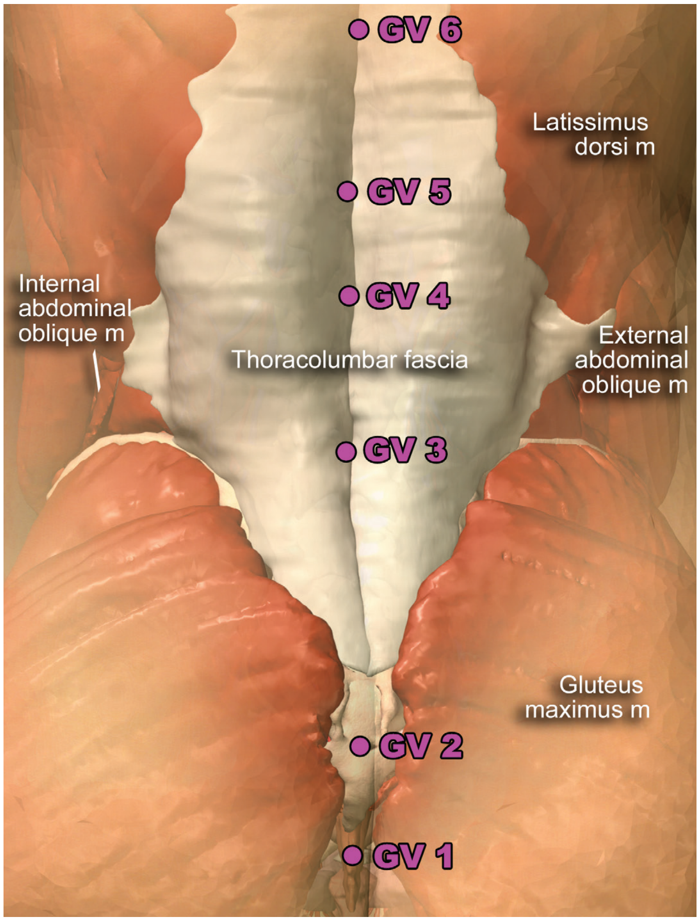


Figure 14-15. GV 4 appears often in formulae for low back pain and stiffness of the spine. This image reveals the point's central location within the broad expanse of the thoracolumbar fascia. This extensive network of connective tissue distributes load, orchestrates movement, and manages spinal stability when functioning properly. If injury should impose maladaptive strain patterns on the thoracolumbar fascia, it may compromise one or more of these functions.

- **Dorsal branches of right and left 2nd lumbar arteries:** The lumbar arteries branch off of the aorta and embrace their respective vertebrae. Each lumbar artery supplies twigs to its vertebral body; dorsal branches from the artery also supply the back muscles and spinous process on that vertebra.

Spinal branches enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bone, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches also supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain

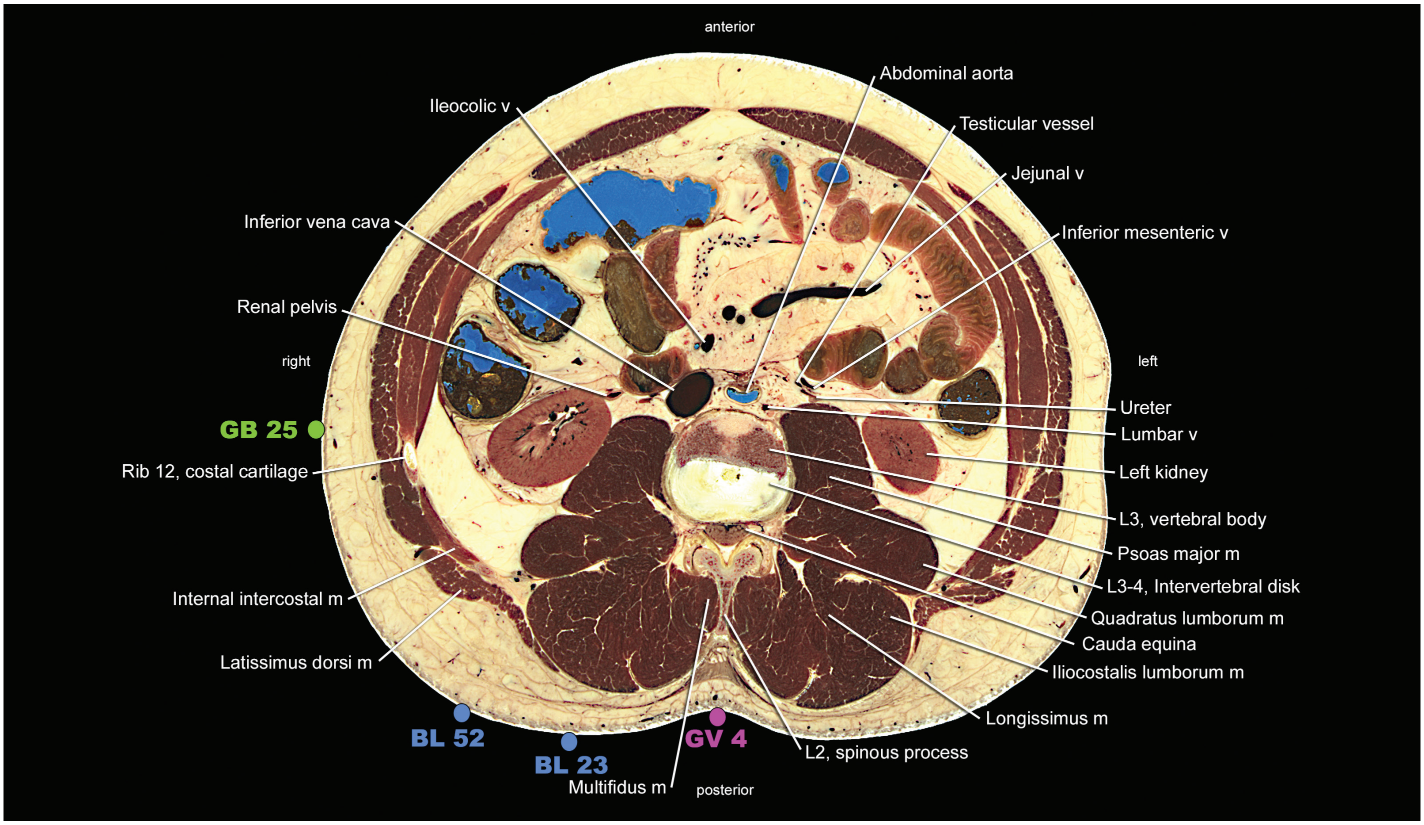

anterior
Ileocolic v
Abdominal aorta
Testicular vessel
Jejunal v
Inferior vena cava
Inferior mesenteric v
Renal pelvis
right
left
GB 25
Ureter
Lumbar v
Rib 12, costal cartilage
Left kidney
L3, vertebral body
Psoas major m
L3-4, Intervertebral disk
Internal intercostal m
Quadratus lumborum m
Cauda equina
Latissimus dorsi m
Iliocostalis lumborum m
Longissimus m
BL 52
GV 4
BL 23
L2, spinous process
Multifidus m
posterior

Figure 14-16. The ancient Chinese regarded GV 4, located between the kidneys, as the origin or foundation of life in the individual, hence its descriptive title, "Life Gate". They may have mistakenly attributed reproductive function to the kidneys instead of the adrenal glands, which produce sex hormones. Or, perhaps they were considering the embryologic progenitor of the reproductive system, i.e., the mesonephros, which develops into both genital and renal/urinary tissue. Also note how the acupuncture points GV 4, BL 23, BL 52, and GB 25 comprise the "kidney tiara" and encircle the kidneys. The "kidney tiara" protocol is designed to treat renal disorders and neuromodulate kidney function by means of spinal segmental reflexes.

internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Spinal pain or stiffness:** GV 4, GV 20, BL 23, BL 52, acupuncture to tender trigger points, restricted myofascial bands, BL 60, KI 3.
- **Headache:** GV 4, BL 60, LR 3, LI 4, GV 24.5, GV 20, BL 10.
- **Spinal meningitis:** GV 4, GV 2, GV 14, GV 20.
- **Genitourinary problems:** erectile dysfunction, vaginal discharge uterine bleeding, urethritis, urinary retention: GV 4, BL 23, BL 25, BL 28, BL 31, BL 32, BL 33, BL 34, SP 6, ST 36, KI 3.
- **Kidney problems:** GV 4, BL 23, BL 28, BL 52, GB 25, KI 3.
- **Acupuncture analgesia for the caudal region of the body:** GV 4, GV 2, ST 36, BL 60, GV 20, dense disperse electroacupuncture stimulation applied three spinal cord segments cranial and caudal to the area requiring analgesia.

Evidence-Based Applications

- Neuroanatomically, GV 4 may support sexual performance through its influence on **spinal sympathetic pathways.**[2]
- Acupuncture at CV 3, CV 6, GV 4, BL 23, BL 32, LI 4, ST 36, and KI 3 provided significant improvement in anal continence for patients experiencing **fecal incontinence.**[3]
- Spinal cord stimulation at the L2-3 segments significantly reduced excitatory responses to colorectal distension experimentally applied to rats. These data showed that lumbar spinal cord stimulation afforded neuromodulation of responses generated by lumbosacral spinal neurons in response to noxious mechanical stimulation of the colon. This experiment provides insight into the possible mechanisms of action of acupuncture input at the L2-3 cord for discomfort related to **irritable bowel syndrome** and other colon conditions.[4]
- Spinal cord stimulation modulated the activity of lumbosacral spinal neurons receiving noxious input from the urinary bladder caused by distension, suggesting a mechanism by which acupuncture stimulation reaching the L2-3 spinal cord segments may reduce hypersensitivity and/or the pain from cystitis and other urinary bladder disorders.[5]
- Acupuncture at BL 23, BL 28, and GV 4 or CV 4, CV 6, and SP 6 benefited patients with diurnal symptoms associated with **idiopathic bladder instability.**[6]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[7]
- Of the following group of points, 12 were chosen according to the Chinese medical assessment of men with **low quality sperm.**

Following a series of acupuncture treatments, their fertility index increased significantly, following improvements in the parameters of total functional sperm fraction, percent viability, total motile spermatozoa per ejaculate, and integrity of the axonema. The acupuncture points from which the 12 were selected included: LU 7, LI 4, LI 11, ST 30, ST 36, SP 6, SP 9, SP 10, HT 7, BL 20, BL 23, BL 33, KI 6, KI 7, PC 6, LR 5, LR 8, CV 1, CV 2, CV 4, CV 6, and GV 4.[8]

- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 **helped relieve symptoms related to narcotic drug withdrawal**.[9]
- Acupuncture to GV 3, GV 4, BL 23, BL 24, BL 25, BL 36, BL 37, BL 40, and BL 54 in older patients with **chronic low back pain** provided improved functional capacity for up to four weeks; patients in the acupuncture group had fewer medication-related side effects compared to the control group.[10]
- Electroacupuncture at GV 4 in mice **suppressed delayed type hypersensitivity** and appears to involve the pituitary and neuroendocrine system.[11]
- Electroacupuncture at GB 29 and GV 4, applied to ovariectomized rats promoted release of insulin-like growth factor, which may help improve **post-menopausal osteoporosis** problems by increasing bone marrow density in this osteoporosis model, according to a Chinese study.[12]

References

1. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. *Movement, Stability and Low Back Pain: The Essential Role of the Pelvis*. New York: Churchill Livingstone, 1997.
2. Wong J. Male sexual impotence, sildenafil citrate, and acupuncture. *Medical Acupuncture*. (Undated.) Obtained at http://www.medicalacupuncture.com/aama_marf/journal/vol13_1/article5.html on 11-21-05
3. Scaglia M, Delaini GG, Destefano I, et al. Fecal incontinence treated with acupuncture – a pilot study. *Autonomic Neuroscience: Basic and Clincial*. 2009;145:89-92.
4. Qin C, Lehew RT, Khan KA, et al. Spinal cord stimulation modulates intraspinal colorectal visceroreceptive transmission in rats. *Neurosci Res*. 2007;58(1):58-66.
5. Qin C, Farber JP, and Foreman RD. Spinal cord stimulation modulates activity of lumbosacral spinal neurons receiving input from urinary bladder in rats. *Neuroscience Letters*. 2007;428:38-42.
6 Philp T, Shah JR, and Worth PHL. Acupuncture in the treatment of bladder instability. British Journal of Urology. 1988;61:490-493.
7. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research*. 2003;31:552-556.
8. Siterman S, Eltes F, Wolfson V, Zabludovsky N, and Bartoov B. Efffect of acupuncture on sperm parameters of males suffering from subfertility related to low sperm quality. *Archives of Andrology*. 1997;39:155-161.
9. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.
10. Meng CF, Wang D, Ngeow J, Lao L, Peterson M, and Paget S. Acupuncture for chronic low back pain in older patients: a randomized, controlled trial. *Rheumatology*. 2003;42:1508-1517.
11. Kasahara T, Amemiya M, Wu Y, and Oguchi K. Involvement of central opioidergic and nonopioidergic neuroendocrine systems in the suppressive effect of acupuncture on delayed type hypersensitivity in mice. *Int J Immunopharmac*. 1993;15(4):501-508.
12. Feng Y, Lin H, Zhang Y, et al. Electroacupuncture promotes insulin-like growth factors system in ovariectomized osteoporosis rats. *Am J Chin Med*. 2008;36(5):889-897.

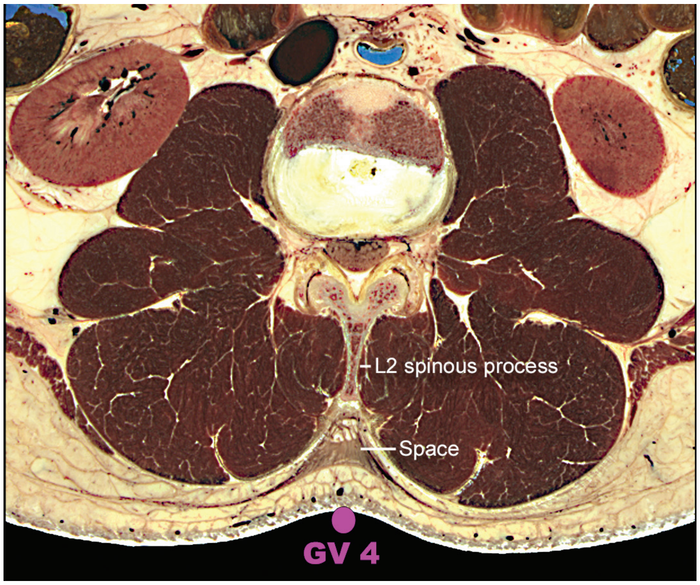


Figure 14-17. Note how a space has appeared deep to GV 4 between the subcutaneous fat and the spinous process of L2. An acupuncture needle entering here would transmit differences in tissue resistance as reaches the cavern. It behooves the practitioner to remain sensitive to palpatory feedback delivered not only through one's hands during myofascial evaluation, but also when needling so as not to miss important information about underlying tissue health and/or disease that such changes in tissue resistance suggest.

GV 5

Xuan Shu "Suspended Pivot"

On the dorsal midline, in the depression caudal to the L1 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: The midline connective tissues can be viewed as an integrated complex, called the "interspinous-supraspinous-thoracolumbar (IST) ligamentous complex".[1] It has been likened to a connective tissue sleeve, or stocking, linking the thoracolumbar fascia to the anterior longitudinal ligament of the spine. This functional connectivity allows the various components to work in an organized manner.

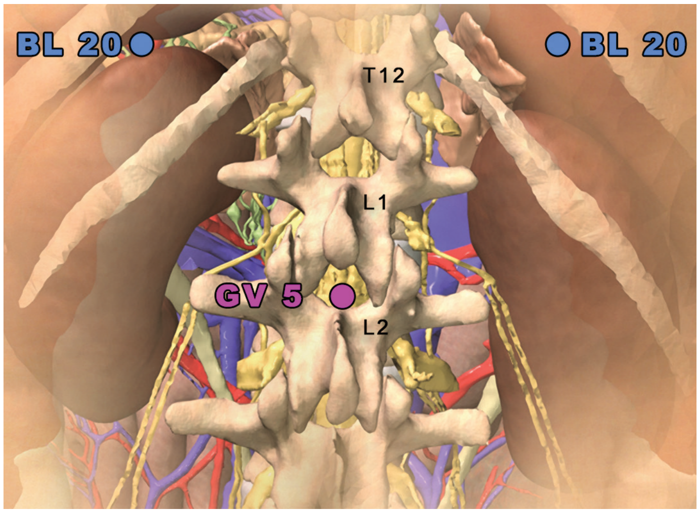


Figure 14-18. The name "Suspended Pivot" for GV 5 refers to the way in which L1 acts as a fulcrum for the thoracic and lumbar portions of the spine. A rich and varied collection of anatomical features occupies this truncal midsection. The iliohypogastric and ilioinguinal nerves angle in a caudolateral direction from L1, headed on a trajectory to supply the pelvis with sensory and sympathetic supply. Deep to GV 5, one sees the spinal cord through the intervertebral disk space. Renal vessels reach to and from the kidneys on either side of L1. The ureters, in light green, exit the renal pelvises and course toward the bladder. More ventral sit the intestines, large and small. The pinkish pyramidal adrenal glands rest atop the kidneys. Between the left kidney and spleen in the top left corner appears the pancreas and nearby lymph nodes, denoted by BL 20, the Back Shu point for the spleen or "spleen-pancreas". That is, because the ancient Chinese failed to recognize the physiologic significance and anatomic uniqueness of the pancreas they misattributed pancreatic activities to the spleen. The term "spleen-pancreas" is used to mitigate this oversight.

Furthermore, structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Thoracolumbar fascia, in particular its dorsal (posterior) layer, facilitates load transfer between the spine, pelvis, and legs. Examine the connections it makes with major movers of the torso as shown in Figures 14-15, 14-16, and 14-19.

Dysfunction within the thoracolumbar fascia may introduce excessive pull on these attachments, causing cause intense and disabling pain. Interspinous locations such as GV points denote sites where strain patterns from the right and left sides intersect.

Nerves

- **Dorsal rami of lumbar spinal nerves from T11 to L1 or L2:** Innervate the local skin, muscles, and ligaments.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 5 and the somatosomatic as well as somatovisceral reflex connections, neuromodulatory opportunities exist for treating thoracolumbar back pain, genitourinary conditions, kidney problems, and gastrointestinal disorders.

Sensory input from the kidney reaches the T10-T11 levels of the spinal cord, although the network of sympathetic preganglionic neurons actually spans a broader spinal segmental level, possibly extending into the cranial lumbar cord. Spinal cord segments ferrying sympathetic supply to the kidney become important targets for neuromodulation in patients with renal disease and hypertension. That is, neuromodulation of cranial lumbar spinal segments has the potential to reduce spinal cord sensitization and sympathetic over-activation.

GV points act on midline anatomy and neuromodulate by means of the medial branch of the dorsal primary ramus of the related spinal nerve. Points on the inner BL line have the capacity to influence both the medial and lateral branches of the dorsal primary rami, while outer BL line points impact predominantly the lateral branch. Even though points on the inner and outer BL channels initiate somatic afferent stimulation through different branches, the end clinical result often overlaps because sensory fibers from both locations travel through similar spinal nerves, destined to the same or adjacent spinal cord segments. One can select an interspinous GV line point at the same level to bolster spinal segmental attention.

Note that BL points on the back interact with muscle tissue whereas GV points largely do not. This translates into activating fewer types of nerve endings and mechanoreceptors with the latter, leading to less of a neuromodulatory impact compared to BL points. Treating only GV points for back pain would neglect the role of myofascial trigger point pathology its generation and perpetuation.

A "compromise" point location between GV points and the inner BL line is denoted by the Huatuojiaji point group. These sites occur

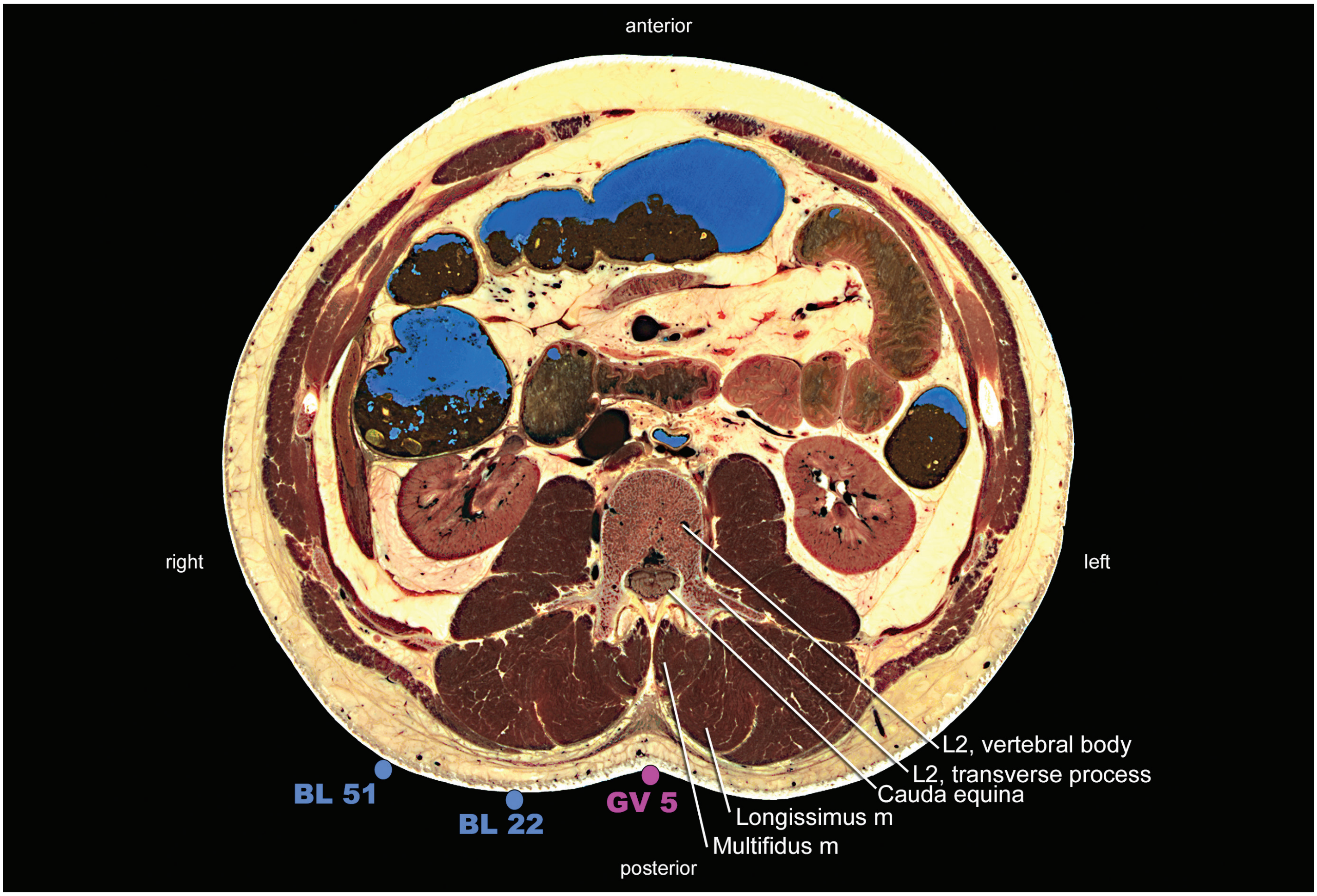


Figure 14-19. Note the anatomic "security blanket" of hypaxial and epaxial muscles that couches the L2 vertebral body at GV 5. When functioning well, these structures support spinal integrity and strength. When neurons misfire, myofascial pathology and proprioceptive confusion erupt, calling for neuromodulation with acupuncture and/or related techniques.

at each vertebral level, 0.5 cun from midline. They target both muscle tissue and potentially both medial and lateral branches of the dorsal primary ramus, depending on the spinal level.

Anatomically, as shown by Figure 14-19, Huatuojiaji points would influence the multifidus muscle, i.e., part of the spinalis group, rather than the longissimus or iliocostalis band. Treating back pain effectively requires astute palpation in order to define which muscles, fascial layers, and trigger points are causing problems. Acupuncture needling, manual therapy, and laser treatment can then target the actual source(s) of pain. That is, focusing on unaffected or less affected zones other than main problem may confer indirect benefit but leave the largest source of tension and myofascial pathology relatively untouched.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

- **Dorsal branches of right and left 1st lumbar arteries:** The lumbar arteries branch off of the aorta and hug their respective vertebrae. Each lumbar artery supplies twigs to its vertebral body; dorsal branches from the artery also supply the back muscles and spinous process on that vertebra.

Spinal branches enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bone, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches also supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Gastrointestinal problems, including diarrhea, dysentery, enterocolitis, dyspepsia, abdominal pain:** GV 5, BL 22, BL 25, CV 10, BL 21, ST 36, SP 6.
- **Lumbar pain:** GV 5, BL 22, BL 23, BL 25, local tender points, BL 39, BL 40, BL 60, KI 3.

References

1. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. *Movement, Stability and Low Back Pain: The Essential Role of the Pelvis*. New York: Churchill Livingstone, 1997.

GV 6

Ji Zhong "Center of the Spine"

On the dorsal midline, in the depression caudal to the T11 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: The midline connective tissues can be viewed as an integrated complex, called the "interspinous-supraspinous-thoracolumbar (IST) ligamentous complex".[1] It has been likened to a connective tissue sleeve, or stocking, linking the thoracolumbar fascia to the anterior longitudinal ligament of the spine. This functional connectivity allows the various components to work in an organized manner.

Furthermore, structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Thoracolumbar fascia, in particular its dorsal (posterior) layer, facilitates load transfer between the spine, pelvis, and legs. Examine the connections it makes with major movers of the torso as shown in Figures 14-15, 14-16, and 14-19. Figure 14-22 reveals the way in which the thick, dorsal component of the thoracolumbar fascia has narrowed as it meets the caudal tendon of the trapezius muscle.

Dysfunction within the thoracolumbar fascia may introduce excessive pull on these attachments, causing cause intense and disabling pain. Note, too, as illustrated by Figure 14-20, how the insertion of the trapezius tendon onto the caudal thoracic spinous processes increases traction on this "Center of the Spine".

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its caudal connection to the thoracic spine at GV 6 and thereabouts may aid in the resolution of tension and strain patterns in the back, neck, and head.

Nerves

- **Dorsal rami of thoracic spinal nerves from T11 and nearby spinal segmental levels:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 6 and the somatosomatic as well as somatovisceral reflex connections therefrom, neuromodulatory opportunities exist for treating thoracolumbar back pain, splenic disorders, hepatobiliary dysfunction, kidney problems, and gastrointestinal disorders. For example, over a quarter of patients with symptomatic gallstone disease report back pain referred to the area denoted by GV 6.[3]

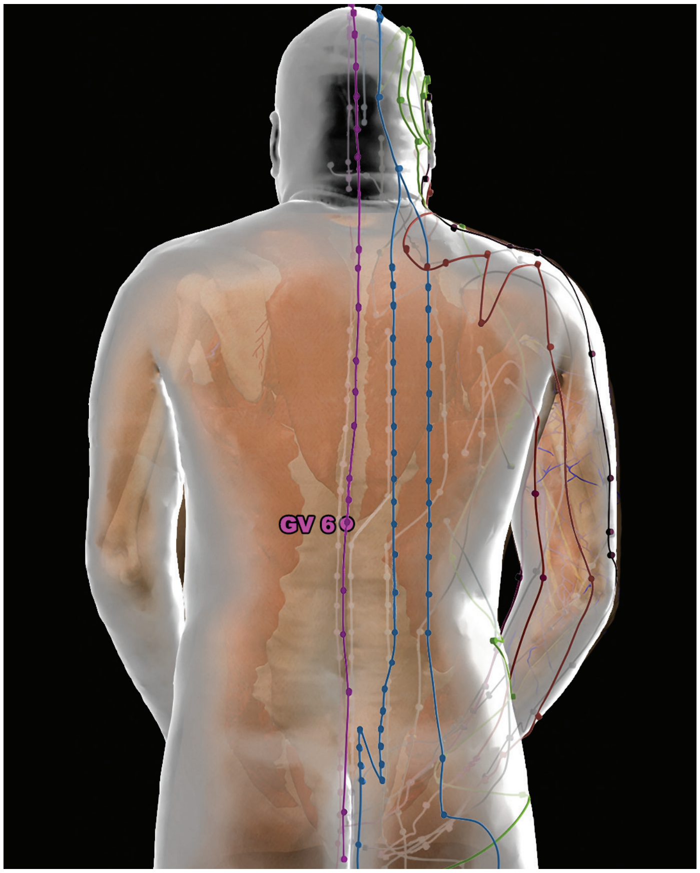


Figure 14-20. GV 6, called "Center of the Spine", is located at approximately the middle of the back.

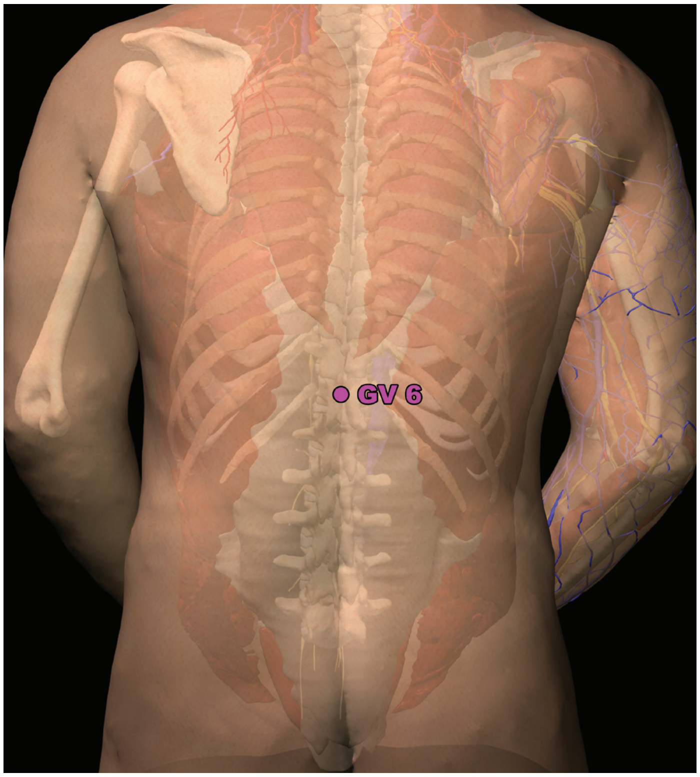


Figure 14-21. GV 6 lands at the interface where the thoracic spine becomes lumbar and the trapezius tendon turns to thoracolumbar fascia.

GV points act on midline anatomy and neuromodulate by means of the medial branch of the dorsal primary ramus of the related spinal nerve. Points on the inner BL line have the capacity to influence both the medial and lateral branches of the dorsal primary rami, while outer BL line points impact predominantly the lateral branch. Even though points on the inner and outer BL channels initiate somatic afferent stimulation through different branches, the end clinical result often overlaps because sensory fibers from both locations travel through similar spinal nerves, destined to the same or adjacent spinal cord segments. One can select an interspinous GV line point at the same level to bolster spinal segmental attention.

Note that, as evidenced by the cross-section in Figure 14-22, BL 20 (Back Shu point for the spleen) neighbors GV 6 at the T11-T12 level. Therefore, GV 6 could conceivably reinforce actions of BL 20 as well as the outer BL line point BL 49, located at this level as well. Furthermore, Figure 14-22 exposes the relationship of the spleen organ (and pancreas) to the left-sided BL 20 and BL 49.

Note that BL points on the back interact with muscle tissue whereas GV points largely do not. This translates into activating fewer types of nerve endings and mechanoreceptors with the latter, leading to less of a neuromodulatory impact compared to BL points. Treating only GV points for back pain would neglect the role of myofascial trigger point pathology its generation and perpetuation.

A "compromise" point location between GV points and the inner BL line is denoted by the Huatuojiaji point group. These sites occur at each vertebral level, 0.5 cun from midline. They target both muscle tissue and potentially both medial and lateral branches of the dorsal primary ramus, depending on the spinal level.

Treating back pain effectively requires astute palpation in order to define which muscles, fascial layers, and trigger points are causing problems. Acupuncture needling, manual therapy, and laser treatment can then target the actual source(s) of pain. That is, focusing on unaffected or less affected zones other than main problem may confer indirect benefit but leave the largest source of tension and myofascial pathology relatively untouched.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. However, drugs, air, and other material that enters or is injected into the epidural space can course through this valveless system and reach the heart or brain.

The epidural venous plexus communicates with the lumbar veins of the inferior vena caval system as well as the azygous system, the basivertebral vein, and the intracranial venous sinuses, including the sigmoid, occipital, and basilar venous sinuses. The epidural venous plexus extends its reach to the iliac veins through the sacral venous plexus.

The cerebrospinal venous system redistributes blood and equalizes pressure throughout the extensive valveless network.[2] The rich anastomosis between the vertebral venous system and the intracranial veins justifies the introduction of spinal level GV points for seizures and other intracranial conditions.

- **Dorsal branches of right and left 11th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery feed the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

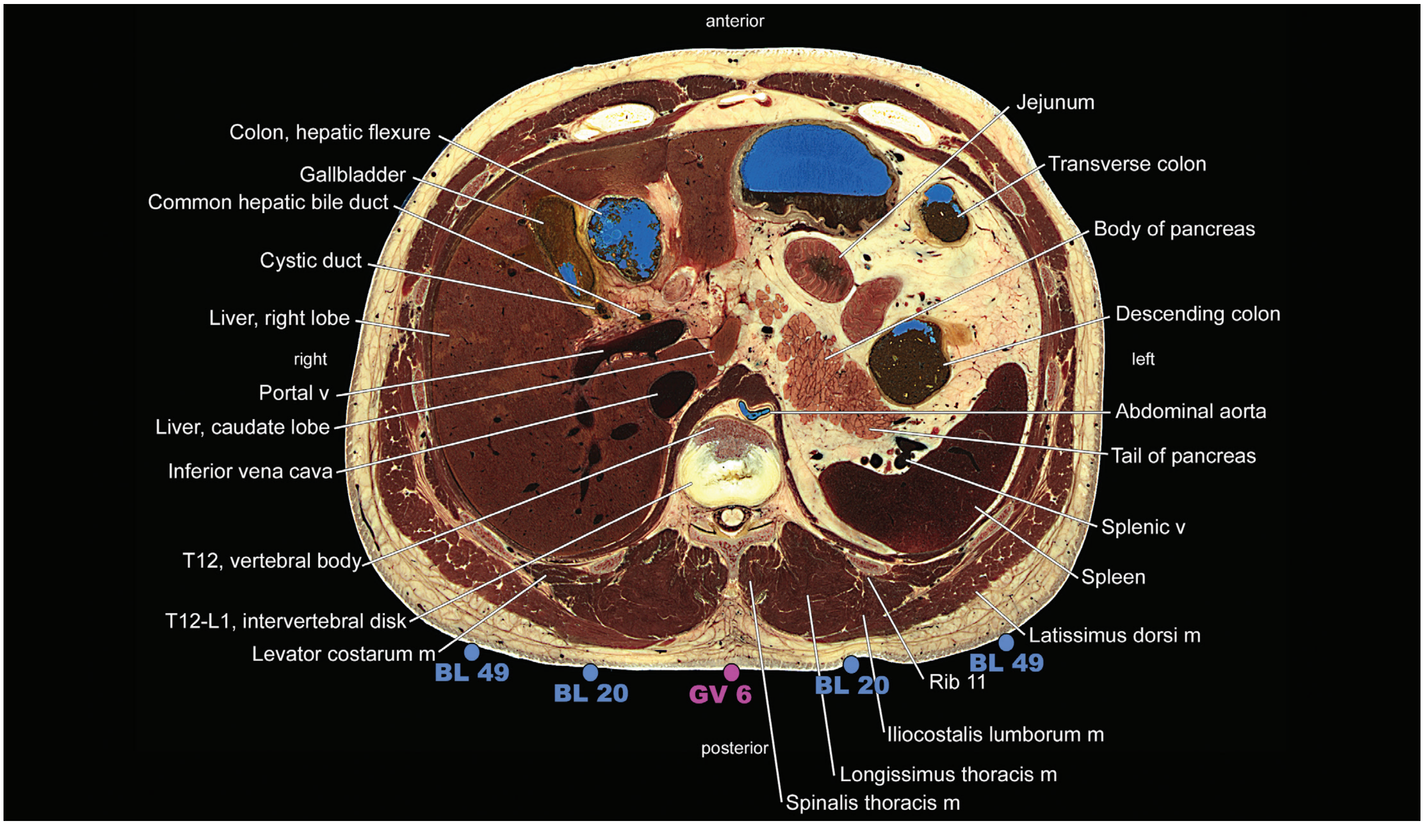

anterior
Colon, hepatic flexure
Gallbladder
Common hepatic bile duct
Cystic duct
Liver, right lobe
right
Portal v
Liver, caudate lobe
Inferior vena cava
T12, vertebral body
T12-L1, intervertebral disk
Levator costarum m
BL 49
BL 20
GV 6
posterior
Jejunum
Transverse colon
Body of pancreas
Descending colon
left
Abdominal aorta
Tail of pancreas
Splenic v
Spleen
Latissimus dorsi m
BL 49
BL 20
Rib 11
Iliocostalis lumborum m
Longissimus thoracis m
Spinalis thoracis m

Figure 14-22. This cross-section highlights the diversity of somatic and visceral structures potentially affected by neuromodulation at GV 6.

Indications and Potential Point Combinations

- **Thoracolumbar back pain or stiffness:** GV 6, BL 20, BL 21, BL 23, tender trigger points, BL 40, BL 60.
- **Seizures:** GV 6, GV 20, GV 24.5, BL 10, ST 36, LR 3, HT 7.
- **Abdominal distension, bloating, flatulence:** GV 6, BL 20, BL 21, BL 49, ST 36.

References

1. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. *Movement, Stability and Low Back Pain: The Essential Role of the Pelvis.* New York: Churchill Livingstone, 1997.

2. Tobinick E. The cerebrospinal venous system: anatomy, physiology, and clinical implications. *Medscape CME.* Obtained at http://cme.medscape.com/viewarticle/522597 on 06-05-10.

3. Berhane T, Vetrhus M, Hausken T, et al. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: The results of a prospective study. *Scandinavian Journal of Gastroenterology.* 2006;41:93-101.

GV 7

Zhong Shu “Central Pivot”

On the dorsal midline, in the depression caudal to the T10 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

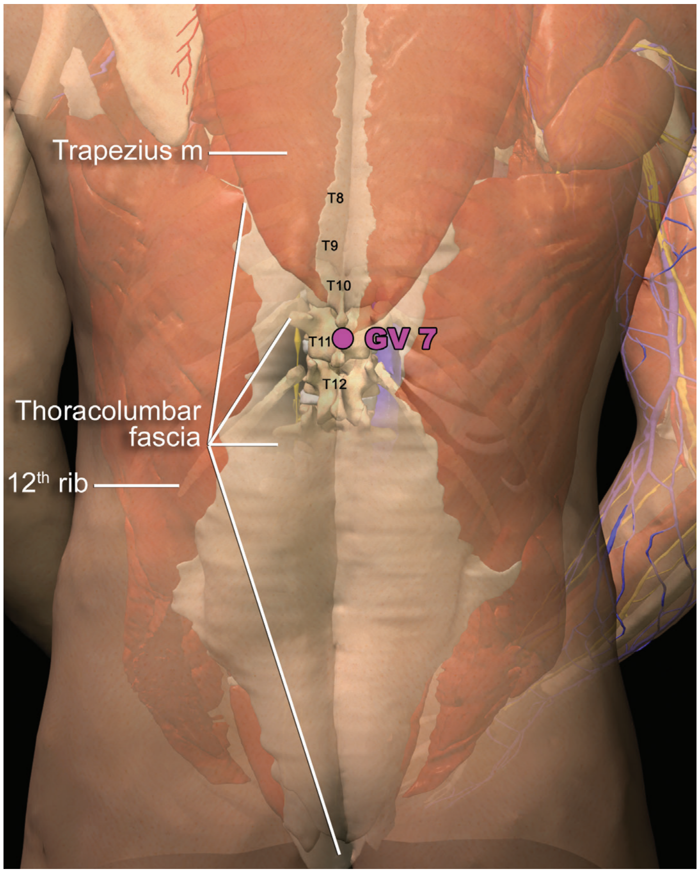


Figure 14-23. The descriptive names for GV 7, “Central Pivot”, “Spinal Center” (GV 6) and “Suspended Pivot” (GV 5) connote the anatomy and function of the spine. Lines defined by each border of the trapezius and the contralateral 12th rib intersect, or “pivot” around GV 7, hence its name. This image exposes the thoracolumbar fascia in its full extent, from T8 to the tip of the sacrum. A segment of the sympathetic chain of paraspinal ganglia appears just to the left of GV 7 and the inferior vena cava to its right.

Clinical Relevance: The midline connective tissues can be viewed as an integrated complex, called the “interspinous-supraspinous-thoracolumbar (IST) ligamentous complex”.[1] It has been likened to a connective tissue sleeve, or stocking, linking the thoracolumbar fascia to the anterior longitudinal ligament of the spine. This functional connectivity allows the various components to work in an organized manner.

Furthermore, structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Thoracolumbar fascia, in particular its dorsal (posterior) layer, facilitates load transfer between the spine, pelvis, and legs. Examine the connections it makes with major movers of the torso as shown in Figures 14-15, 14-16, and 14-19.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its caudal connection to the thoracic spine at GV 7 and thereabouts may aid in the resolution of tension and strain patterns in the back, neck, and head.

Nerves

- **Dorsal rami of thoracic spinal nerves from T10 and nearby spinal segmental levels:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 7 and the somatosomatic as well as somatovisceral reflex connections therefrom, neuromodulatory opportunities exist for treating back pain, splenic disorders, hepatobiliary dysfunction, and upper gastrointestinal disorders. For example, over a quarter of patients with symptomatic gallstone disease report back pain referred to the vicinity of GV 7, level with BL 19 and BL 48 – see Figure 14-24.[2]

GV points act on midline anatomy and neuromodulate by means of the medial branch of the dorsal primary ramus of the related spinal nerve. Points on the inner BL line have the capacity to

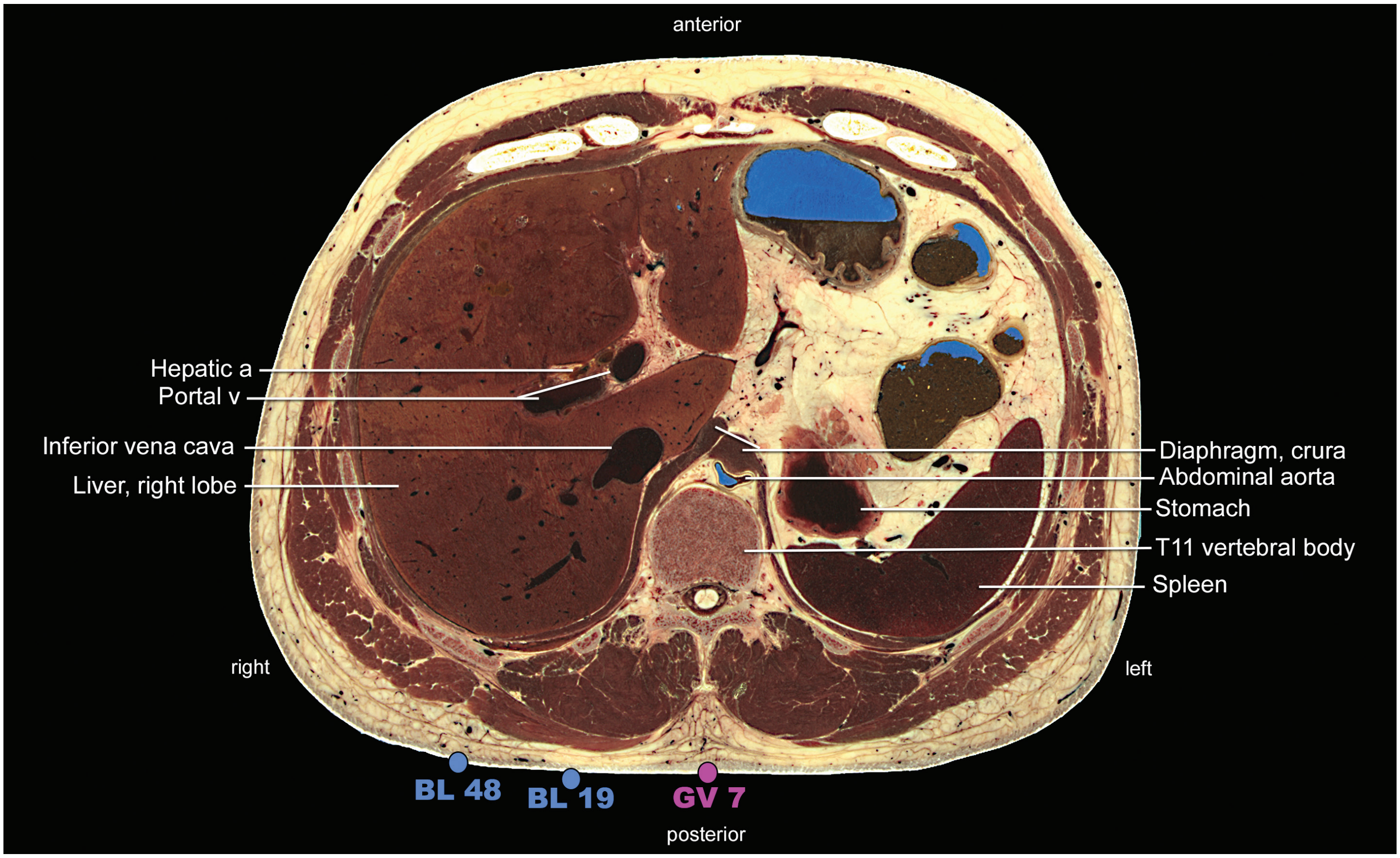


Figure 14-24. This cross-section, level with GV 7, BL 19, and BL 48, shows the liver and spleen, i.e., structures charged with cleansing and, when necessary, producing blood.

influence both the medial and lateral branches of the dorsal primary rami, while outer BL line points impact predominantly the lateral branch. Even though points on the inner and outer BL channels initiate somatic afferent stimulation through different branches, the end clinical result often overlaps because sensory fibers from both locations travel through similar spinal nerves, destined to the same or adjacent spinal cord segments. One can select an interspinous GV line point at the same level to bolster spinal segmental attention.

Note that BL points on the back interact with muscle tissue whereas GV points largely do not. This translates into activating fewer types of nerve endings and mechanoreceptors with the latter, leading to less of a neuromodulatory impact compared to BL points. Treating only GV points for back pain would neglect the role of myofascial trigger point pathology its generation and perpetuation.

A “compromise” point location between GV points and the inner BL line is denoted by the Huatuojiaji point group. These sites occur at each vertebral level, 0.5 cun from midline. They target both muscle tissue and potentially both medial and lateral branches of the dorsal primary ramus, depending on the spinal level.

Treating back pain effectively requires astute palpation in order to define which muscles, fascial layers, and trigger points are causing problems. Acupuncture needling, manual therapy, and laser treatment can then target the actual source(s) of pain. That is, focusing on unaffected or less affected zones other than main problem may confer indirect benefit but leave the largest source of tension and myofascial pathology relatively untouched.

Vessels

- Posterior external vertebral venous plexus: This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.
- **Dorsal branches of right and left 10th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Stiffness or pain in the thoracic spine on the midline:** GV 7, local tender points.
- **Icterus:** GV 7, BL 18, BL 19, ST 36, LR 3.
- **Cholelithiasis referring to the midback:** GV 7, BL 19, GB 24, ST 36, CV 12.
- **Nausea, vomiting:** GV 7, PC 6.

References

1. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. *Movement, Stability and Low Back Pain: The Essential Role of the Pelvis*. New York: Churchill Livingstone, 1997.
2. Berhane T, Vetrhus M, Hausken T, et al. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: The results of a prospective study. *Scandinavian Journal of Gastroenterology*. 2006;41:93-101.

GV 8

Jin Suo "Sinew Contraction"

On the dorsal midline, in the depression caudal to the T9 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: The midline connective tissues can be viewed as an integrated complex, called the "interspinous-supraspinous-thoracolumbar (IST) ligamentous complex".[1] It has been likened to a connective tissue sleeve, or stocking, linking the thoracolumbar fascia to the anterior longitudinal ligament of the spine. This functional connectivity allows the various components to work in an organized manner.

Furthermore, structural linkages between the thoracolumbar fascia, multifidus myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing thoracolumbar fascia tension and restriction.

Thoracolumbar fascia, in particular its dorsal (posterior) layer, facilitates load transfer between the spine, pelvis, and legs. Examine the connections it makes with major movers of the torso as shown in Figures 14-15, 14-16, and 14-19.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its caudal connection to the thoracic spine at GV 8 and thereabouts may aid in the resolution of tension and strain patterns in the back, neck, and head.

Nerves

- **Dorsal rami of thoracic spinal nerves from T9 and nearby spinal segmental levels:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Considering the spinal segmental nerve supply for GV 8 and the somatosomatic as well as somatovisceral reflex connections therefrom, neuromodulatory opportunities exist for treating back pain, splenic disorders, hepatobiliary dysfunction, upper gastrointestinal disorders, and caudal lung lobe disease. To illustrate the viscerosomatic connection between the gallbladder and caudal mid-thoracic region, over a quarter of patients with symptomatic gallstone disease report back pain referred to the vicinity of GV 8, level with BL 18 and BL 47 – see Figure 14-26.[3]

GV points act on midline anatomy and neuromodulate by means of the medial branch of the dorsal primary ramus of the related spinal nerve. Points on the inner BL line have the capacity to influence both the medial and lateral branches of the dorsal primary rami, while outer BL line points impact predominantly the lateral branch. Even though points on the inner and outer BL channels initiate somatic afferent stimulation through different branches, the end clinical result often overlaps because sensory fibers from both locations travel through similar spinal nerves, destined to the same or adjacent spinal cord segments. One can select an interspinous GV line point at the same level to bolster spinal segmental attention.

Note that BL points on the back interact with muscle tissue whereas GV points largely do not. This translates into activating fewer types of nerve endings and mechanoreceptors with the latter, leading to less of a neuromodulatory impact compared to BL points. Treating only GV points for back pain would neglect the role of myofascial trigger point pathology its generation and perpetuation.

A "compromise" point location between GV points and the inner BL line is denoted by the Huatuojiaji point group. These sites occur at each vertebral level, 0.5 cun from midline, as depicted in Figures 14-25A and 14-26. Huatuojiaji points target both muscle tissue and potentially both medial and lateral branches of the dorsal primary ramus, depending on the spinal level. In Figure 14-26, note the distinct difference in muscle tissue "marbling" and fibrous tissue distribution between the transversospinalis group and the longissimus/iliocostalis muscles. Muscles that surround the trunk, including the latissimus dorsi and external abdominal oblique muscles, exhibit another characteristic appearance altogether.

Treating back pain effectively requires astute palpation in order to define which muscles, fascial layers, and trigger points are causing problems. Acupuncture needling, manual therapy, and laser treatment can then target the actual source(s) of pain. That

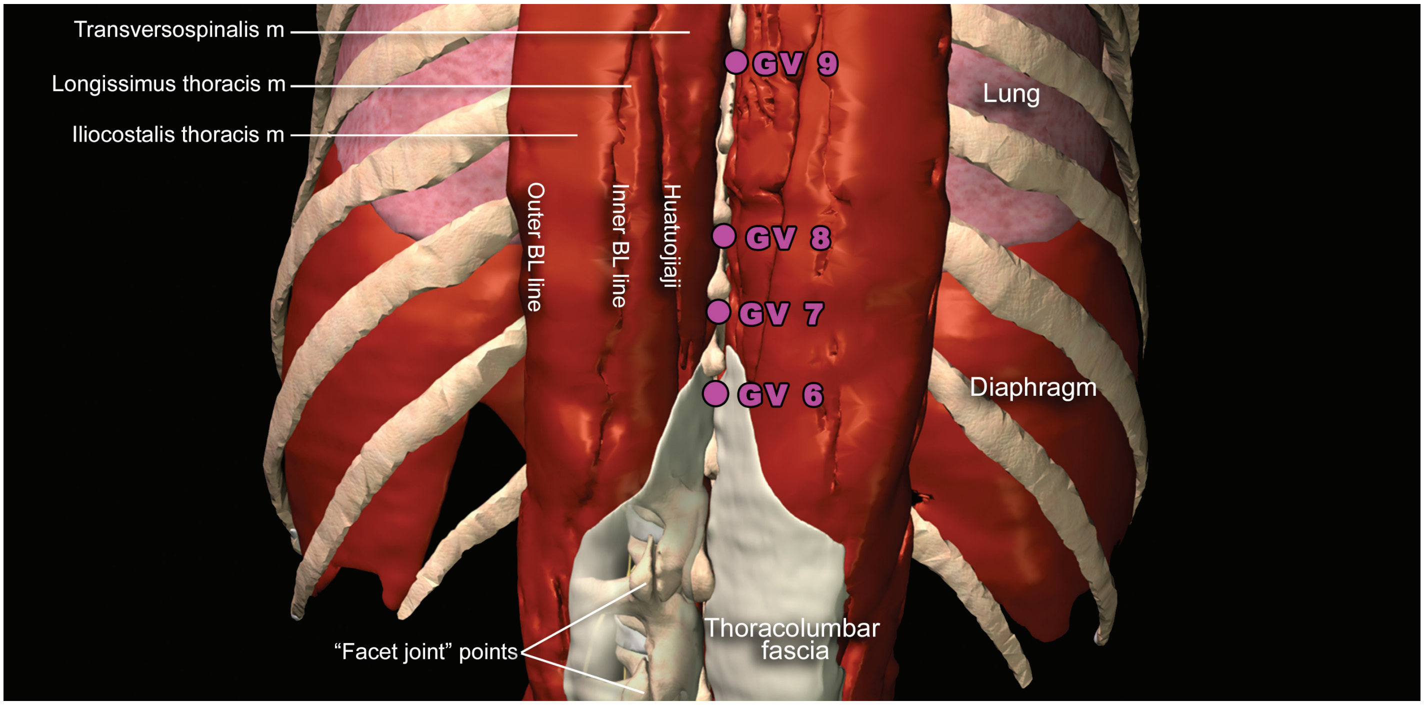

Transversospinalis m
Longissimus thoracis m
Iliocostalis thoracis m
GV 9
Lung
Outer BL line
Inner BL line
Huatuojiaji
GV 8
GV 7
GV 6
Diaphragm
"Facet joint" points
Thoracolumbar fascia

Figure 14-25A. By removing the trapezius muscle and the dorsal layer of thoracolumbar fascia, the erector spinae muscles appear clearly as do their borders. The grooves that divide them define the inner and outer BL lines as well as the Huatuojiaji points, about 0.5 cun from the midline at each vertebral level. The midline denotes the GV pathway, while "facet joint" points occur approximately 1 cun from the midline. One names Huatuojiaji and facet joint points by their vertebral level, as they are found at each one, in contrast to GV and BL points which carry distinct alphanumeric designations that differ from the standard vertebral numbering system.

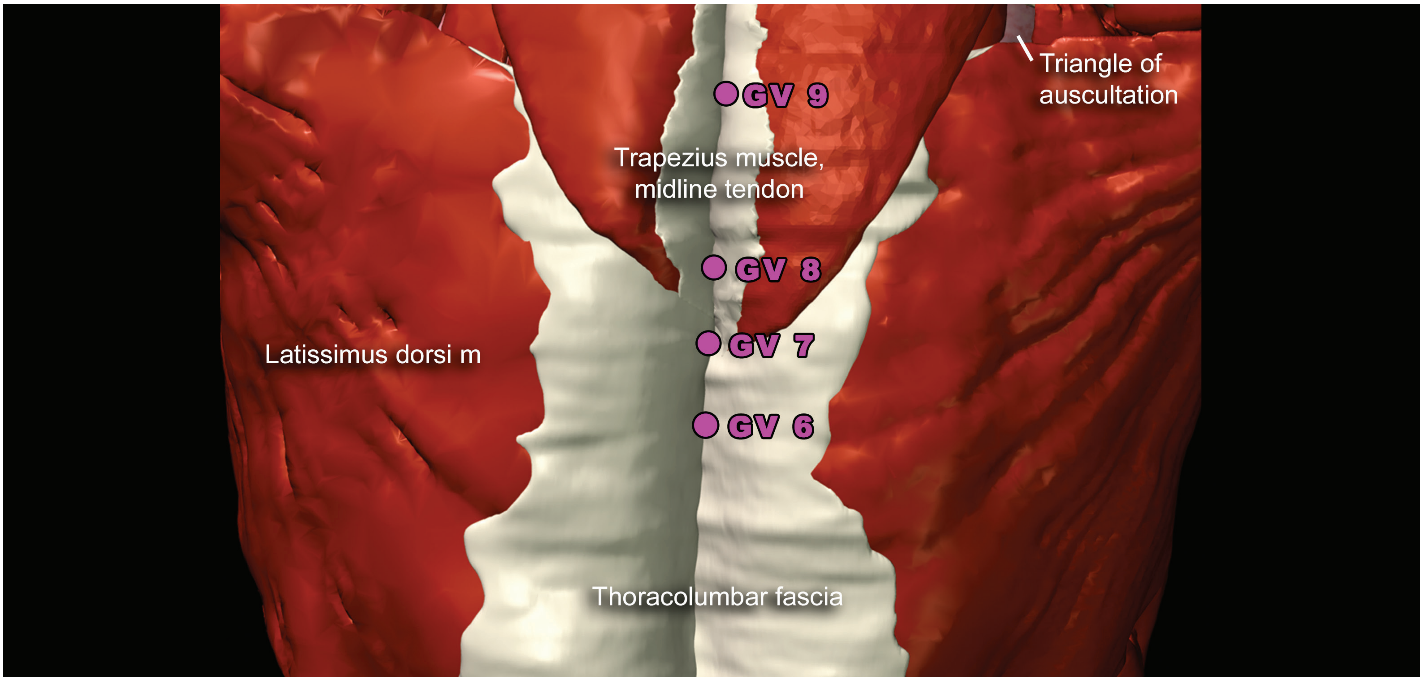

GV 9
Triangle of auscultation
Trapezius muscle, midline tendon
GV 8
GV 7
Latissimus dorsi m
GV 6
Thoracolumbar fascia

Figure 14-25B. The name for GV 8 of "Sinew Contraction" speaks of the intersecting lines of force generated at GV 8 by the trapezius muscle and thoracolumbar fascia.

is, focusing on unaffected or less affected zones other than main problem may confer indirect benefit but leave the largest source of tension and myofascial pathology relatively untouched.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

- **Juncture of the hemiazygous, accessory hemiazygous, and azygous veins from T6 to T9:**[2] (See Figure 14-25C.)

The left side of the caudodorsal body wall drains into the hemiazygous vein caudal to the connection with the azygous vein across the mid-thoracic vertebral bodies.

Cranial to the hemiazygous-azygous juncture at about T8, the accessory hemiazygous vein drains the posterior body wall. The hemiazygous vein begins as a continuation of the left ascending lumbar vein below the diaphragm. It ascends through the left intermediate crus of the diaphragm and travels up the caudal mediastinum to reach the vertebral body of T8 or T9. Somewhere between T6 and T9, the hemiazygous vein crosses the midline dorsal to the esophagus and descending thoracic aorta and ventral to the spine, headed to the azygous vein, into which it drains. The accessory hemiazygous vein also courses vertically along the dorsal mediastinum, left of T5-6 and T7-8. Its drainage pattern varies; at its cranial extent, it may form a continuous vessel with the left superior intercostal vein or drain into it. At its caudal end, it either joins with the hemiazygous vein or crosses obliquely ventral to the T7-T8 vertebrae to join the azygous vein directly.

- **Dorsal branches of right and left 9th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Spinal pain or stiffness:** GV 8, GV 4, BL 23, local tender points and areas of myofascial dysfunction.

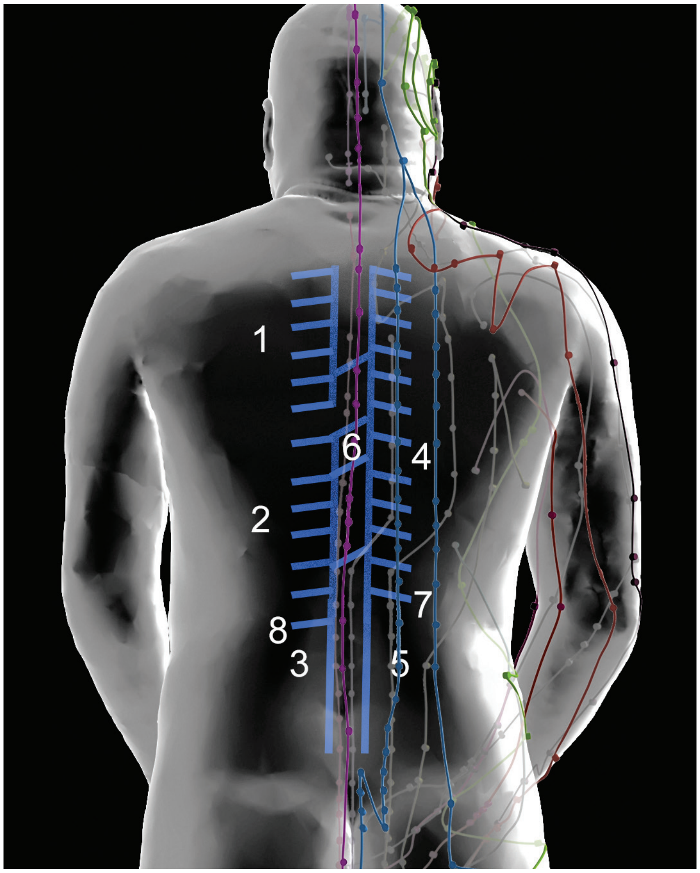


Figure 14-25C. Azygous system of veins. GV, as a singular vessel, embodies not only the vertebral venous plexuses but also the azygous venous network that drains deoxygenated blood from the dorsal body wall. The azygous system communicates directly with the vertebral venous plexuses as well as bronchial and pericardial veins, though anatomic variations occur often. In most cases, the azygous vein (4), exists only on the right side, formed from the union of the ascending lumbar (5) and right subcostal (7) veins. At its cranial extent (not shown), the azygous vein arches over the right main bronchus at the root of the lung to join the superior vena cava. The azygous system is asymmetrical, as this diagram indicates. That is, while deoxygenated blood from the right side of the back drains directly into the azygous, blood from the left caudal dorsal body wall drains into the hemiazygous (2), a vein that begins as the left ascending lumbar vein (3) or left renal vein (8). Venous blood from the left cranial back empties into the accessory hemiazygous (1) vein. The hemiazygous and accessory hemiazygous become tributaries of the azygous by means of any number of adjoining branches that cross the midline (6).

- **Impaired circulation to the spinal cord (compressive myelopathy, spinal cord infarction, etc.):** GV, Huatuojiaji, and facet joint points related to involved spinal segmental and vertebral levels. Laser, acupuncture, and soft tissue manual therapy to be applied gently.

References

1. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to back pain. In: Vleeming A, Mooney V, Snijders CJ, et al. *Movement, Stability and Low Back Pain: The Essential Role of the Pelvis.* New York: Churchill Livingstone, 1997.
2. Chen HJJ. Absence of the left brachiocephalic vein with venous return through the left superior intercostal vein: CT findings. *Journal of Thoracic Imaging.* 2008;23(3):202-205.
3. Berhane T, Vetrhus M, Hausken T, et al. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: The results of a prospective study. *Scandinavian Journal of Gastroenterology.* 2006;41:93-101.

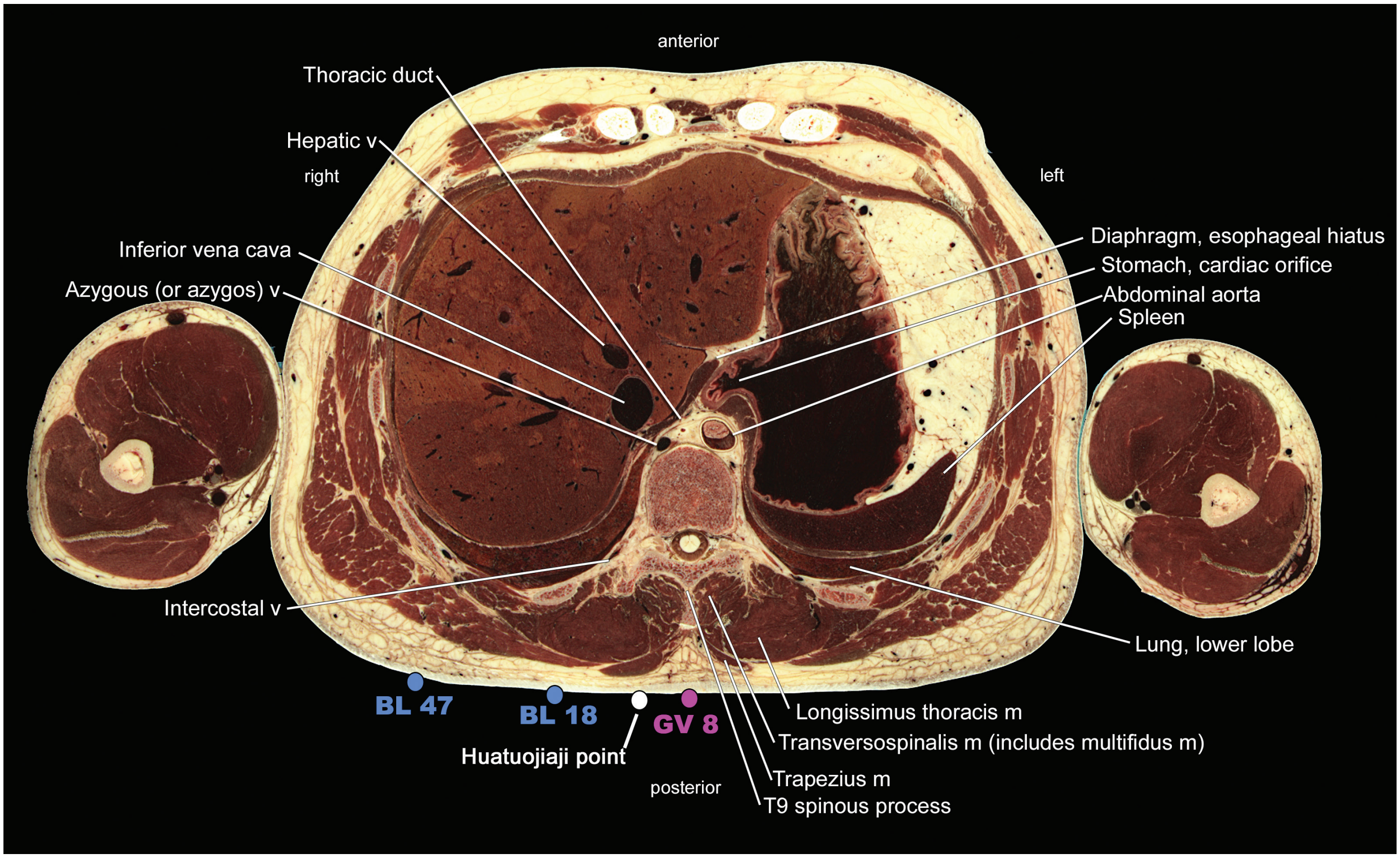

anterior
Thoracic duct
Hepatic v
right
left
Inferior vena cava
Azygous (or azygos) v
Diaphragm, esophageal hiatus
Stomach, cardiac orifice
Abdominal aorta
Spleen
Intercostal v
Lung, lower lobe
BL 47
BL 18
GV 8
Huatuojiaji point
Longissimus thoracis m
Transversospinalis m (includes multifidus m)
Trapezius m
posterior
T9 spinous process

Figure 14-26. Communication between the azygous and hemiazygous veins takes place between T6 and T9 on the ventral border of the vertebral bodies. The azygous vein appears in this cross section to the left of the aorta. The right intercostal vein shown here making its way toward the azygous is draining the posterior body wall. Deoxygenated blood from the caudal wall of the thorax will drain into the azygous system of veins and ultimately into the superior vena cava. The azygous vein communicates with the vertebral venous plexuses and mediastinal, esophageal, and bronchial veins.

GV 9

Zhi Yang "Reaching Yang"

On the dorsal midline of the thorax, in the depression caudal to the spinous process T7. Approximately level with the caudal angle of the scapula.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae. In the lumbar spine, the connective tissue of the supraspinous ligament arises from the midline attachments of the dorsal layer of the thoracolumbar fascia as well as the longissimus and multifidus muscles. Dense connective tissue fibers from the thoracolumbar fascia form distinctive bands that cross the midline and then merge with fibers from the other side to form the supraspinous and interspinous ligaments.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. The interspinous ligaments may represent an extension of thoracolumbar fascia.
- **Thoracolumbar fascia:** An extensive fascial sheet that encloses the deep muscles of the back, with lateral attachments to the internal oblique and transversus abdominis muscles.

Clinical Relevance: Structural linkages between the thoracolumbar fascia, transversospinalis group myofascia, supraspinous and interspinous ligaments, ligamentum flavum, and facet joint capsules, offer opportunities to reduce pain and debility from facet dysfunction by addressing tension and restriction in the thoracolumbar fascia. This multilayered structure, i.e., the thoracolumbar fascia facilitates load transfer between the spine, pelvis, and legs. The fascia begins to dissipate at about the level of GV 9. Review its anatomy in Figures 14-25A and 14-25B.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its caudal connection to the thoracic spinous processes at GV 9 and thereabouts may aid in the resolution of tension and strain patterns in the back, neck, and head.

Nerves

- **Dorsal rami of thoracic spinal nerves from T7 and nearby spinal segmental levels:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

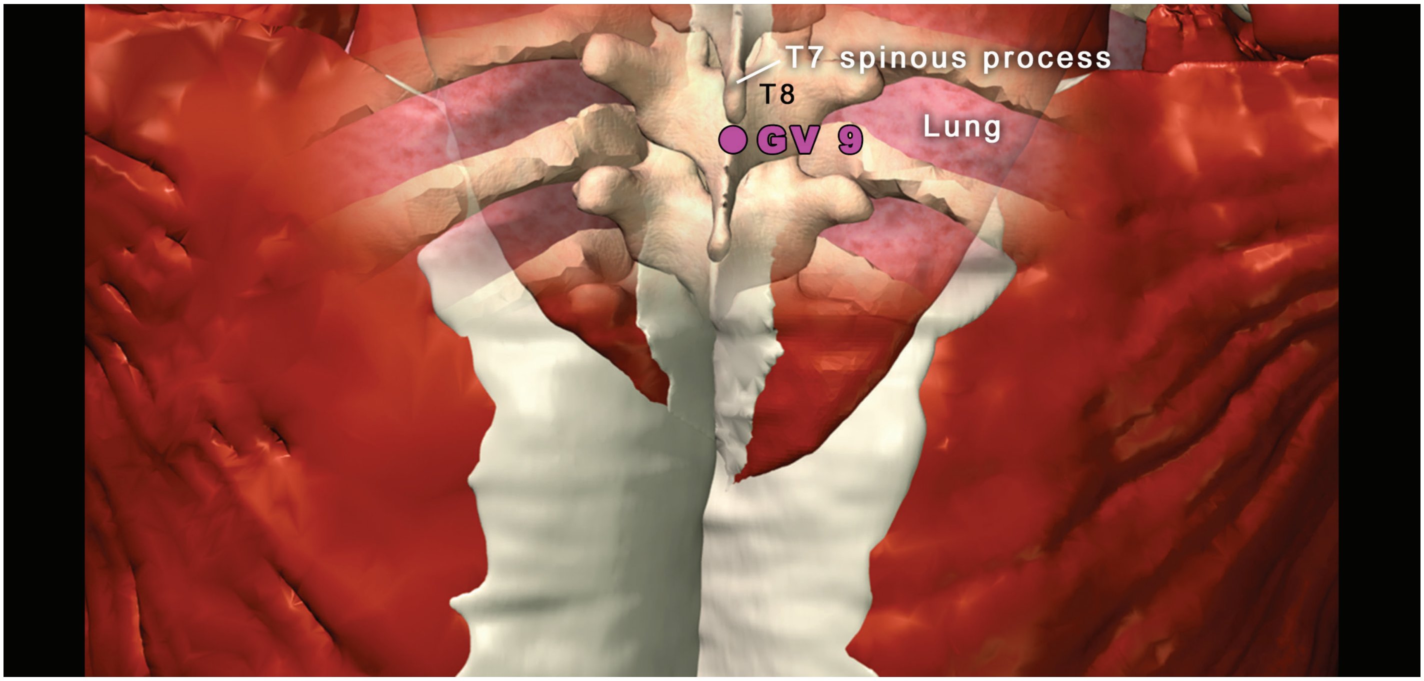


Figure 14-27. At "Reaching Yang" or GV 9, the GV channel reaches the thorax, filled by air-filled lungs (in the living individual). This contrasts with GV 8, located over the organ-dense abdomen (c.f. Figure 14-26). In Chinese medicine, chambers harboring air or empty space are considered "Yang" whereas solid or fluid-filled structures fall in the complementary "Yin" category. In this image, a window created through the dorsal musculature of the back allows visualization of the underlying lung tissue which, in the living individual, would expand with inspiration.

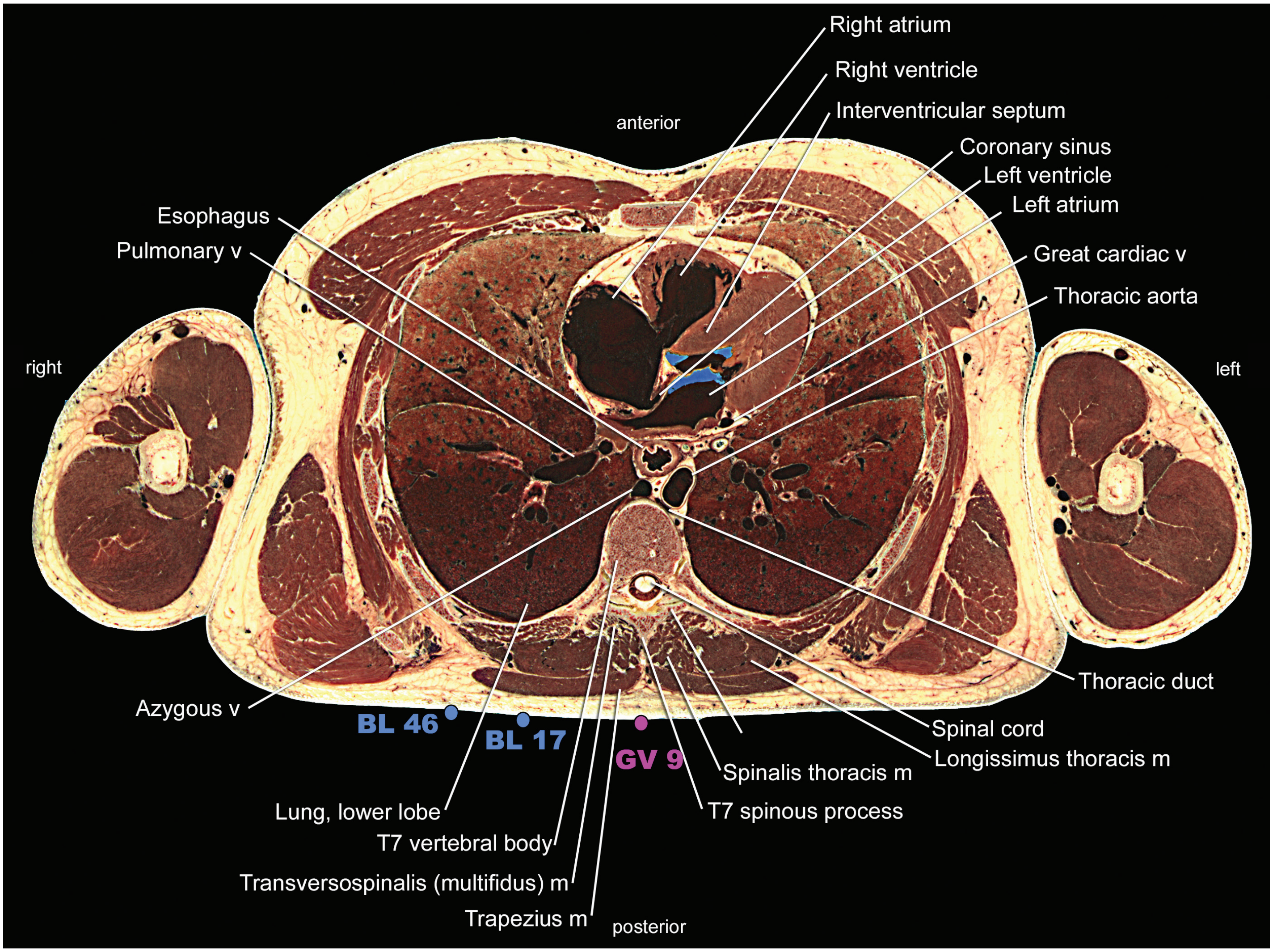

Right atrium
Right ventricle
Interventricular septum
anterior
Coronary sinus
Left ventricle
Left atrium
Esophagus
Pulmonary v
Great cardiac v
Thoracic aorta
right
left
Thoracic duct
Azygous v
BL 46
BL 17
GV 9
Spinal cord
Longissimus thoracis m
Spinalis thoracis m
T7 spinous process
Lung, lower lobe
T7 vertebral body
Transversospinalis (multifidus) m
Trapezius m
posterior

Figure 14-28. GV 9, GV 10, and GV 11 relate to diverse intrathoracic structures, including the heart, lungs, and esophagus. This horizontal plane also contains critical conduits such as the azygous venous network, pulmonary vein, thoracic duct, and aorta. Note, as well, the depth of myofascial tissue available for treatment through acupuncture and related techniques deep to GV 9. Not labeled but evident is the connection about to happen between the left posterior intercostal vein and the azygous system on the ventrolateral vertebral body of T7.

Clinical Relevance: Spinal segmental influences begat by neuromodulatory treatment at GV 9 may benefit problems associated with the back (via somatosomatic effects), vascular flow (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Both cardiopulmonary and cranial abdominal organs may refer pain to the mid-back. Note the numerous layers of connective tissue deep to GV 9 in Figure 14-28 as well as the multitude of vessels, including the thoracic duct, aorta, and azygous vein, shown ventral to the vertebral body of T7. This indicates that it may be possible to neuromodulate a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal primary ramus at GV 9.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.
- **Juncture of the hemiazygous, accessory hemiazygous, and azygous veins from T6 to T9:**[1] (See Figure 14-25C.) The left side of the caudodorsal body wall drains into the hemiazygous vein caudal to the connection with the azygous vein across the mid-thoracic vertebral bodies. Cranial to the hemiazygous-azygous juncture at about T8, the accessory hemiazygous vein drains the posterior body wall. The hemiazygous vein begins as a continuation of the left ascending lumbar vein below the diaphragm. It ascends through the left intermediate crus of the diaphragm and travels up the caudal mediastinum to reach the vertebral body of T8 or T9. Somewhere between T6 and T9, the hemiazygous vein crosses the midline dorsal to the esophagus and descending thoracic aorta and ventral to the spine, headed to the azygous vein, into which it

drains. The accessory hemiazygous vein also courses vertically along the dorsal mediastinum, left of T5-6 and T7-8. Its drainage pattern varies; at its cranial extent, it may form a continuous vessel with the left superior intercostal vein or drain into it. At its caudal end, it either joins with the hemiazygous vein or crosses obliquely ventral to the T7-T8 vertebrae to join the azygous vein directly.

- **Dorsal branches of right and left 7th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Diaphragmatic irritation:** GV 9, BL 17, CV 16, KI 22.
- **Dysphagia:** GV 9, CV 22, CV 12, BL 10.
- **Pneumonia, cough, dyspnea:** GV 9, LU 1, LU 2, BL 13, BL 14, ST 36.
- **Cholecystitis, hepatitis:** GV 9, BL 18, BL 19, ST 36, GB 34.
- **Midthoracic pain:** GV 9 and areas of myofascial tenderness to palpation as indicated by palpation. Examine the region for sources of referred pain to this section of the back.

Evidence-Based Applications

- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 helped relieve symptoms related to **narcotic drug withdrawal.**[2]
- Moxibustion at GV 14, GV 9, and GV 4 produced **greater elevation of temperature** in the **lumbar region** than did administration of moxibustion at a single site, GV 14.[3] This makes sense, in that with the three-point application, GV 4 is in the lumbar region.
- Violet laser acupuncture applied to GV 14 raised **skin temperature** at GV 9, a "far field" point, indicating that thermal changes can occur at a distance from the stimulation site.[4]

References

1. Chen HJJ. Absence of the left brachiocephalic vein with venous return through the left superior intercostal vein: CT findings. *Journal of Thoracic Imaging*. 2008;23(3):202-205.
2. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.
3. Mori H, Tanaka TH, Kuge H, et al. Is there a difference between the effects of one-point and three-point moxibustion stimulation on skin temperature changes of the posterior trunk surface? *Acupunct Med*. 2012;30(1):27-31.
4. Litscher G, Wang L, Huang T, et al. Violet laser acupuncture – part 3: pilot study of potential effects on temperature distribution. *J Acupunct Meridian Stud*. 2011;4(3):164-167.

GV 10

Ling Tai "Spirit Tower" "Spirit Terrace"

On the posterior midline of the thorax, in the depression inferior to the spinous process of the 6th thoracic vertebra (T6).

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices.

Clinical Relevance: Strain in the spinal ligaments exhibit strain patterns that may significantly alter joint mechanics.[3] Disruption of the posterior ligamentous complex (PLC) or other forms of ligamentous damage may compromise spinal stability.[4] PLC components display an orderly sequence of rupture when traumatized, beginning with distraction of the facet joint capsules and edema of the interspinous ligament. Following that, the supraspinous, interspinous, and flavum ligaments may rupture. Considering the impact of trauma on the sites that house GV points of the spine, palpation and treatment of local interspinous tender locations with acupuncture and related techniques for individuals with back pain or history of spinal trauma may ease discomfort and speed healing.

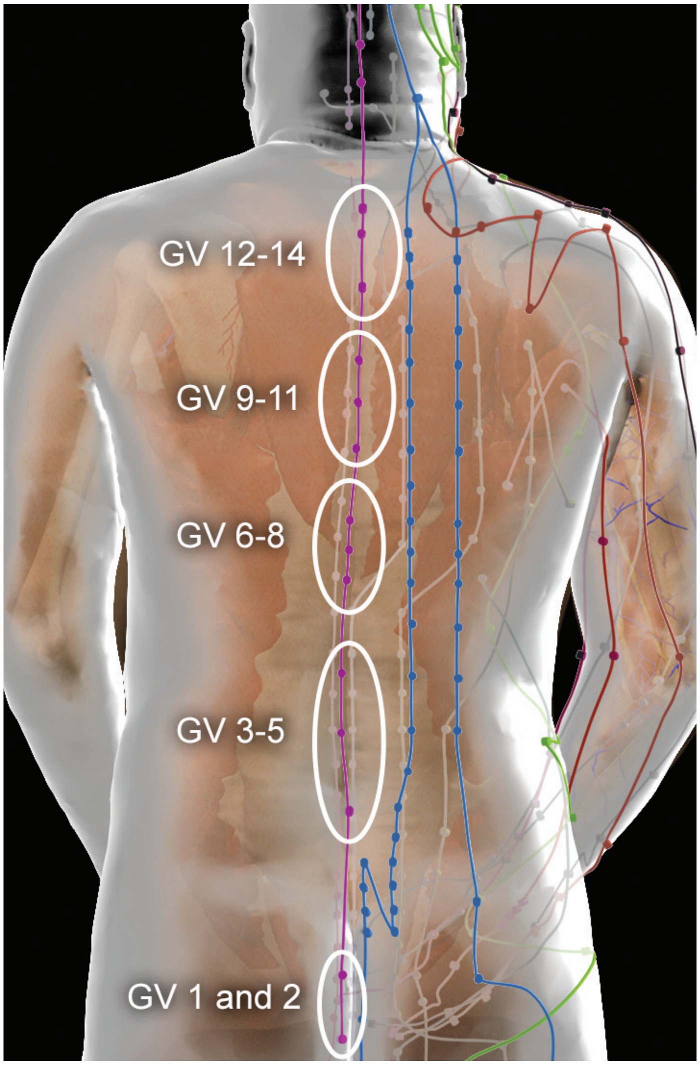


Figure 14-29. The name "Spirit Tower" or "Spirit Terrace" for GV 10 connotes an elevated locale from which a visionary or leader surveys her territory. With the spinal column as a platform and the heart where spirit resides (in ancient Chinese thought), GV 10 becomes a watchtower.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its attachment to the thoracic spinous processes near GV 10 and thereabouts may aid in the resolution of tension and strain patterns.

Nerves

- **Dorsal rami of thoracic spinal nerves from T6 and nearby spinal segmental levels:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Spinal segmental influences begat by neuromodulatory treatment at GV 10 may benefit problems associated with the back (via somatosomatic effects), vascular flow (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Dysfunction affecting the esophagus, heart, lungs, and cranial abdominal organs may refer pain to the mid-back. In fact, tenderness to palpation of GV 7, GV 8, GV 9, and GV 10 has been found to correspond with the presence of digestive disease.[5]

Note the numerous layers of connective tissue deep to GV 10 in Figure 14-30 as well as the multitude of vessels, including the thoracic duct, aorta, and azygous vein, housed ventral to the vertebral body. This indicates that it may be possible to neuromodulate a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal primary ramus at GV 10.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain

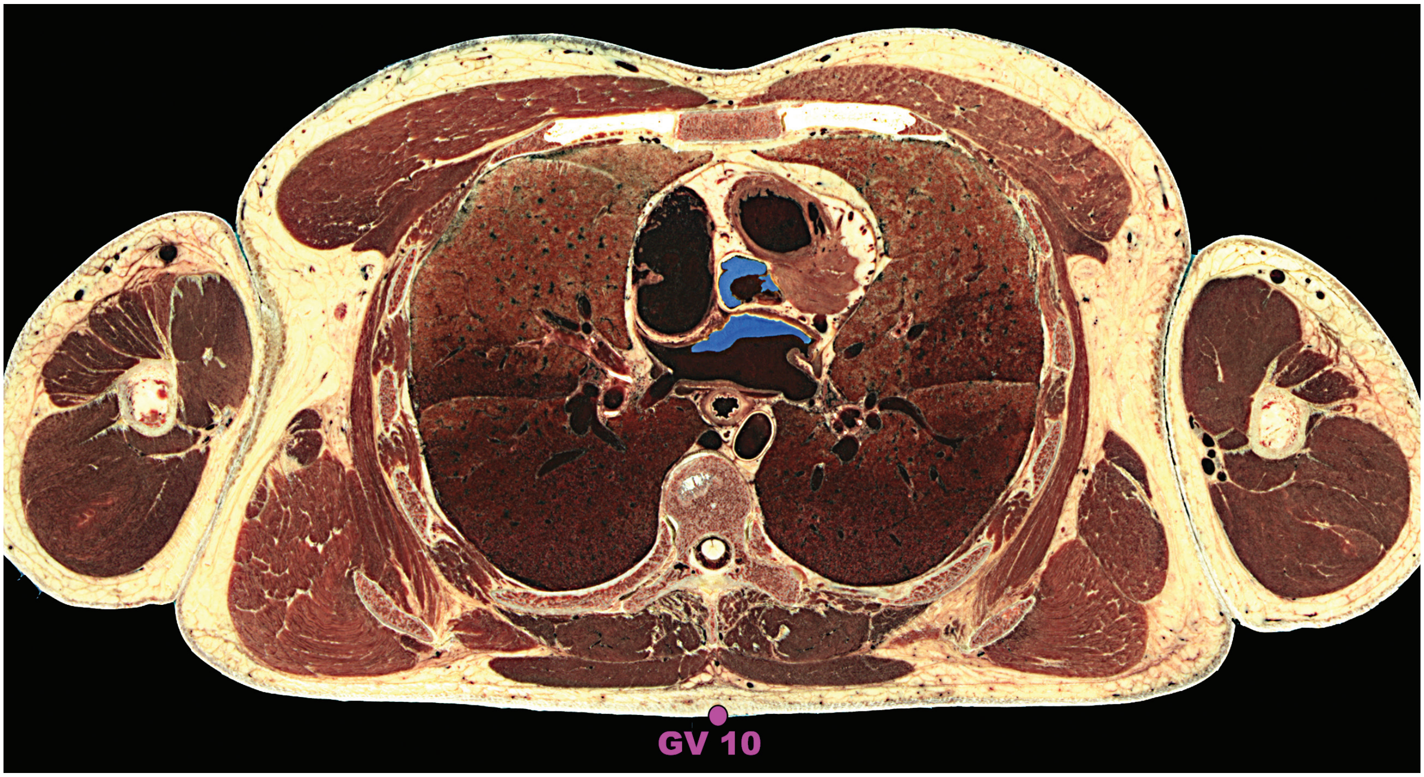


Figure 14-30. Ancient Taoists viewed the heart itself as a Sprit Tower (see Ellis et al in Grasping the Wind, p. 335). The relationship between GV 10 and the heart becomes clear with this cross section, as does the intimate association between the azygous vein, part of the GV, and the thoracic aorta (Chong Mai).

into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

- **Juncture of the hemiazygous, accessory hemiazygous, and azygous veins from T6 to T9:**[1] (See Figure 14-25C.) The left side of the caudodorsal body wall drains into the hemiazygous vein caudal to the connection with the azygous vein across the mid-thoracic vertebral bodies. Cranial to the hemiazygous-azygous juncture at about T8, the accessory hemiazygous vein drains the posterior body wall. The hemiazygous vein begins as a continuation of the left ascending lumbar vein below the diaphragm. It ascends through the left intermediate crus of the diaphragm and travels up the caudal mediastinum to reach the vertebral body of T8 or T9. Somewhere between T6 and T9, the hemiazygous vein crosses the midline dorsal to the esophagus and descending thoracic aorta and ventral to the spine, headed to the azygous vein, into which it drains. The accessory hemiazygous vein also courses vertically along the dorsal mediastinum, left of T5-6 and T7-8. Its drainage pattern varies; at its cranial extent, it may form a continuous vessel with the left superior intercostal vein or drain into it. At its caudal end, it either joins with the hemiazygous vein or crosses obliquely ventral to the T7-T8 vertebrae to join the azygous vein directly.
- **Dorsal branches of right and left 6th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Respiratory issues (asthma, cough, dyspnea):** GV 10, GV 14, BL 15, BL 14, LU 7, LI 4, ST 36, and local tender points.

- **Thoracic back pain and stiffness:** GV 10, BL 16, BL 23, local tender trigger points and restricted myofascial dysfunction.
- **Neck stiffness:** GV 10, GV 14, BL 10, GB 20, as well as tender and tense myofascial dysfunction.
- **Digestive disorders of the cranial abdomen:** Palpate GV 7, GV 8, GV, 9, GV 10, and nearby BL points to examine for patterns related to one of more internal organs. Verify with further diagnostics as needed. Treat tender locations, Back Shu and Front Mu points for involved organs. Add PC 6 and/or ST 36.

Evidence-Based Applications

- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 helped relieve symptoms related to **narcotic drug withdrawal.**[2]
- Eliciting tenderness to palpation of GV 7, GV 8, GV 9, and GV 10 during the myofascial evaluation portion of the physical examination may cause one to consider the presence of **digestive disease**,[6] including gallbladder dysfunction.[7]

References

1. Chen HJJ. Absence of the left brachiocephalic vein with venous return through the left superior intercostal vein: CT findings. *Journal of Thoracic Imaging*. 2008;23(3):202-205.
2. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.
3. Robertson DJ, Von Forell GA, Alsup J, et al. Thoracolumbar spinal ligaments exhibit negative and transverse pre-strain. *J Mech Behav Biomed Mater*. 2013;23C:44-52.
4. Pizones J, Zuniga L, Sanchez-Mariscal F, et al. MRI study of post-traumatic incompetence of posterior ligamentous complex: importance of the supraspinous ligament. Prospective study of 74 traumatic fractures. *Eur Spine J*. 2012;21:2222-2231.
5. Yang GY, Xu JS, and Wu ZX. Regular pattern of pain reaction by pressing along the Governor Vessel on the back in patients with digestive system disease. *Zhongguo Zhen Jiu*. 2012;32(2):135-137.
6. Yang GY, Xu JS, and Wu ZX. Regular pattern of pain reaction by pressing along the Governor Vessel on the back in patients with digestive system disease. *Zhongguo Zhen Jiu*. 2012;32(2):135-137.
7. Berhane T, Vetrhus M, Hausken T, et al. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: The results of a prospective study. *Scandinavian Journal of Gastroenterology*. 2006;41:93-101.

GV 11

Shen Dao "Spirit Pathway" "Spirit Path"

On the dorsal midline of the thorax, in the depression caudal to the T5 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices.

Clinical Relevance: Spinal ligaments exhibit strain patterns that may significantly alter joint mechanics.[4] Disruption of the posterior ligamentous complex (PLC) or other forms of ligamentous damage may compromise spinal stability.[5] PLC components display an orderly sequence of rupture when traumatized, beginning with distraction of facet joint capsules and edema of the interspinous ligament. Following that, the supraspinous, interspinous, and flavum ligaments may tear. When one anticipates the impact of trauma on interspinous sites along the GV line, palpation and treatment of tender locations with acupuncture and related techniques may ease discomfort and speed healing in individuals with back pain or history of spinal trauma.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its attachment to the thoracic spinous processes near GV 11 and thereabouts may aid in the resolution of thoracic tension and strain patterns.

Nerves

- **Dorsal rami of thoracic spinal nerves from T3-T5:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Spinal segmental influences begat by neuromodulatory treatment at GV 11 may benefit problems associated with the back (via somatosomatic effects), vascular flow (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Dysfunction affecting the esophagus, heart, lungs, and cranial abdominal organs may refer pain to the mid-back. It may be possible to neuromodulate

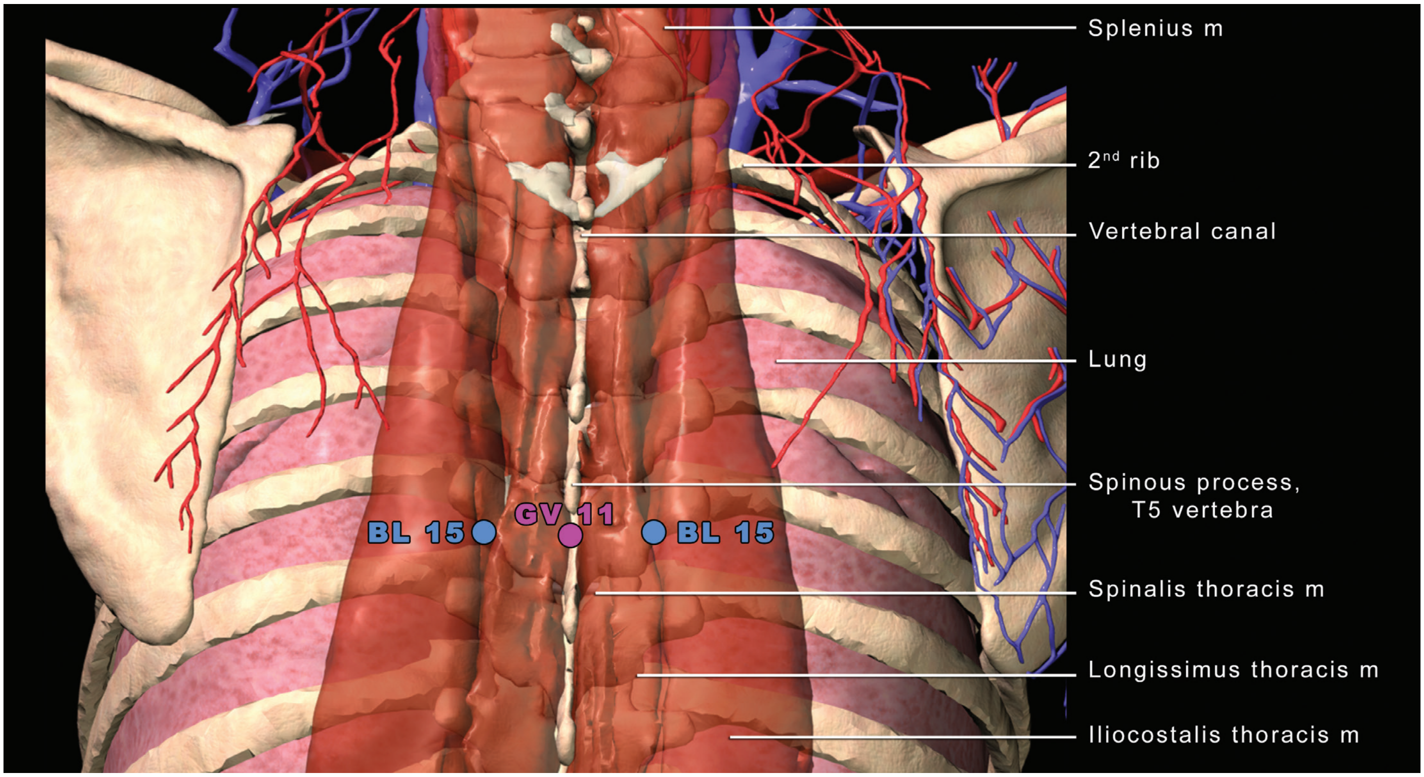


Figure 14-31. One finds GV 11, "Spirit Path", level with BL 15, the Back Shu points associated with the heart ("spirit residence"). Somatovisceral reflexes between the T5-T6 spinal segments and heart underlie these connections.

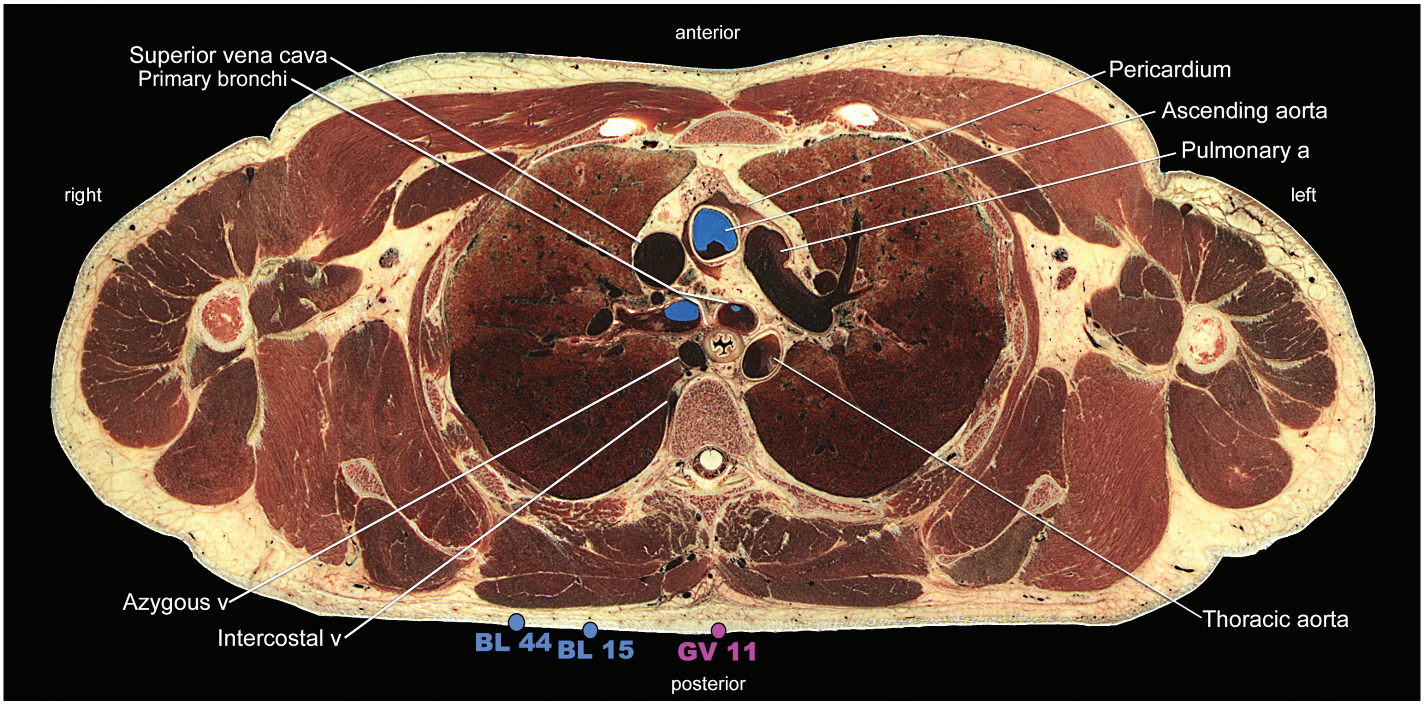


Figure 14-32. At its cranial extent, the azygous vein arches over the right main bronchus to join the superior vena cava. This cross-section cuts a plane just caudal to this connecting arch, exposing the two as separate structures on either side of the right primary bronchus. While somatovisceral reflexes provide a neuroanatomic pathway from GV 11 to the heart, deoxygenated blood reaches the heart by way of the azygous-superior vena caval connection. Either way, the name "Spirit Pathway" applies, given that "spirit" in Chinese medicine alludes to the heart as its home base.

a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal primary ramus at GV 11.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.
- **Dorsal branches of right and left 5th thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Tension in the back that radiates to the chest, intercostal neuralgia, back pain and stiffness:** GV 11, trigger points along the intercostal region, myofascial trigger points.
- **Fear, anxiety, sorrow, worry:** GV 11, BL 14, BL 15, GV 20, ST 36, SP 6, LU 7, CV 17.

Evidence-Based Applications

- Electroacupuncture at GV 11 and GV 16 suppressed both hyperemia and excessive glutamate release during and after transient ischemia in gerbils. Both hyperemia and excessive glutamate after ischemia may be important factors contributing to brain damage via reperfusion injury. This suggests that such suppression contributes to the neuroprotective effects of electroacupuncture in cases of **ischemic brain damage.**[1]

- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 helped relieve symptoms related to **narcotic drug withdrawal.**[2]
- A Chinese study reported that treating GV 11 with a retained needle resulted in reduced symptom scores and serum IgE levels in patients with **chronic urticaria.**[3]

References

1. Pang J, Itano T, Sumitani K, Negi T, and Miyamoto O. Electroacupuncture attenuates both glutamate release and hyperemia after transient ischemia in gerbils. *American Journal of Chinese Medicine*. 2003;31(2):295-303.

2. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.

3. Gao H, Li XZ, Ye WW, et al. (Chinese) Influence of penetrative needilng of Shendao (GV 11) on the symptoms score and serum IgE content in chronic urticaria patients. *Zhen Ci Yan Jiu*. 2009;34(4):272-275.

4. Robertson DJ, Von Forell GA, Alsup J, et al. Thoracolumbar spinal ligaments exhibit negative and transverse pre-strain. *J Mech Behav Biomed Mater*. 2013;23C:44-52.

5. Pizones J, Zuniga L, Sanchez-Mariscal F, et al. MRI study of post-traumatic incompetence of posterior ligamentous complex: importance of the supraspinous ligament. Prospective study of 74 traumatic fractures. *Eur Spine J*. 2012;21:2222-2231.

GV 12

Shen Zhu "Body Pillar"

On the dorsal midline of the thorax, in the depression caudal to the T3 spinous process.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices.

Clinical Relevance: Spinal ligaments may exhibit strain patterns that may significantly alter joint mechanics.[2] Disruption of the posterior ligamentous complex (PLC) or other forms of ligamentous damage may compromise spinal stability.[3] PLC components display an orderly sequence of rupture when traumatized, beginning with distraction of facet joint capsules and edema of the interspinous ligament. Following that, the supraspinous, interspinous, and flavum ligaments may tear. When one anticipates the impact of trauma on interspinous sites along the GV line, palpation and treatment of tender locations with acupuncture and related techniques may ease discomfort and speed healing in individuals with back pain or history of spinal trauma.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

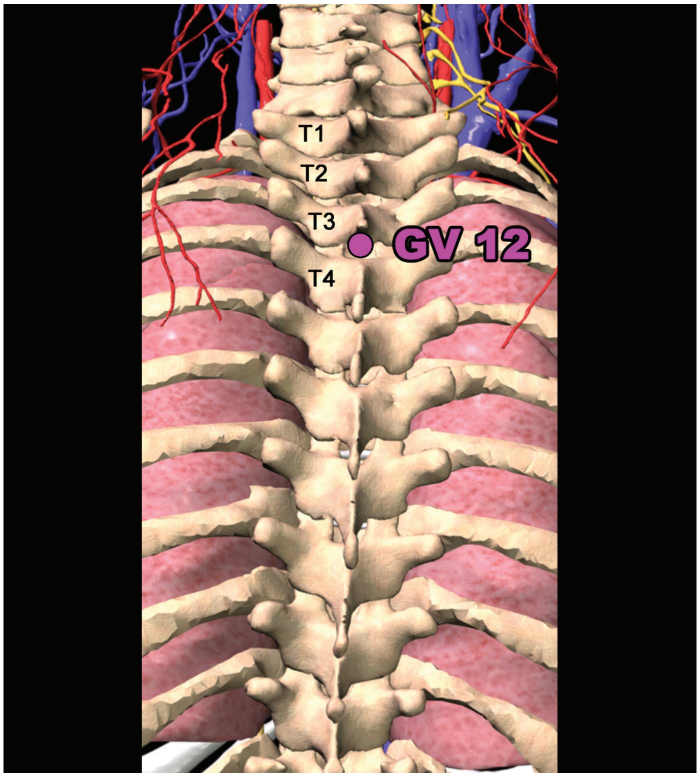


Figure 14-33. GV 12, called "Body Pillar" evokes the image of a weight-bearing column, i.e., the spine, with GV 12 sitting near the top.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its attachment to the thoracic spinous processes near GV 12 and thereabouts may aid in the resolution of thoracic tension and strain patterns.

Nerves

- **Dorsal rami of thoracic spinal nerves from T2-T3:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Spinal segmental influences begat by neuromodulatory treatment at GV 12 may benefit problems associated with the back (via somatosomatic effects), vascular flow (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Dysfunction affecting the esophagus, heart, lungs, and cranial abdominal organs may refer pain to the mid-back. It may be possible to neuromodulate a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal primary ramus at GV 12.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

In the cranial thorax, the epidural venous plexuses anastomose with the superior intercostal veins by way of the intervertebral veins.[1] This links the vertebral venous system to the systemic venous network. It allows blood from the neck and thoracic limbs to course in a caudal direction through the epidural venous plexuses to the superior intercostal vein and into the azygous vein. Additional cervicothoracic level communications between

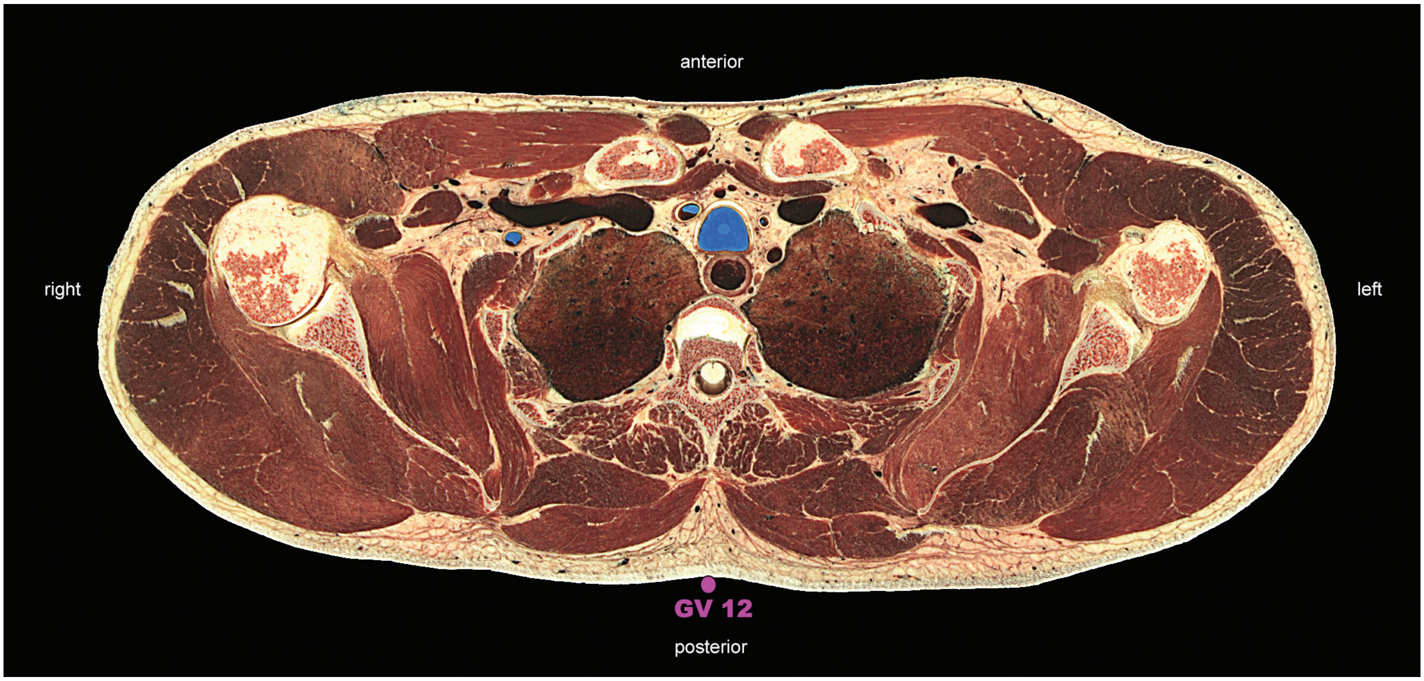


Figure 14-34. This cross-section at GV 12 portrays the abundant soft tissue deep to GV 12 and the nearby vicinity occupied by Huatuojiaji, facet, and BL line points. It also indicates the contrasting natures of the muscles filling the paraspinal grooves on each side. This view of the layered anatomy allows one to anticipate changes in tissue resistance to needle entry as the tip progresses through skin, subcutaneous fat, and, for the paraspinal points, the trapezius, and erector spinae muscles.

the vertebral venous system and the systemic venous network include connections between the longitudinal prevertebral vein, the superior intercostal vein, and the azygous venous system as well as juncture of the longitudinal prevertebral vein with veins of the upper esophagus.

- **Dorsal branches of right and left 3rd thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Respiratory problems such as bronchitis, dyspnea, cough, asthma:** GV 12, BL 13, LI 4, LU 7,ST 36, CV 22, CV 17.
- **Thoracic back pain or stiffness:** GV 12, GB 21, local tender or tense trigger points.

References

1. Ibukuro K, Fukuda H, Mori K, et al. Topographic anatomy of the vertebral venous system in the thoracic inlet. *AJR*. 2001;176:1059-1065.
2. Robertson DJ, Von Forell GA, Alsup J, et al. Thoracolumbar spinal ligaments exhibit negative and transverse pre-strain. *J Mech Behav Biomed Mater*. 2013;23C:44-52.
3. Pizones J, Zuniga L, Sanchez-Mariscal F, et al. MRI study of post-traumatic incompetence of posterior ligamentous complex: importance of the supraspinous ligament. Prospective study of 74 traumatic fractures. *Eur Spine J*. 2012;21:2222-2231.

GV 13

Tao Dao "Way of Happiness" "Happiness Path" "Kiln Path"

On the dorsal midline of the thorax, in the depression caudal to the spinous process T1.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices.

Clinical Relevance: Spinal ligaments may exhibit strain patterns that may significantly alter joint mechanics.[2] Disruption of the posterior ligamentous complex (PLC) or other forms of ligamentous damage may compromise spinal stability.[3] PLC components display an orderly sequence of rupture when traumatized, beginning with distraction of facet joint capsules and edema of the interspinous ligament. Following that, the supraspinous, interspinous, and flavum ligaments may tear. When one anticipates the impact of trauma on interspinous sites along the GV line, one can use palpation and treatment of tender locations with acupuncture and related techniques to ease discomfort and speed healing in individuals with back pain or history of spinal trauma.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the source of much myofascial discomfort. Releasing its attachment to the thoracic spinous processes near GV 13 and thereabouts may aid in the resolution of thoracic tension and strain patterns.

Nerves

- **Dorsal rami of thoracic spinal nerves from C8-T1:** Innervate the local skin, muscles, and ligaments.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: The location of GV 13 and GV 14 on the cranial thorax places them within a high traffic zone for the autonomic nervous system, susceptible to the neuromodulatory influences of acupuncture.

Spinal segmental influences induced by neuromodulatory techniques applied to GV 13 may benefit problems associated with the back (via somatosomatic effects), vascular flow (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Dysfunction affecting the esophagus, heart, lungs, and cranial abdominal organs may refer pain to the upper back or shoulder region. It may be possible to neuromodulate a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal

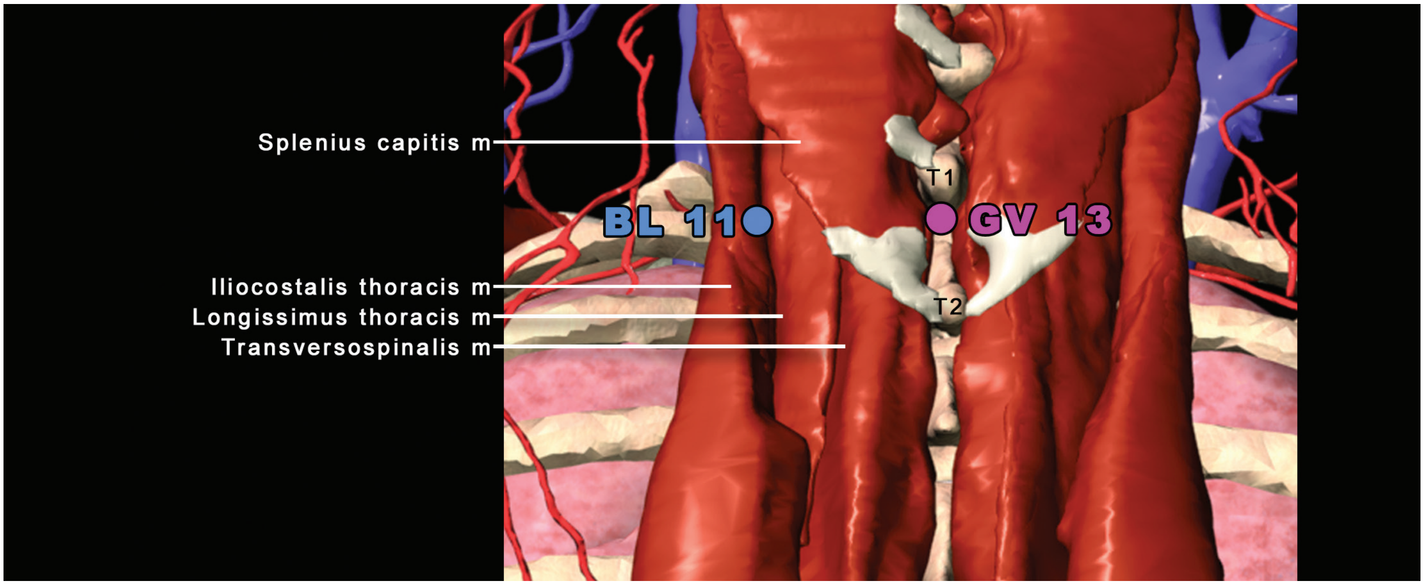


Figure 14-35A. The splenius capitis muscle resides deep to the trapezius muscle (not shown) and superficial to the erector spinae group (i.e., the transversospinalis, longissimus, and iliocostalis muscles). The splenius capitis arises from the caudal half of the nuchal ligament as well as the spinous processes of C7, T1, and T2, as indicated here. The muscle inserts onto the mastoid process of the temporal bone and just caudal to the superior nuchal line. Splenius capitis contraction thus causes the head to extend with bilateral contraction or side bend and rotate with unilateral activation. GV 13 sits between the right and left splenius capitis muscles at the myotendinous junction level, a zone rich with Golgi tendon organs.

primary ramus of the spinal nerves occurring at GV 13.

Respiratory conditions may benefit from GV 13 stimulation because somatovisceral reflexes travel from the point to spinal segments affecting the lungs and bronchi. Immune modulation ensues with reduction of sympathetic hyperactivity. Release of endogenous opioids, reduction in sympathetic tone, relaxation of regional musculature, and spinal cord neuromodulation work in concert to relieve neck and upper back pain.

Functionally, acupressure or acupuncture applied to GV 13, "Happiness Path", confers a relaxing, antinociceptive effect mediated at least in part by endogenous opioids. This harkens back to the response caused by scruffing the neck in certain non-human species.[4]

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

In the cranial thorax, the epidural venous plexuses anastomose with the superior intercostal veins by way of the intervertebral veins.[1] This links the vertebral venous system to the systemic venous network. It allows blood from the neck and thoracic limbs to course in a caudal direction through the epidural venous plexuses to the superior intercostal vein and into the azygous vein. Additional cervicothoracic level communications between the vertebral venous system and the systemic venous network include connections between the longitudinal prevertebral vein, the superior intercostal vein, and the azygous venous system as well as juncture of the longitudinal prevertebral vein with veins of the upper esophagus.

- **Dorsal branches of right and left 1st thoracic arteries:** The thoracic arteries arise from the posterior intercostal arteries, and embrace their respective vertebrae. Each thoracic artery supplies twigs to its related vertebral body; dorsal branches from each artery also supply the back muscles and spinous process on that vertebra. Furthermore, spinal branches from each artery enter the vertebral (spinal) canal via the intervertebral foramen, providing blood supply to the bones, periosteum, and ligaments comprising the internal aspects of the vertebral canal walls. Some of these spinal branches supply the extradural or epidural space.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

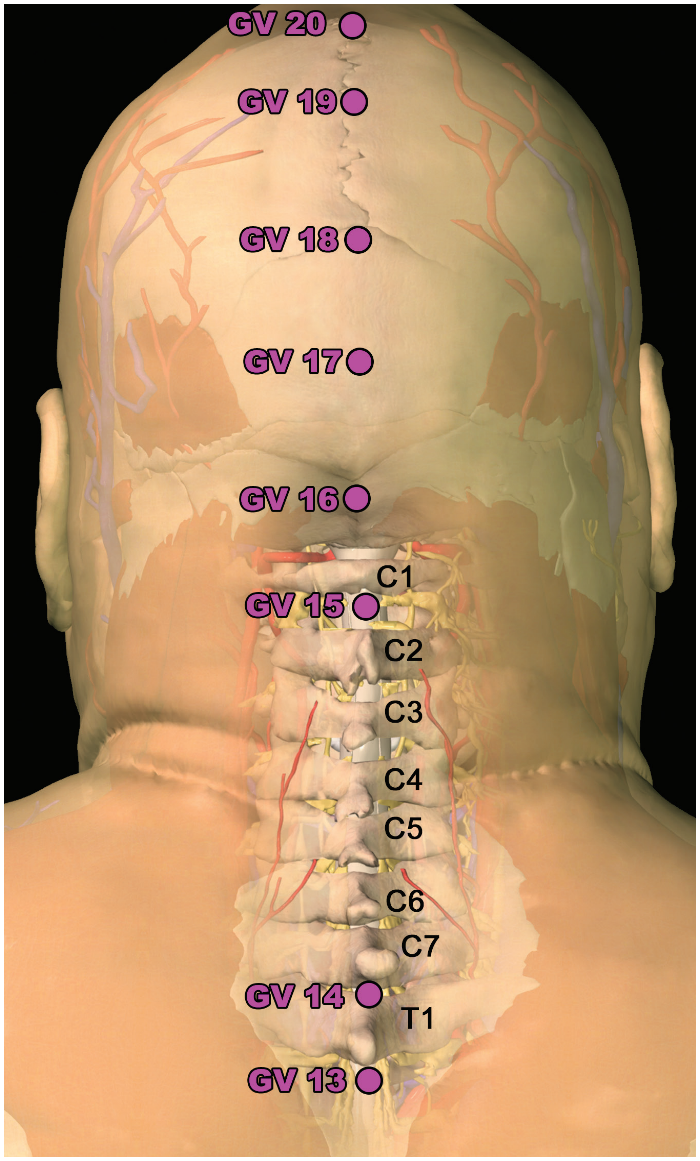


Figure 14-35B. Chinese kilns of old contained knobby projections resembling spinous processes. This explains the name "Kiln Path" for GV 13, located at the start of a bumpy road to the occiput.

Indications and Potential Point Combinations

- **Cervicothoracic pain or restriction:** GV 13, GV 14, BL 10, GB 21, local trigger points.
- **Torticollis:** GV 13, ST 10, ST 11, LI 16, LI 17, BL 10, GB 12, GB 20, local trigger points.

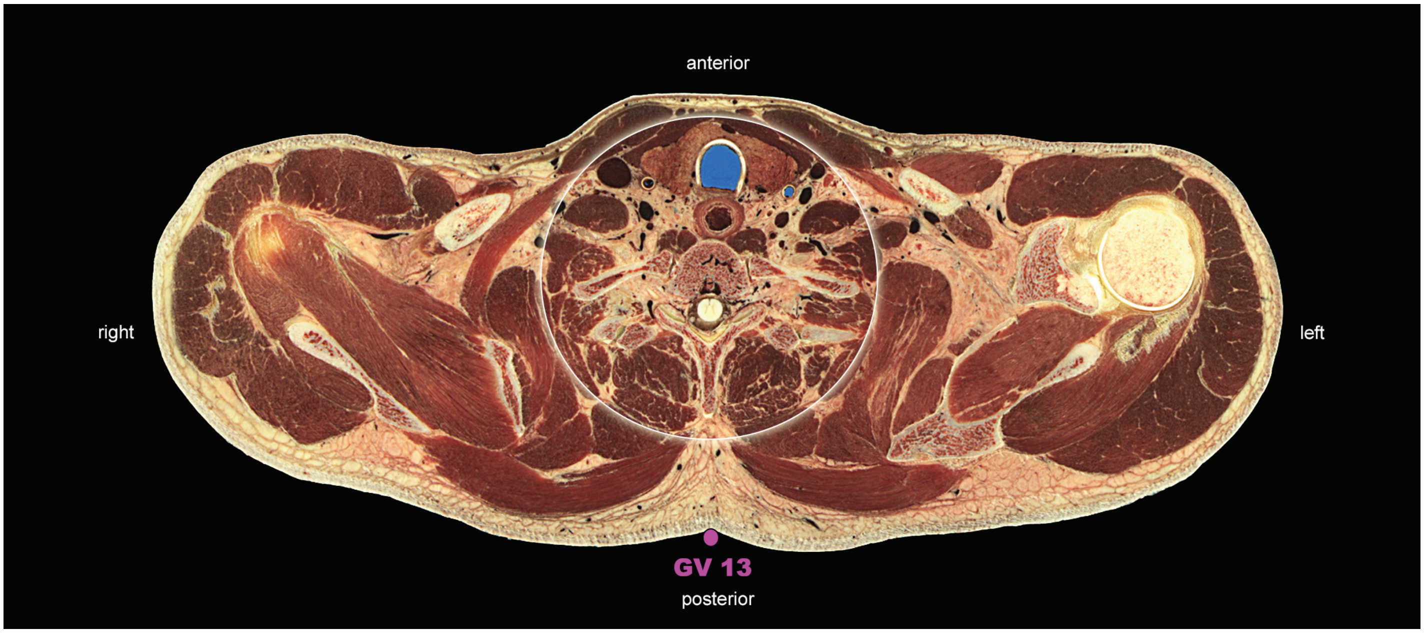


Figure 14-36. Anatomy of the body's core differs in structure and function from that around it. Note the change in tissue type and consistency when moving from inside to outside the circle. Within the circle appears the thyroid gland, major vessels, the trachea, esophagus, spinal cord, and muscles involved in stabilizing and bending the spine. Outside the circle, tissue function pertains more to movement than body maintenance, mainly composed of large appendicular musculature exhibiting substantial homogeneity. To see this cross-section with structures labeled, visit Figure 7-24, which examines this plane in relation to BL 11, level with GV 13.

- **Fever and chills:** GV 13, GV 14, LI 11, LI 4, ST 36, ST 44.
- **Cervicogenic cephalalgia:** GV 13, BL 10, BL 9, GV 20, LI 4, local trigger points.
- **Trapezius tension:** GV 13, GV 21, BL 10, GB 20, GV 20.
- **Dizziness:** GV 13, GV 20, GB 20, BL 10, LR 3, GB 34.
- **Feeling of heat throughout the body:** GV 13, GV 14, GV 20, ST 36, LR 3, LI 4.

References

1. Ibukuro K, Fukuda H, Mori K, et al. Topographic anatomy of the vertebral venous system in the thoracic inlet. *AJR.* 2001;176:1059-1065.
2. Robertson DJ, Von Forell GA, Alsup J, et al. Thoracolumbar spinal ligaments exhibit negative and transverse pre-strain. *J Mech Behav Biomed Mater.* 2013;23C:44-52.
3. Pizones J, Zuniga L, Sanchez-Mariscal F, et al. MRI study of post-traumatic incompetence of posterior ligamentous complex: importance of the supraspinous ligament. Prospective study of 74 traumatic fractures. *Eur Spine J.* 2012;21:2222-2231.
4. Miranda A, LeLaCruz F, and Zamudio SR. Immobility response elicited by clamping the neck induces antinociception in a "tonic pain" test in mice. *Life Sci.* 2006;79(11):1108-1113.

GV 14

Daz Hui (or Da Zhui) "Great Hammer" or "Great Vertebra"

At the dorsal midline at the cervico-thoracic junction, in the depression caudal to the spinous process of C7.

In order to differentiate C7 from T1 for point localization, begin by identifying the two most prominent spinous processes in the cervicothoracic junction. Ask the patient to bend the neck forward while each of your thumbs contacts the two largest processes. The C7 spinous process will move cranial during cervical ventroflexion while the T1 spinous process will not, due to its relative fixation of position by the rib cage. GV 14 lands between the spinous processes of C7 and T1. See Figure 14-37B to appreciate the size of the C7 and T1 spinous processes compared to its more cranial counterparts.

Connective Tissues

- **Supraspinous ligament:** Connects the apices of the spinous processes of adjacent vertebrae.
- **Interspinous ligament:** Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. In the neck, the interspinous ligaments may be better described as fascial sheets.

Clinical Relevance: Spinal ligaments may exhibit strain patterns that may significantly alter joint mechanics.[20] Disruption of the posterior ligamentous complex (PLC) or other forms of ligamentous damage may compromise spinal stability.[21] PLC components, which include the supraspinous ligament, interspinous ligament, and ligamentum flavum, display an orderly sequence of rupture when traumatized, beginning with distraction of facet joint capsules and edema of the interspinous ligament. Following that, parts of the PLC may tear. When one anticipates the impact of trauma on interspinous sites along the GV line, one can use palpation and treatment of tender locations with acupuncture and related techniques to ease discomfort and speed healing in individuals with back pain or history of spinal trauma.

Tendons

- **Tendon of the trapezius muscle:** The trapezius originates from 1) the external occipital protuberance and superior nuchal line of the occipital bone, 2) the ligamentum nuchae, 3) the spinous process of the seventh cervical vertebra and the spinous processes of all thoracic vertebrae, and 4) the corresponding portions of the supraspinous ligament. The superior fibers insert onto the posterior aspect of the lateral clavicle; the middle fibers insert onto the acromion and the spine of the scapula; the inferior fibers converge near the scapula to end in an aponeurosis, which inserts onto a tubercle at the medial end of the spine of the scapula. The superior fibers elevate the scapula, the middle fibers retract it, and the inferior fibers depress the scapula.

Clinical Relevance: The trapezius muscle makes extensive connections throughout the upper body and constitutes the

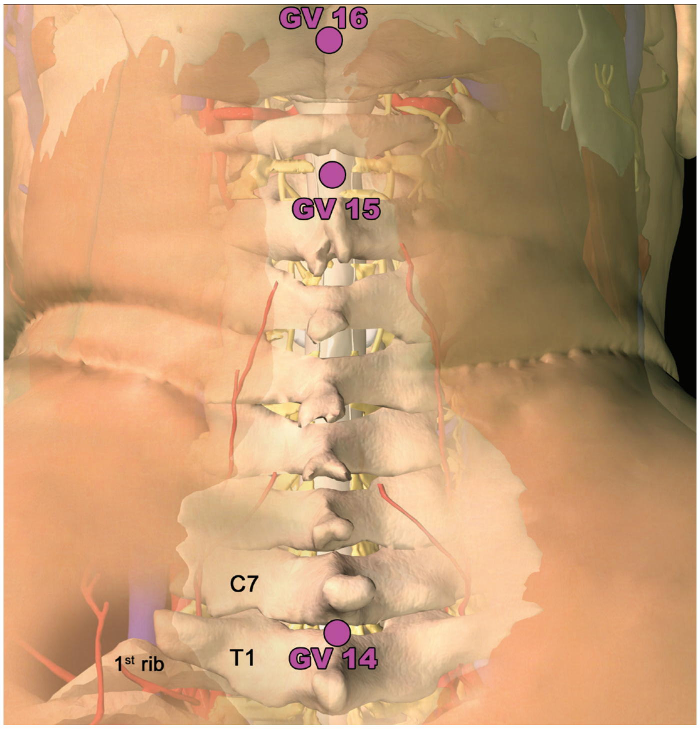


Figure 14-37A. GV 14, shown here between the spinous process of C7 and T1 can be challenging to locate. Because the first rib attaches to T1, this juncture restricts the spinous process from moving craniad when the patient ventroflexes the neck. Therefore, in order to distinguish between the C7 and T1 spinous processes, first identify the most prominent spinous processes in the cervicothoracic region. Palpate the processes while the patient flexes the neck. C7 will travel cranial with cervical flexion while T1 will not, or only minimally.

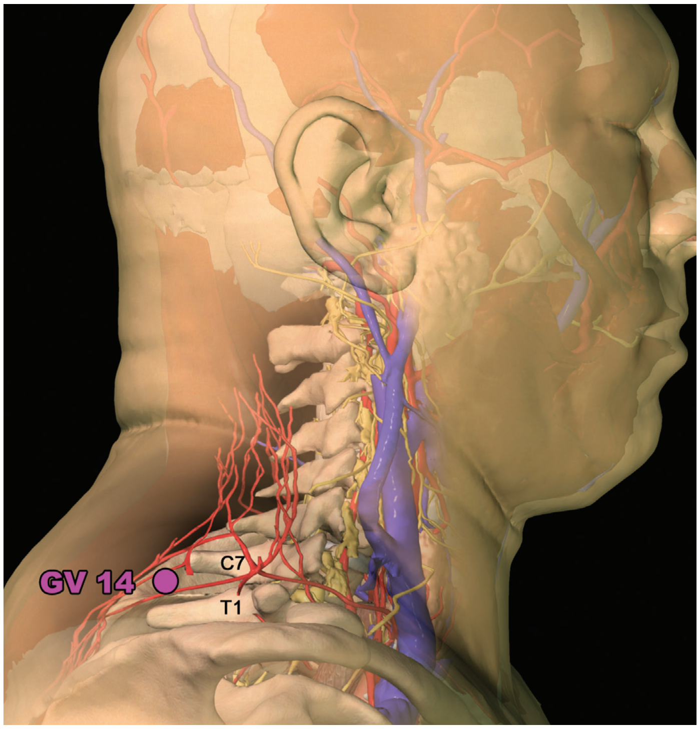


Figure 14-37B. The ancient Chinese metaphorically referred to the vertebrae as "spine hammers". C7, by having the largest spinous process of the cervical vertebrae, earns the name "Great Hammer" or "Great Vertebra".

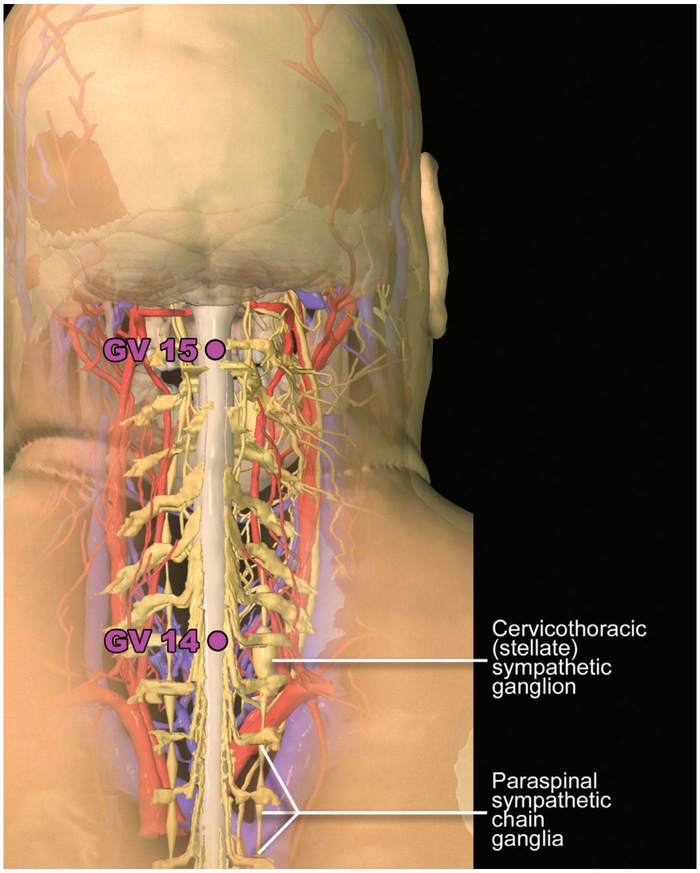

GV 15
GV 14
Cervicothoracic (stellate) sympathetic ganglion
Paraspinal sympathetic chain ganglia

Figure 14-38. GV 14 lands between the C8/T1 spinal cord segments and the C7/T1 vertebrae. This cervicothoracic region of the central nervous system marks the beginning of the sympathetic nervous system network within the spinal cord. In this depiction, the stellate ganglion can be seen to the right of GV 14 as a vertical oblong structure ventral to the horizontal spinal nerve.

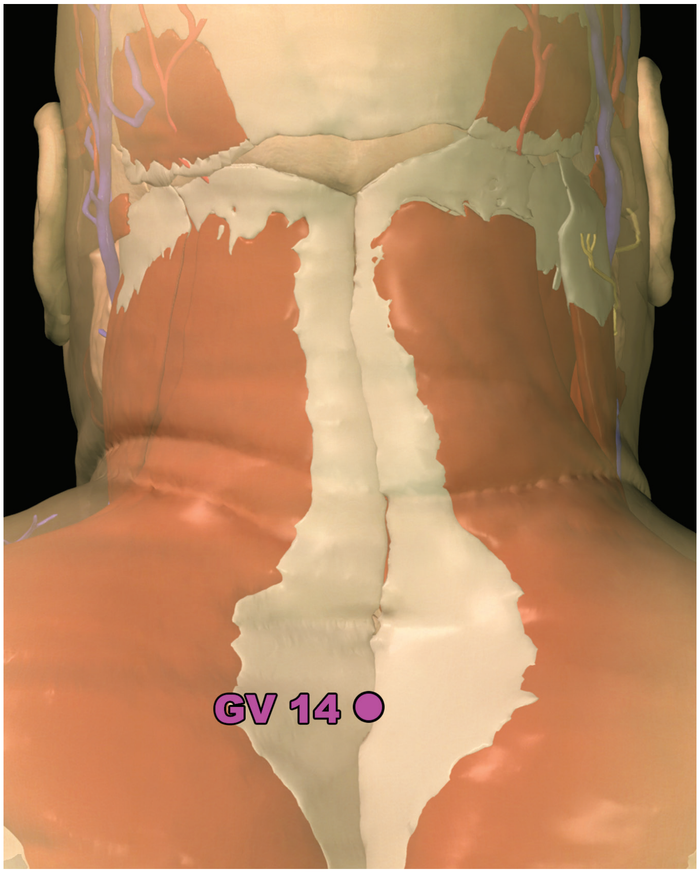


Figure 14-39. Beyond its immunoregulatory and neuromodulatory effects, GV 14 also treats neck and shoulder pain. The confluence of muscular attachments at this site justifies its inclusion in treatments to address myofascial restriction of the head and neck.

source of much myofascial discomfort. Releasing its attachment to the thoracic spinous processes near GV 14 and thereabouts may aid in the resolution of thoracic tension and strain patterns. View the trapezius fibers crossing the midline in Figure 14-40.

Beyond its local effects on the musculoskeletal system, stimulation of GV 14 exerts widespread influences on homeostasis. Somatic afferent convey impulses from GV 14 to the cranio-thoracic spinal cord segments and invoke autonomic nervous system modulation. This aids in normalizing circulation to myofascial tissue in the cervicothoracic region and reducing trigger point formation and perpetuation.

Nerves

- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.
- **Dorsal rami of thoracic spinal nerves from C6-T1:** Innervate the local skin, muscles, and ligaments.

Clinical Relevance: The location of GV 13 and GV 14 on the cranial thorax places them within a high traffic zone for the autonomic nervous system, susceptible to the neuromodulatory influences of acupuncture.

Preganglionic fibers emanating from the lateral horn of the upper thoracic spinal cord segments migrate to and synapse in the stellate (cervicothoracic, inferior), middle, or superior cervical sympathetic ganglia in the neck. These fibers supply head and neck structures as well as thoracic organs such as the heart. Embryologically, the heart developed in the neck; this helps explain why the fibers ascend from the cranial thoracic segments to the neck and back down to the thorax.

Spinal segmental influences induced by neuromodulatory techniques applied to GV 14 may benefit problems associated with the back (via somatosomatic effects), vascular flow and immune function (through somatoautonomic effects) and/or internal organs by dint of somatovisceral reflexes. Dysfunction affecting the esophagus, heart, lungs, and cranial abdominal organs may refer pain to the upper back or shoulder region. It may be possible to neuromodulate a variety of spinal cord activities governing a host of functions when activating the medial branch of the dorsal primary ramus of the spinal nerves occurring at GV 14.

Respiratory conditions may benefit from GV 14 stimulation because somatovisceral reflexes travel from the point to spinal segments affecting the lungs and bronchi. Immune modulation ensues with reduction of sympathetic hyperactivity. Release of endogenous opioids, reduction in sympathetic tone, relaxation of regional musculature, and spinal cord neuromodulation work in concert to relieve neck and upper back pain.

Functionally, acupressure or acupuncture applied to GV 14 confers a relaxing, antinociceptive effect mediated at least in part by endogenous opioids. This harkens back to the response caused by scruffing the neck in certain non-human species.[22]

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.

In the cranial thorax, the epidural venous plexuses anastomose with the superior intercostal veins by way of the intervertebral veins.[1] This links the vertebral venous system to the systemic venous network. It allows blood from the neck and thoracic limbs to course in a caudal direction through the epidural venous plexuses to the superior intercostal vein and into the azygous vein. Additional cervicothoracic level communications between the vertebral venous system and the systemic venous network include connections between the longitudinal prevertebral vein, the superior intercostal vein, and the azygous venous system as well as juncture of the longitudinal prevertebral vein with veins of the upper esophagus.

- **Right and left transverse cervical arteries:** From the thyrocervical trunk, the transverse cervical arteries supply the trunks of the brachial plexus via vasa nervorum. The transverse cervical arteries also supply muscles in the posterior cervical triangle, the trapezius, and the medial scapular region.

Clinical Relevance: Because the veins comprising the epidural venous plexus lack valves, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Arm and upper thoracic pain or weakness:** GV 14, neuroanatomically designated points according to the etiology of pain (e.g., trigger points for myofascial dysfunction) or weakness (e.g., neuropathic peripheral or spinal nerves, injured spinal cord segments).
- **Trapezius and cervical muscle tension:** GV 14, GB 21, GB 20, BL 10, BL 18, BL 23, local tender points or restricted regions.
- **Occipital headache:** GV 14, BL 10, BL 9, GV 20, GV 24.5, GV 21, local tender trigger points.
- **Seizures:** GV 14, ST 36, LR 3, HT 7, HT 3, BL 7, BL 8, BL 10, GV 20.
- **Immune regulation, early viral infection:** GV 14, LI 11, LI 4, ST 36, BL 13, BL 18, BL 23.
- **Hypertension:** GV 14, ST 36, LR 3, LI 4, HT 4, PC 6.
- **Respiratory problems, including bronchitis, asthma, and emphysema:** GV 14, BL 12, BL 13, LI 4, LU 7, ST 36.
- **Fever:** GV 14, GV 20, ST 36, LI 4, LR 3, BL 10.
- **Urticaria, eczema:** GV 14, LI 11, LI 4, ST 36, LU 7, LR 3, BL 18.

Evidence-Based Applications

- Acupuncture applied to GV 14, BL 13, LU 1, CV 17, ST 36, and SP 6 in rats with **immune-mediated pulmonary inflammatory lesions** countered the inflammatory process and deposition of collagen around ovalbumin-Sepharose beads which had been intravenously embolized to the lungs in rats pre-sensitized to that protein.[2]
- Case series studied application of GV 14 in cases of **acute upper respiratory infection, asthma, epilepsy, cervical arthritis, immune stimulation.**[3]
- Treatment for fever using GV 14, GB 20, and LI 11 in 57 patients with **common cold, influenza, acute tonsillitis, or acute bronchitis** helped normalize vital signs and increased T-lymphocytes.[4]
- Acupuncture stimulation at GV 14, BL 12, and BL 13 helps regulate **mucosal and cellular immunity for patients with allergic asthma.**[23]
- Acupuncture at GV 14, GV 15, and additional points improved hearing threshold by more than 20 dB in patients with **refractory sensorineural hearing loss** following failure of conventional therapy.[24]
- “Magnitopuncture” at PC 6 and GV 14 reduced the effects of **driving fatigue.**[5]
- A case report using acupuncture therapy for **intractable hiccups complicating acute myocardial infarction** showed that GV 14 rapidly terminated the hiccups.[6]
- Repeated acupuncture at ST 36, LI 11, SP 10, and GV 14 significantly decreased leukocyte and lymphocyte values in healthy humans, although cortisol and norepinephrine plasma levels remained unchanged. The mechanism whereby acupuncture affected **leukocyte circulation** was unclear (see following study).[7]
- Acupuncture at GV 14 may modify circulating levels of subpopulations of leukocytes by means of modulating **prostaglandin** levels. That is, the effect of acupuncture at GV 14 in **significantly**

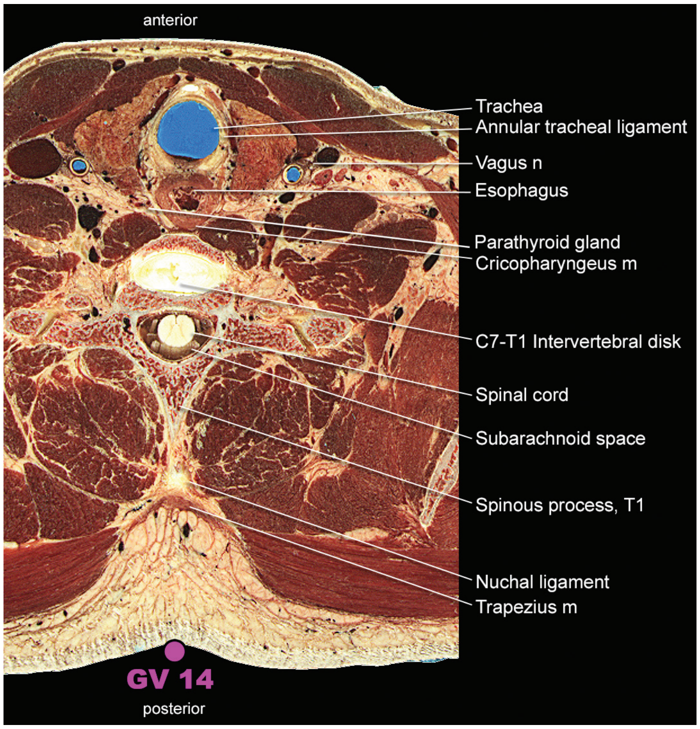


Figure 14-40. A needle entering GV 14 would first encounter the skin and subcutaneous tissue, followed by trapezius fibers, the supraspinous ligament, the nuchal ligament, and finally the T1 spinous process.

increasing leukocyte and neutrophil counts was **partially inhibited by the administration of aspirin prior to acupuncture.**[25]

- Violet laser acupuncture at GV 14 (405 nm, 110 mW, 500 micrometer spot size, time 10 minutes) produced significant increases in flux, i.e., the product of red blood cell concentration and flow velocity, 3 cm from the acupuncture point. This illustrated that violet laser acupuncture at GV 14 increases activity in the **local microcirculation.**

- Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a **reduction of minimum alveolar concentration (MAC) of isoflurane** by 16.7% in dogs. Acupuncture-assisted anesthesia thus potentiated the anesthetic effects of volatile anesthetic agents.[8]

- Acupuncture at GV 14 and GB 20 effectively treated **occipital neuralgia** in a series of cases.[9]

- Electroacupuncture at GV 2, GV 14, and ST 36 markedly **suppressed cortical epileptiform discharges** in rats. Possible mechanisms involved include alterations of opioid, serotonin, and gamma-aminobutyric acid (GABA) levels and recurrent inhibition of the cortex and hippocampus.[10]

- Electroacupuncture at GV 14, CV 20, CV 2, Yintang outperformed ST 36 and SP 6 in **alleviating cognitive deficits** in rats with experimentally induced epilepsy. The points on the head also abolished brain tissue shrinkage in the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and reirhinal cortex, and stimulation of the two points on the limbs (ST 36 and SP 6) prevented brain shrinkage in the same areas except for the hippocampus. The effect was serotonin-dependent.[11]

- Electroacupuncture at GV 14, GV 20, GV 24.5, GV 16, GB 20, PC 6, and SP 6 produced more pronounced and long-lasting improvements in patients with **major depressive disorder** than did manual acupuncture. Acupuncture seems to accelerate the clinical response to the selective serotonin reuptake inhibitor class of anti-depressants.[26]

- A Chinese study reported success in addressing **vertebrobasilar ischemic vertigo** by means of filiform needling at ST 40, GB 20, GV 20, LU 7, and dermal needle tapping at GV 14 in order so regulate cerebral blood flow.[12]

- Violet laser acupuncture (405 nm, 110 mW, 500 micrometers spot size) applied to GV 14 **increased blood flow velocity in the basilar artery** (but not the middle cerebral artery to a significant extent) and also evoked at de qi sensation similar to manual acupuncture needle stimulation.[27]

- EA at GV 2, GV 14, GV 20, GV 24.5, **prevented tissue shrinkage of the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and perirhinal cortex.** EA at ST 36 and SP 6 prevented tissue shrinkage in all of the aforementioned regions except for the dorsal hippocampus. EA to GV 2 + GV 14 + GV 20 + GV 24.5 or ST 36 + SP 6 reduced the cognitive deficits in pilocarpine-epileptic rats. Administration of p-chlorophenylalanine, a compound that depletes serotonin, negated the behavioral and some of the histologic changes due to EA. This suggests that the functional recovery exhibited by the rats may have been influenced through serotonergic pathways affected by acupuncture and subsequent **neuroprotective benefits.**[13]

- Acupuncture at GV 14, LU 7, GB 20, GB 5, and ST 8 effectively reduced the incident of **migraine without aura.**[14]

- Bleeding and cupping GV 14 provided analgesia for various painful conditions such as **toothache, headache, sore throat, and ocular inflammation.**[15]

- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 helped relieve symptoms related to **narcotic drug withdrawal.**[16]

- Acupuncture stimulation of GV 14 caused **hypothermia** via a decrease in metabolic rate, an increase in cutaneous circulation on the back, and perspiration. In contrast, acupuncture stimulation of PC 6 or ST 36 produced a slight hyperthermia, putatively due to a decrease in cutaneous circulation.[17]

- Violet laser acupuncture (405 nm, 110 nW, 500 micrometer spot size, 10 min stimulation) applied to GV 14 significantly **increased tissue temperature** at the point as well as in the "far field" area of GV 9.[28]

- Spinal cord stimulation at the C8-T1 segments suppressed excitatory responses to cardiac and esophageal inputs entering at T3-T4.[18] This may aid in explaining the benefits of GV 14 for **cardiac and esophageal problems.**

- Electroacupuncture stimulation of GV 14, GV 2, and LR 13 preserved vitality and decreased dorsal **skin flap necrosis** in experimental rats.[19]

References

1. Ibukuro K, Fukuda H, Mori K, et al. Topographic anatomy of the vertebral venous system in the thoracic inlet. *AJR.* 2001;176:1059-1065.
2. Katsuya EM, deCastro MA, Carneiro CR, et al. Acupuncture reduces immune-mediated pulmonary inflammatory lesions induced in rats. *Forsch Komplementmed.* 2009;16(6):413-416.
3. Anran L. Clinical application of moxibustion over point Dazhui. *Journal of Traditional Chinese Medcine.* 1999;19(4):283-286.
4. Tan D. Treatment of fever due to exopathic Wind-Cold by rapid acupuncture. *Journal of*

Traditional Chinese Medicine. 1992;12(4):267-271.

5. Li Z, Jiao K, Chen M, and Wang C. Reducing the effects of driving fatigue with magnitopuncture stimulation. *Accident Analysis and Prevention*. 2004;36:501-505.

6. Liu F-C, Chen C-A, Yang S-S, and Lin S-H. Acupuncture therapy rapidly terminates intractable hiccups complicating acute myocardial infarction. *Southern Medical Journal*. 2005;98(3):385-387.

7. Kou W, Bell JD, Gareus I, Pacheco-Lopez G, Goebel MU, Spahn G, Stratmann M, Janssen OE, Schedlowski M, and Dobos GJ. Repeated acupuncture treatment affects leukocyte circulation in healthy young male subjects: a randomized single-blind two-period crossover study. *Brain, Behavior, and Immunity*. 2005;19:318-324.

8. Culp LB, Skarda RT, and Muir WW 3rd. Comparisons of the effects of acupuncture, electroacupuncture, and transcutaneous cranial electrical stimulation on the minimum alveolar concentration of isoflurane in dogs. *Am J Vet Res*. 2005;66(8):1364-1370.

9. Huang N. Acupuncture treatment of occipital neuralgia with Dazhui and Fengchi acupoints. *World J Acup-Mox*. 2002;12(3):29-31.

10. Wu D. Mechanism of acupuncture in suppressing epileptic seizures. *Journal of Traditional Chinese Medicine*. 1992;12(3):187-192.

11. Dos Santos JG Jr, Tabosa A, do Monte FH, et al. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neurosci Lett*. 2005;384(3):234-238.

12. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *J Tradit Chin Med*. 2009;29(2):87-89.

13. Guilherme dos Santos Jr. J. Tabosa A, Hoffman Martins do Monte F, Blanco MM, de Oliveira Freire A, and Mello LE. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neuroscience Letters*. 2005;384:234-238.

14. Liguori A, Petti F, Bangrazi A et al. Comparison of pharmacological treatment versus acupuncture treatment for migraine without aura – analysis of socio-medical parameters. *J Tradit Chin Med*. 2000;20(3):213-240.

15. Wu J. Observation on analgesic effect of acupuncturing the Dazhui point. *Journal of Traditional Chinese Medicine*. 1989;9(4):240-242.

16. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.

17. Lin M-T, Liu G-G, Soong J-J, Chern Y-F, and Wu K-M. Effects of stimulation of acupuncture loci Ta-Chuei (Go-14), Nei-Kuan (EH-6) and Tsu-San-Li (St-36) on thermoregulatory function of normal adults. *Am J Chin Med*. 1979;7(4):324-332.

18. Qin C, Farber JP, Linderoth B, et al. Neuromodulation of thoracic intraspinal visceroreceptive transmission by electrical stimulation of spinal dorsal column and somatic afferents in rats. *J Pain*. 2008;9(1):71-78.

19. Uema D, Orlandi D, Freitas RR, et al. Effect of electroacupuncture on DU-14 (Dazhui), DU-2 (Yaoshu), and Liv-13 (Zhangmen) on the survival of Wistar rats' dorsal skin flaps. *J Burn Care Res*. 2008;29:353-357.

20. Robertson DJ, Von Forell GA, Alsup J, et al. Thoracolumbar spinal ligaments exhibit negative and transverse pre-strain. *J Mech Behav Biomed Mater*. 2013;23C:44-52.

21. Pizones J, Zuniga L, Sanchez-Mariscal F, et al. MRI study of post-traumatic incompetence of posterior ligamentous complex: importance of the supraspinous ligament. Prospective study of 74 traumatic fractures. *Eur Spine J*. 2012;21:2222-2231.

22. Miranda A, LeLaCruz F, and Zamudio SR. Immobility response elicited by clamping the neck induces antinociception in a "tonic pain" test in mice. *Life Sci*. 2006;79(11):1108-1113.

23. Yang YQ, Chen HP, Wang Y, et al. Considerations for use of acupuncture as supplemental therapy for patients with allergic asthma. *Clin Rev Allergy Immunol*. 2013; 44(3):254-261.

24. Yin CS, Park HJ, and Nam HJ. Acupuncture for refractory cases of sudden sensorineural hearing loss. *J Altern Complement Med*. 2010;16(9):973-978.

25. Rivas-Vilchis JF, Barrera-Escorcia E, and Fregosos-Padilla M. The effect of acupuncture on leukocyte levels in peripheral blood is modified by aspirin. *Prc West Pharmacol Soc*. 2009;52:61-62.

26. Qu S-S, Huang Y, Zhang Z-J, et al. A 6-week randomized controlled trial with 4-week follow-up of acupuncture combined with paroxetine in patients with major depressive disorder. *Journal of Psychiatric Research*. 2013;47(6):726-732.

27. Litscher G, Huang T, Wang L, et al. Violet laser acupuncture – Part 1: effects on brain circulation. *J Acupunct Meridian Stud*. 2010;3(4):255-259.

28. Litscher G, Wang L, Huang T, et al. Violet laser acupuncture – Part 3. Pilot study of potential effects on temperature distribution. *J Acupunct Meridian Stud*. 2011;4(3):164-167.

GV 15

Ya Men "Gate of Muteness"

In the suboccipital region on the dorsal midline, in the depression cranial to the spinous process of C2. Located 1 cun caudal to GV 16.

Forbidden to electroacupuncture. Can cause stroke or seizure. No moxa. Avoid deep needle insertion.[1] Withdraw needle if uncomfortable or if it the patients claims that it feels like an electric shock.

Connective Tissues

- **Ligamentum nuchae (Nuchal ligament):** Comprises a dorsal midline raphe and a midline fascial septum. The dorsal midline raphe arises from the interweaving fibers on the right and left sides of the upper trapezius as well as the splenius capitis and rhomboid minor muscles. The raphe spans the cervical spine and attaches firmly to the external occipital protuberance and the C7 spinous process.

The midline fascial septum courses ventral to the dorsal midline raphe. It is confluent with the interspinous ligament, the atlanto-axial membrane, and the atlanto-occipital membrane.

- Interspinous ligament: Connects adjacent spinous processes by attaching spinous processes from their roots to their apices. In the neck, the interspinous ligaments constitute fascial sheets.

Clinical Relevance: The ligamentum nuchae may or may not attach to the cervical spinal dura mater between C1 and C2; this matter remains under investigation.[5] However, the rectus capitis posterior minor and major both do connect to the dura. Tension in these muscles causes neck pain and headache by placing traction on the dura. Because the caudal dura receives innervation from the vagus nerve, autonomic disturbances often accompany headache and migraine caused by dural traction.

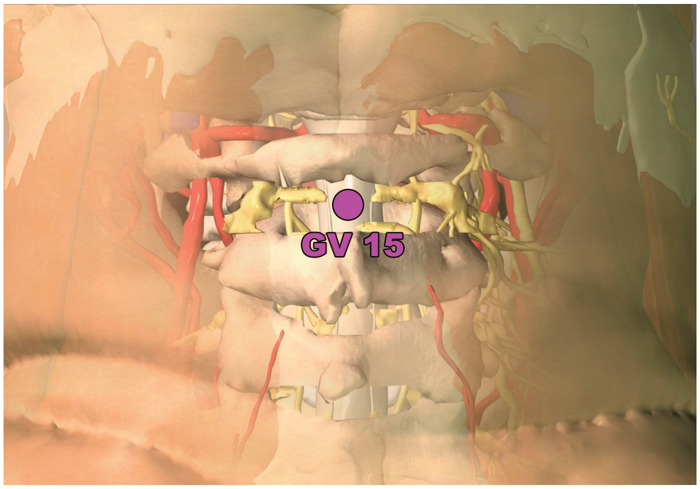


Figure 14-41. GV 15, "Mute's Gate", traditionally appears in formulae for language disorders. The point was considered a "gate" to the voice. However, deep needling at GV 15 may also render someone speechless by dint of death. Do not needle deeply at GV 15 or GV 16. Be aware, too, that even with manual therapy, sustained pressure applied to the suboccipital region can interfere with speech by affecting sensorimotor connections from cranial nerves between brain and buccal cavity by way of the cisterna magna.

Muscles

- **Trapezius muscle:** Fibers of the cranial, or superior, part of the trapezius elevate the scapula (i.e., when shrugging the shoulders).
- **Semispinalis capitis muscle, medial part:** Extends the head.
- **Rectus capitis posterior major muscle:** Provides proprioceptive input regarding head orientation and dural tension along with its partner, the rectus capitis posterior minor muscle. Also extends the head at the upper cervical spine.

Clinical Relevance: Myofascial dysfunction in many muscles on the back of the head and neck can lead to cervicogenic headache and instability.

Trigger points in the upper semispinalis capitis muscle adjacent to GV 15 incite radiating pain to the ipsilateral temporal region with diffuse pain that wraps around the head like a crown.

Trigger points in the suboccipital muscles tend to create pain perceived as penetrating the skull in a poorly localizable fashion. Patients may first complain that the entire head aches, but upon further questioning and examination, tenderness to palpation may center on a unilateral suboccipital focus.

In contrast to the way in which splenius cervicis trigger points causes pain that feels like it goes "right through the head", suboccipital trigger point pain is rarely so focused. Pain in the occipital regions can also arise from trigger points in the multifidi, levator scapulae, splenius cervicis, and infraspinatus muscles. Restriction in the soft tissues in the neck elevates pressure on large, vital neural, vascular, and glandular components, raising the potential for pain and suboptimal endocrine regulation.

The discovery of connections between suboccipital muscles (i.e., the rectus capitis posterior major and minor as well as the obliquus capitis inferior muscles[6]) and the dura explains a common etiology of cervicogenic headache.[7] Myodural connections form of soft tissue bridges in the atlantoaxial interspace level with GV 15 and the atlantooccipital interspace level with GV 16.

The soft tissue adjoining muscle to dura harbors proprioceptive neurons, implicating suboccipital muscles in aiding the brain in its control over head position and dural tension.[8] Researchers speculate that myodural biofeedback "may play a role in maintaining the integrity of the subarachnoid space and, subsequently, cerebrospinal pressure. If this mechanism does exist, its failure may result in a variety of clinical manifestations including those arising from increasing dural tension, namely cervicogenic headaches."[9]

While some have excised the myofascial bridge to alleviate chronic headache,[10] nonsurgical approaches should be tried first, including manual therapy, laser therapy, and cautious acupuncture.

Cervicogenic dizziness may result from abnormal afferent activity in cervical muscles.[11] Specifically, abnormal input that reaches vestibular nuclei from dysfunctional proprioceptors of the upper cervical region can contribute not only to neck pain and tension but also produce muscle spasms that aggravate dizziness. Dizziness worsens muscle spasm and muscle tension worsens dizziness. Patients may provide a history of looking upward with neck extended for a period of time preceding the dizziness. This should raise one's index of suspicion. However, rule out other possible diagnoses of dizziness or vertigo as well before assuming the cause is the neck.

If one suspects a cervicogenic cause of dysequilibrium, manual therapy, laser, and cautious acupuncture at GV 15, BL 10, and other regional points may be warranted.

Figure 14-43 examines the relationship between GV 15, the rectus capitis posterior major muscle, and the obliquus capitis inferior muscle. Note, too, the presence of deep cervical veins in this cross section, suggesting that manual therapy and/or laser therapy would provide safer means of addressing trigger point pathology in the deep suboccipital structures than would needling to reach these sites.

Nerves

- **Third ("Least") occipital nerve (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[12]
- **Spinal nerves C2-C3, dorsal rami:** Innervate the posterior cranial fossa.
- **Spinal accessory nerve (CN XI):** Innervates the trapezius, along with fibers from C3 and C4, of the cervical plexus.
- **Spinal nerves C2 – C4, dorsal rami:** Innervate semispinalis capitis muscle.

Clinical Relevance: Nerves in the suboccipital region may become entrapped in the layers of myofascia deep to GV-15, shown by Figure 14-43. Nerve entrapment causes pain and myofascial restriction.

Cervical zygapophyseal joints cause chronic neck pain and headache in up to half of patients. Facet joints receive innervation from the medial branches of the spinal nerves C3 to C7; each nerve supplies the joint above and below.

Although percutaneous radiofrequency ablation (RFA) has become an accepted nonsurgical modality for chronic neck pain, adverse outcomes may occur. RFA of the least (3rd) occipital nerve and the C2-C4 facet joints has led to "dropped head syndrome" in which the patient became unable of extending her neck, inducing a debilitating complication.[13] While acupuncture and related techniques may not be able to repair nerves completely destroyed by RFA, the risk of permanent disability emphasizes the need to address pain and functional compromise with safe and effective approaches such as acupuncture and related techniques before pursuing modalities that can cause irreversible damage.

Third occipital nerve (TON): This dorsal branch of the 3rd cervical spinal nerve must make its way through several layers of deep nuchal musculature, raising the potential for nerve entrapment and irritation. Thus, this nerve likely produces occipital neuralgia more than has been previously recognized.[14] Neuralgia originating from TON disorders mimics GON neuralgia. The superficial medial branch of the C3 spinal nerve, also called the 3rd or least occipital nerve, travels around the dorsolateral surface of the C2-3 zygopophysial (facet) joint that it supplies. It branches at about BL 10. While facet joints caudal to C2-3 receive innervation by the dorsal rami above and below the joint, the C2-3 facets only receive TON innervation. After supplying the facet joint, the TON continues on to supply the semispinalis capitis muscle, traveling deeply along this muscle until it sends a communicating branch to the greater occipital nerve. The risk of third occipital neuralgia increases as a result of its vulnerability to entrapment at the level of the intervertebral disk behind the intervertebral joints. Osteophytes in these joints can produce nerve compression and chronic headache that may remain undiagnosed as a result of clinicians' unfamiliarity with this nerve entrapment syndrome.

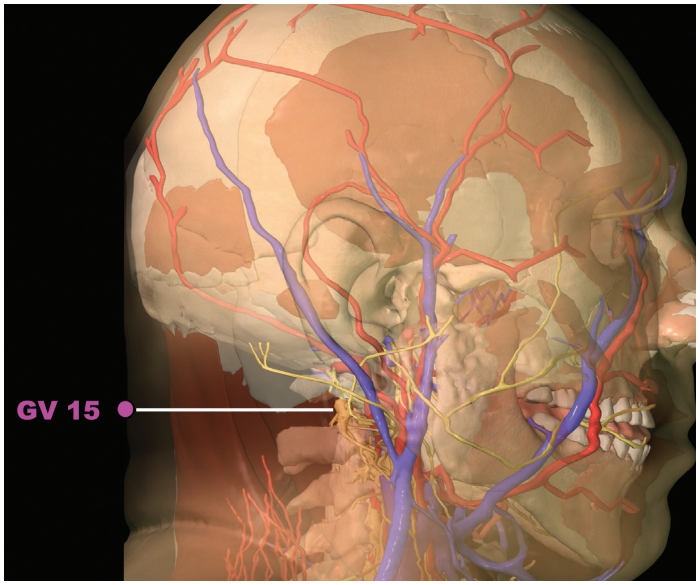


Figure 14-42. The distance from the skin surface to the spinal cord depends on the muscularity and size of the patient. This lateral view as well as the cross-section in Figure 14-43 depicts the depth of muscular, vascular, and neural features from the skin surface. However, anatomy varies between individuals; caution and safety are paramount.

Craniotomies with midline approaches may also damage or irritate the TON and cause occipital neuralgia after suboccipital approaches. Scar tissue envelops the nerve, compressing its branches; pain sometimes worsens with cervical motion and mounting myofascial restriction. Intraoperative traction applied to deeper facet branches of the TON during midline craniotomy damages its deeper facet branches. Acupuncture and related techniques carefully at BL 10, GV 15, and GV 16 can release tension in this region and neuromodulate the TON.

Brain imaging researchers studying acupuncture at GV 15 found that stimulation at this location may improve certain language disorders by activating certain language areas such as the left superior temporal gyrus.[15] Additionally, GV 15 stimulation may neuromodulate hypoglossal nerve (CN XII) function. Neuroanatomically, after the hypoglossal nerve exits the hypoglossal nucleus in the medulla, it travels through the hypoglossal canal and courses alongside the inferior ganglion of the vagus nerve at about the level of GV 15. It crosses the ventral surface of the transverse process of C1, making it vulnerable to injury upon hyperextension of the craniocervical junction. Along its course, it runs adjacent to the superior cervical sympathetic ganglion and arrives at the tongue to supply motor function.

The cisterna magna, or cerebellomedullary cistern, shown in Figure 14-43, contains the vertebral artery, the origin of the posterior inferior cerebellary artery, the choroid plexus, and cranial nerves IX, X, XI, and XII. Given that cranial nerves V, VII, IX, X, XI, and XII are involved in both swallowing and speech,

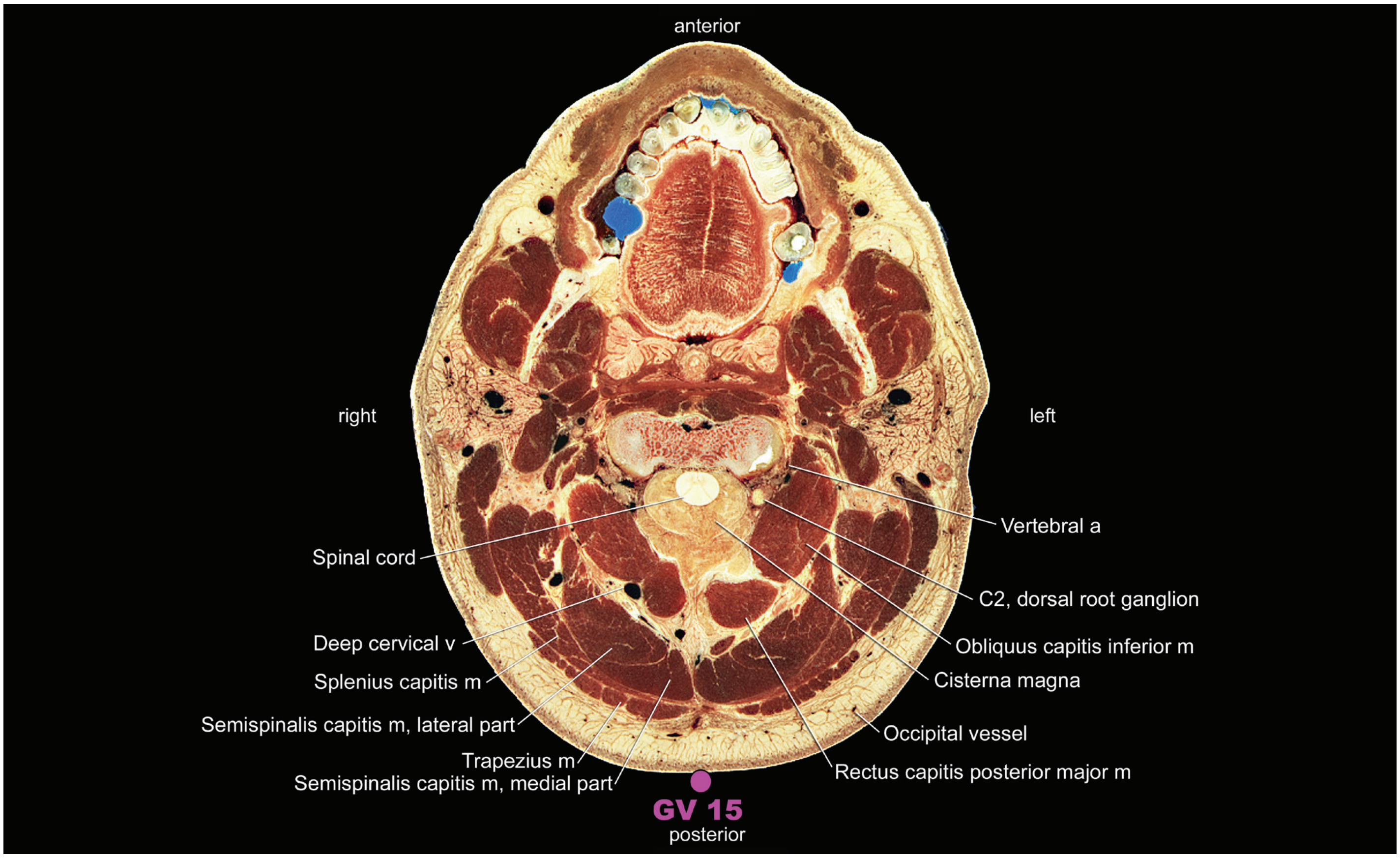


Figure 14-43. GV 15 has several other names in addition to "Gate of Muteness". They include: "Loss-of-Voice Gate", "Tongue Root", "Tongue Swelling", "Opposite the Tongue", "Tongue's Horizontal", "Tongue Repression", and "Repressed Tongue". This cross-section illustrates the way in which GV 15 and the tongue share the same horizontal plane, as described by its alternate names. This image also reveals the proximity of the rectus capitis posterior major and obliquus capitis inferior to the cisterna magna, highlighting the potential for myodural contiguity.

it follows that excessive pressure placed on the suboccipital region may compress one or more of these nerves coursing within the cisterna magna and cause temporary or prolonged dysphagia and/or dysarthria.

Vessels

- **Posterior external vertebral venous plexus:** This venous plexus is formed by the spinal veins along the vertebral column, outside of the vertebral canal. Veins from the vertebral bodies usually drain into the internal vertebral venous plexus, but they may drain into the anterior and posterior external vertebral venous plexuses in addition to the internal one. Because the veins in the epidural venous plexus inside the vertebral column lack valves, they can serve as a collateral route for return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. That is, the epidural venous plexus communicates not only with the lumbar veins of the inferior vena caval system, but also with the azygous system of veins that constitute part of the superior vena caval system. The azygous system of veins links the various venous segments throughout the thoracic, lumbar, and sacral regions.
- **Anastomosis between right and left occipital arteries:** Arising from the external carotid artery, each occipital artery courses along a groove in the base of the skull, and ends in the posterior portion of the scalp.
- **Anastomosis between right and left occipital veins:** The occipital veins typically drain into the suboccipital venous plexus, which drains into the vertebral vein and the deep cervical vein, but occasionally it may drain into the internal jugular vein.
- **Deep cervical artery (from the costocervical trunk, which arises from the subclavian artery):** Supplies the deep cervical muscles.
- **Deep cervical vein:** Receives tributaries from the plexuses around the spinous processes of the cervical vertebrae, and terminates in the lower part of the vertebral vein.

Clinical Relevance: Deep cervical vessels, seen in Figure 14-43 are vulnerable to damage with cervical spinal surgery[16] but also by acupuncture. Employ caution when needling this zone!

Veins of the epidural venous plexus lack valves. As such, they can serve as a collateral route paralleling the main caval route. This establishes another route of return of abdominopelvic venous blood if the inferior vena cava becomes blocked or ligated. This extensive network of freely communicating, valveless, venous channels also permits the metastatic spread of certain tumors. Research indicates that blood flow increases through the vertebral venous plexus as a consequence of increased intra-thoracic or intra-abdominal pressure, as when coughing, straining, or performing certain internal martial arts techniques. In the case of cancer, these passageways could serve as a conduit for metastatic tumor cells to deposit in the vertebrae, though additional factors likely influence the distribution of metastases, including the favorability of the target tissues to growth of metastatic cells and the presence of specific tumor-supportive substances.

Indications and Potential Point Combinations

- **Headache:** GV 15, BL 10, GV 20, Yintang (GV 24.5), LI 4, GB 20, GB 21, local tender trigger points.
- **Neck pain and stiffness:** GV 15, GV 14, GB 21, GB 20, BL 9, BL 10, pertinent trigger points.
- **Epistaxis:** GV 15.
- **Seizures:** GV 15, BL 10, GV 20, ST 36, LR 3, KI 3, ST 40.
- **Anxiety, agitation, depression:** GV 15, GV 20, CV 17, PC 7, ST 36.
- **Post–stroke aphasia, aphonia:** GV 15, CV 23, ST 36, GV 20.
- **Post-traumatic hypoglossal nerve dysfunction:**[2] GV 15, GV 16, BL 10, SI 17, CV 23, CV 24.
- **Post-craniotomy occipital neuralgia:** Laser therapy to BL 10, GV 15, GV 16, GB 20.

Evidence-Based Applications

- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[3]
- Occipital nerve stimulation has gained acceptance as a treatment for **refractory primary headache.**[4]
- Acupuncture at GV 14, GV 15, and other points in addition to patient education **improved hearing threshold** by more than 20 dB.[17]
- Acupuncture for **aphasia** after stroke frequently involves GV 15, SP 6, Nos. 1 through 3 language sections on the scalp, GB 20, HT 5, Yuye, Jinjin, CV 23, and PC 6, and GV 20.[18]

References

1. Zhao J and Jiao BJ. Advances in research on the safety of acupuncture for acupoints GV 15, GV 16, and GB 20 in the treatment of Cerebrovascular disease. *Medical Acupuncture.* 15(3). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol15_3/article5.html on 01-10-06.
2. Loro WA and Owens B. Unilateral hypoglossal nerve injury in a collegiate wrestler: a case report. *Journal of Athletic Training.* 2009;44(5):534-537.
3. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research.* 2003;31:552-556.
4. Bartsch T, Paemeleira K, and Goadsby PJ. Neurostimulation approaches to primary headache disorders. *Curr Opin Neurol.* 2009;22:262-268.
5. Nash L, Nicholson H, Antonio L, et al. Configuration of the connective tissue in the posterior atlanto-occipital interspace. *Spine.* 2005;30:1359–1366.
6. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J.* 2013;13(5):558-563.
7. Kahkeshani K and Ward PJ. Connection between the spinal dura mater and suboccipital musculature: evidence for the myodural bridge and a route for its dissection – a review. *Clin Anat.* 2012;25(4):415-422.
8. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J.* 2013;13(5):558-563.
9. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J.* 2013;13(5):558-563.
10. Hack GD and Hallgren RC. Chronic headache relief after section of suboccipital muscle dural connections: a case report. *Headache.* 2004; 44:84–89.
11. Wrisley DM, Sparto PJ, Whitney SL, et al. Cervicogenic dizziness: a review of diagnosis and treatment. *J Orthop Sports Phys Ther.* 2000;30:755-766.
12. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.
13. Stoker GE, Buchowski JM, and Kelly MP. Dropped head syndrome following multilevel cervical radiofrequency ablation: a case report. *J Spinal Disord Tech.* 2013;26(8):444-448.
14. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.
15. Li G, Liu H-L, Cheung RTF, et al. An fMRI study comparing brain activation between word generation and electrical stimulation of language-implicated acupoints. *Human Brain Mapping.* 2003;18:233-238.
16. Yue BYT, Le Roux CM, Corlett R, et al. The arterial supply of the cervical and thoracic spinal muscles and overlying skin: anatomical study with implications for surgical wound complications. *Clinical Anatomy.* 2013;26(5):584-591.
17. Yin CS, Park HJ, and Nam HJ. Acupuncture for refractory cases of sudden sensorineural hearing loss. *J Altern Complement Med.* 2010;18=6(9):973-978.
18. Sun Y, Xue SA, and Zuo Z. Acupuncture therapy on apoplectic aphasia rehabilitation. *J Tradit Chin Med.* 2012;32(3):314-321.

GV 16

Feng Fu "Palace of Wind" "Wind Mansion"

On the nuchal region, on the dorsal midline, in the depression below the external occipital protuberance. Located approximately 1 cun within the caudal hairline, if one exists.

Caution: Avoid deep insertion.[1]

Brain tissue or vessel damage may result.

Withdraw needle if patient reports feeling an electric shock.

Deep needling may cause acute intracranial hemorrhage or other serious neurologic injury.[2]

Connective Tissues

- **Ligamentum nuchae (Nuchal ligament):** This strong median ligament, otherwise known as a "intervertebral syndesmosis", merges with the supraspinous ligament in the neck and extends from the external occipital protuberance to the spinous process of C7.[11] This bilaminar, fibroelastic, intermuscular septum sits between several paired muscles at the dorsal cervical midline. The nuchal ligament likely assists with head stabilization and maintenance of the lordotic curvature of the cervical spine. Continuity along the midline between the nuchal ligament and the caudal spinal dura at the atlanto-occipital and atlanto-axial segments is controversial.[3,4]

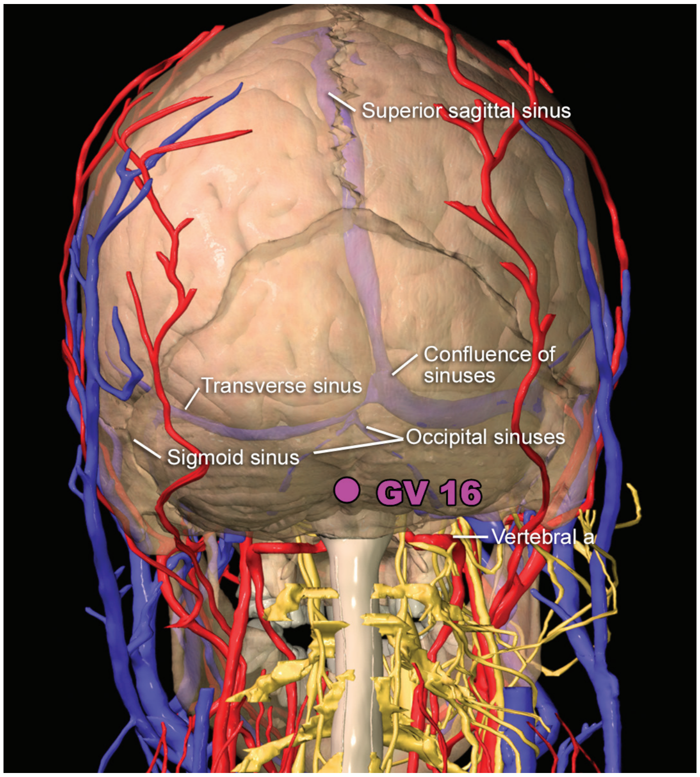


Figure 14-44. This image reveals the connection between GV 16 and the dural venous sinuses. Most notably, GV 16 resides near the occipital sinus, the smallest of all the sinuses. Usually, humans have a single occipital sinus but this individual had a small network. Small venous channels around the foramen magnum (where the spinal cord exits the skull) join the terminal portion of the transverse sinus. Here, the conjoined occipital sinuses drain into the left transverse sinus. It is not uncommon for the confluence of sinuses to occur off the midline, usually to the right, as shown. The connection between the occipital sinus(es) and with the posterior internal vertebral venous plexus is where cerebrospinal venous system transitions from spinal to cranial vascular structures.

- **Posterior atlanto-occipital (PAO) membrane:** This membrane (also known as a ligament) attaches to the foramen magnum and the caudal arch of the atlas. It serves as a canopy for the spinal cord exiting the foramen magnum. An acupuncture needle should never encounter the PAO membrane.

Clinical Relevance: Ossification of the nuchal ligament (ONL) results from the gradual calcification of fibroelastic tissue. Stiffening the nuchal ligament reduces active range of motion in neck flexion and extension. Patients with prominent ONL on radiograph may exhibit more severe cervical radiculopathy and degenerative changes in the spine.[12] Encouraging patients to safely pursue active range of motion exercise for the neck should aid in maintaining flexibility within the nuchal ligament and comfort in the neck. Reducing tension and pain in the neck with acupuncture and related techniques supports patients in these efforts and may also confer benefit to the nuchal tissue itself.

Repetitive motion injury or irritation of the nuchal ligament can predispose patients to develop of painful osseous nodules considered "calcinosis circumscripta".[13] Patients with calcinosis circumscripta of the nuchal ligament usually exhibit neck pain and a history of cervical trauma. These metaplastic localized modifications of nuchal ligament tissue most often develop in the higher mobility regions of C4-C7.

The free border of the PAO membrane arches over the vertebral artery and the suboccipital nerve. Conceivably, stiffening of the PAO membrane could compress these neurovascular elements. More importantly, perhaps, given that the membrane adheres to both dura mater and suboccipital muscles, it provides a vehicle by which strain and traction transfer between the central nervous system and the myofascia of the neck.[14] This connective tissue bridge would allow the rectus capitis posterior minor muscle to limit dural infolding during head and neck extension. At the same time, however, this myodural connection acts as a source of pain and dysfunction. Fortunately, one can treat this site (but always gently and safely) to alleviate stress and proprioceptive disturbances.

Muscles

- **Rectus capitis posterior minor (RCPm) muscle:** This small proprioceptor for the head arises from the tubercle on the posterior arch of the atlas and inserts onto the medial portion of the inferior nuchal line of the occipital bone, as well as onto the surface between the inferior nuchal line and the foramen magnum. Some fibers attach to the spinal dura and the posterior atlanto-occipital (PAO) membrane (ligament). Tendinous fibers from the medial and deep parts of the RCPm muscle are continuous antero-inferiorly with the posterior cervical spinal dura, the PAO membrane joins with the RCPm fascia, tendon, and perivascular sheaths, and the PAO membrane fuses with the spinal dura but not the atlas in the antero-inferior portion.[5] The double-layered PAO membrane extends laterally between the RCPm muscle and the vertebral vascular sheath. In so doing, the PAO membrane anchors the RCPm to the vertebral vascular sheath. The membrane splits on the medial aspect to accommodate the external vertebral plexus and surrounding connective tissue; its deep layer fuses with the spinal dura, as mentioned earlier. The PAO membrane sits at the transition zone between the cranial and spinal dura, perivascular sheaths related to the internal and external vertebral venous plexuses and marginal dural sinus, and the deep layer of the RCPm fascia. See Figure 14-47C to examine these relationships more in-depth.

- **Rectus capitis posterior major muscle:** Provides proprioceptive input regarding head orientation and dural tension along with its partner, the rectus capitis posterior minor muscle. Also extends the head at the upper cervical spine.
- **Trapezius muscle:** Fibers of the cranial, or superior, part of the trapezius elevate thescapula (i.e., when shrugging the shoulders).
- **Semispinalis capitis muscle, medial part:** Extends the head.

Clinical Relevance: The fossa defined by the superior and inferior nuchal lines houses several muscular attachments reserved for superficial movers of the head including the occipitalis, trapezius, sternocleidomastoid, semispinalis capitis, and the splenius capitis muscles. More deeply, between the inferior nuchal line and the foramen magnum reside the rectus capitis posterior minor, rectus capitis posterior major, and obliquus superior. These small structures provide subtle head movements and, more importantly, proprioception. Refer to Figures 14-46 and 14-47A for further exploration of these myofascial relationships to GV 16.

The discovery of connections between suboccipital muscles (i.e., the rectus capitis posterior major and minor as well as the obliquus capitis inferior muscles[15]) and the dura explains a common etiology of cervicogenic headache.[16] Myodural connections form of soft tissue bridges in the atlantoaxial interspace level with GV 15 and the atlantooccipital interspace level with GV 16. See Figure 14-47C.

The soft tissue adjoining muscle to dura harbors proprioceptive neurons, implicating suboccipital muscles in aiding the brain in its control over head position and dural tension.[17] Researchers speculate that myodural biofeedback "may play a role in maintaining the integrity of the subarachnoid space and, subsequently, cerebrospinal pressure. If this mechanism does exist, its failure may result in a variety of clinical manifestations including those arising from increasing dural tension, namely cervicogenic headaches."[18] On the other hand, weakness or atrophy in the suboccipital muscles may lead to hypermobility and irritation of local nerve fibers.

Patients with suboccipital trigger points express tenderness to palpation, referred pain evoked by sustained pressure, and pain worsening when they actively extend the upper cervical spine. Trigger points in the suboccipital muscles tend to create pain perceived as penetrating the skull in a poorly localizable fashion. Patients may first complain that the entire head aches, but upon further questioning and examination, tenderness to palpation may center on a unilateral suboccipital focus. In comparison, trigger points in the upper semispinalis capitis muscle adjacent to GV 15 incite radiating pain to the ipsilateral temporal region with diffuse pain that wraps around the head like a crown.

While some have excised the myofascial bridge to alleviate chronic headache,[19] nonsurgical approaches should certainly be tried first, including manual therapy, laser therapy, and cautious acupuncture.

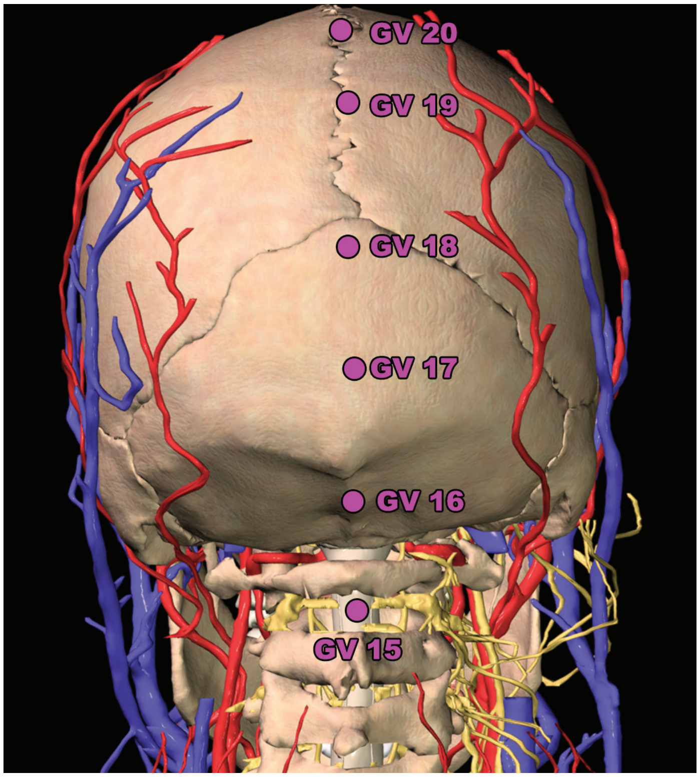


Figure 14-45. One finds GV 16 in a depression just inferior to the external occipital protuberance as shown here. Nearby GV points are also shown along the midline.

Prolonged nociceptive input from trigger points in the head and neck invoke central sensitization in the cervical cord and trigeminal nucleus caudalis. View the spinal nucleus of the trigeminal nerve in Figure 14-47A. The pars caudalis is the most caudal portion of the spinal nucleus. Pain signals may relay between the suboccipital region and muscles of mastication.[20,21] Acupuncture and related techniques may aid in breaking this cycle counteracting chronic pain in the head and neck.

Pain in the occipital regions can also arise from trigger points in the multifidi, levator scapulae, splenius cervicis, and infraspinatus muscles. Restriction in the soft tissues of the neck places pressure on large, vital neural, vascular, and glandular components, increasing the risk of producing pain and potentially negatively impacting glandular function.

Cervicogenic dizziness may result from abnormal afferent activity in cervical muscles, especially those in the suboccipital section of the spine.[22] Abnormal input reaches vestibular nuclei from dysfunctional proprioceptors of the upper cervical region, causing neck pain and tension that aggravate dizziness. Dizziness worsens muscle spasm and a maladaptive positive feedback loop ensues where muscle tension also exacerbates the feeling of being dizzy. Patients may provide a history of looking upward for a long period of time just prior to becoming dizzy. If one suspects a cervicogenic cause of disequilibrium and other causes have been ruled out, manual therapy, laser, and cautious acupuncture at GV 16, GV 15, BL 10, and other regional points may provide relief.

Figure 14-47A exposes the relationship between GV 16, the rectus capitis posterior major and minor muscles, along with the semispinalis capitis muscle. The presence of deep cervical veins beneath GV 16 should give one pause when considering needling

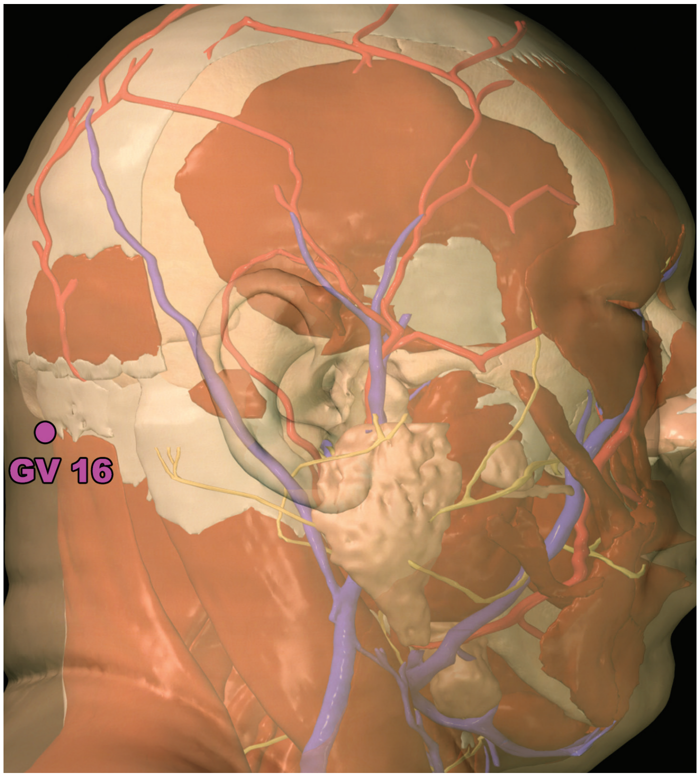


Figure 14-46. The names "Palace of Wind" and "Wind Mansion" for GV 16 refer to the metaphorical condition of "wind invasion" in Chinese medicine. "Wind disorders" include those incited by windy weather (called "exogenous wind") that cause necks to stiffen and noses to run as well as neurologic ailments. "Endogenous wind", according to pre-scientific metaphorical precepts, underlies the onset of various neurologic disturbances such as stroke, facial nerve injury, vertigo, and headache. The fact that GV 16 sits adjacent to several muscles and nerves helps to explain its indication for neck pain while its proximity to the cerebrum and venous sinuses attests to its support of brain function.

beyond the semispinalis capitis. Manual therapy and/or laser treatment would provide safer means of addressing trigger point pathology than would needling deep suboccipital structures.

Nerves

- **Third ("Least") occipital nerve, or TON (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[23]
- **Greater occipital nerve, or GON (C2, (C3)):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[24] (The occipital artery appears in Figure 7-17 lateral to BL 9.) As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.
- **Spinal nerves C2-C3, dorsal rami:** Innervate the posterior cranial fossa.
- **Spinal nerves C2-C4, dorsal rami:** Innervate the semispinalis capitis muscle.
- **Spinal accessory nerve (CN XI):** Provides motor control to the trapezius muscle.
- **C3 and C4 spinal nerves:** Provide pain sensation and proprioceptive function to the trapezius muscle.

Clinical Relevance: Neuroanatomically, nerves supplying GV 16 communicate with vagal, trigeminal, and upper cervical spinal cord pathways. Clinical applications for GV 16, "Wind Mansion" nearly exclusively relate to intracranial or craniocervical pathology. Indications include headache, seizures, vertigo/dizziness, loss of consciousness, cerebrovascular accident (CVA, stroke), agitation, anxiety), pain (cranial, cervical), upper respiratory conditions (rhinitis, sinusitis, epistaxis), and musculoskeletal (somatic) dysfunction. Structure-function connections between the nerves supplying GV 16, associated reflexes, and physiology influenced justify many of these considerations for clinical usage.

Suboccipital structures connect either directly or through reflexes to the upper cervical nerves, the vagus, trigeminal, and upper thoracic sympathetic nerves.

Pain sensation in the posterior fossa and its vasculature travels through a nerve called the recurrent meningeal nerve. This nerve ferries general somatic afferent fibers from the superior vagal ganglion and meningeal rami of the upper three cervical nerves, with C2 predominating. Sympathetic fibers from the superior cervical sympathetic ganglion fibers travel with the recurrent meningeal nerve into the posterior fossa and provide vasomotor control to vessels housed therein.

The recurrent meningeal nerve courses along the walls of the sigmoid sinus to supply the dura of the petrous surface of the temporal bone. Branches visit the transverse sinus on their way to the falx cerebelli, occipital sinus, and dura of the suboccipital cerebellar surface.

Thus, the vagus and upper cervical nerves (comprising the GON and TON) are responsible for producing headache pain on the back of the head[25] and the nauseating malaise associated with vagal irritation. On the other hand, the trigeminal nerve accounts for much of the cranial region headache. That said, both sources can spur the other on by means of the trigeminal nucleus caudalis, seen in Figure 14-47A about midway between the rostral and caudal aspects of the head.

The caudal scalp receives sensory nerve supply from the greater occipital nerve (GON). Crosstalk between the GON and the trigeminal nerve and windup in the trigeminocervical complex in the brainstem and cervical cord supports the inclusion of GV 16 in point protocols addressing intracranial and extracranial sources of discomfort. Stimulation of the GON can reduce pain from headaches that arise in trigeminal nerve territory, likely through mechanisms involving trigemino-cervical convergence at the level of the trigeminal nucleus caudalis.[26]

Nerves in the suboccipital region may become entrapped in the layers of myofascia deep to GV-16, also shown by Figure 14-47A. Nerve entrapment worsens pain and myofascial restriction.

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[27] While surgical implantation of nerve stimulators has been tried for patients with refractory headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[28] acupuncture represents a much less traumatic intervention that does not require generator or lead revision.[29,30]

In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[31] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Some patients experience migraine in conjunction with occipital neuralgia. Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia, as does referred pain from the ipsilateral trigeminal nerve distribution that impacts the C2 spinal cord segment through crosstalk between the spinal nucleus of the trigeminal nerve and the C2 spinal nerve root. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[32] Surgical procedures capable of inducing postoperative occipital neuralgia include the C1 lateral mass screw insertion for stabilization of the atlantoaxial joint.[33]

Third occipital nerve (TON): This dorsal branch of the 3rd cervical spinal nerve must make its way through several layers of deep nuchal musculature, that may compress or otherwise irritate it. This nerve likely produces occipital neuralgia more than has been previously recognized.[34]

Occipital neuralgia originating from TON irritation mimics GON neuralgia. The superficial medial branch of the C3 spinal nerve, also called the 3rd or least occipital nerve, travels around the dorsolateral surface of the C2-3 zygapophyseal (facet) joint that it supplies. It branches at about BL 10. While facet joints caudal to C2-3 receive innervation by the dorsal rami above and below the joint, the C2-3 facets only receive TON innervation. After supplying the facet joint, the TON continues on to supply the semispinalis capitis muscle, traveling deeply along this muscle until it sends a communicating branch to the greater occipital nerve. The risk of third occipital neuralgia increases as a result of its vulnerability to entrapment at the level of the intervertebral disk behind the intervertebral joints. Osteophytes in these joints can produce nerve compression and chronic headache that may remain undiagnosed as a result of clinicians' unfamiliarity with this specific nerve entrapment syndrome.

Cervical zygapophyseal joints cause chronic neck pain and headache in up to half of patients. Facet joints receive innervation from the medial branches of the spinal nerves C3 to C7; each nerve supplies the joint above and below. This calls for treatment not only on the head but also throughout the neck as palpation indicates and symptom manifestations warrant.

Although percutaneous radiofrequency ablation (RFA) has become an accepted nonsurgical modality for chronic neck pain, adverse outcomes may occur. RFA of the least (3rd) occipital nerve and the C2-C4 facet joints has led to "dropped head syndrome" in which the patient became unable of extending her neck, inducing a debilitating complication.[35] While acupuncture and related techniques may not be able to repair nerves completely destroyed by RFA, the risk of permanent disability emphasizes the need to address pain and functional compromise with safe and effective approaches such as acupuncture and related techniques before pursuing modalities that pose risk of irreversible damage.

Midline craniotomies may also damage or irritate the TON and cause neuralgia. Scar tissue may envelop the nerve and compress its branches; pain can worsen with cervical motion and mounting myofascial restriction. Intraoperative traction may damage deeper facet branches of the TON. Acupuncture and related techniques at BL 10, GV 15, and GV 16 can release tension and neuromodulate the TON.

Avoid placing excessive pressure on the suboccipital region during massage or soft tissue manipulative therapy. The cisterna magna, or cerebellomedullary cistern, shown in Figure 14-43 and Figure 14-47A, contains the vertebral artery, the origin of the posterior inferior cerebellar artery, the choroid plexus, and cranial nerves IX, X, XI, and XII. Given that cranial nerves V, VII, IX, X, XI, and XII are involved in both swallowing and speech, it follows that excessive pressure placed on the suboccipital region may compress one or more of these nerves coursing within the cisterna magna and cause temporary or prolonged dysphagia and/or dysarthria.

Vessels

- **Anastomosis between right and left occipital arteries:** Arising from the external carotid artery, each occipital artery courses along a groove in the base of the skull, and ends in the posterior portion of the scalp.
- **Anastomosis between right and left occipital veins:** The occipital veins typically drain into the suboccipital venous plexus, which drains into the vertebral vein and the deep cervical vein, but occasionally it may drain into the internal jugular vein.

Clinical Relevance: The occipital artery is often a main feeding artery in cases of intracranial dural arteriovenous fistulae.[36] Also, blunt, penetrating, or iatrogenic trauma, infectious illness and autoimmune disease can cause scalp aneurysm involving the occipital artery.[37] In that aneurysms of the artery present as painless swellings, avoid acupuncture needling of any scalp mass other than trigger point pathology.

Venous pathways associated with the GV channel extend from the brain to pelvic organs as the cerebrospinal venous system, or CSVS.[38] At GV 16, the vertebral venous plexiform network that coursed throughout the spine transforms into cranial dural venous sinuses. These, in turn, anastomose with veins on the scalp, skull (as diploic veins), and face.

Analogies between the vertebral venous plexuses and the intracranial dural venous sinuses have been drawn. For example, the anterior internal vertebral plexus in the spine resembles the superior and inferior petrosal, cavernous, and lateral sinuses in the head.[39] The posterior internal vertebral venous plexus joins the midline sinus system of the head and there manifest as the superior sagittal, straight, and occipital sinuses.

Bilateral foramina in the base of the skull act as analogues

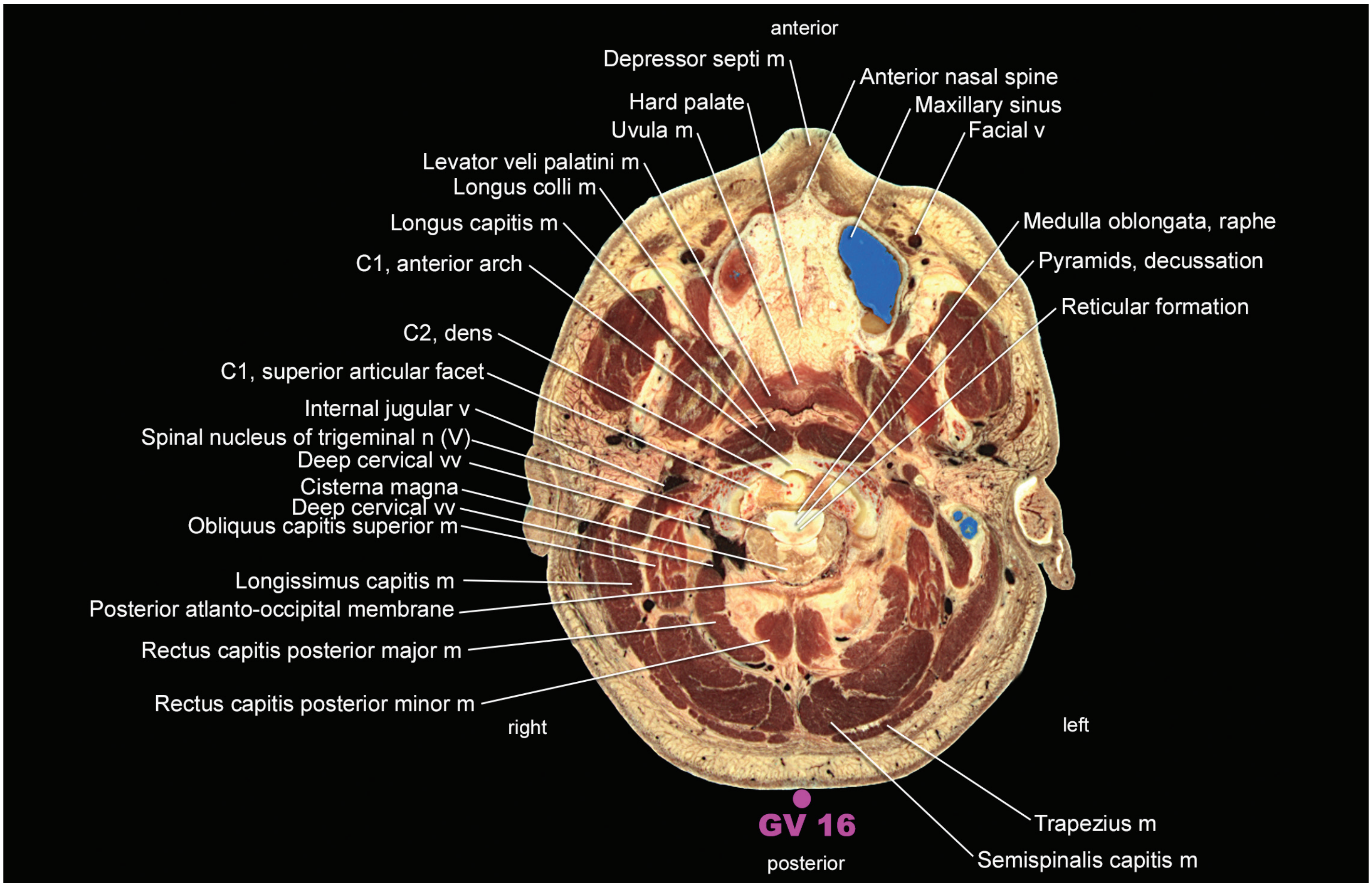

anterior
Depressor septi m
Anterior nasal spine
Hard palate
Maxillary sinus
Uvula m
Facial v
Levator veli palatini m
Longus colli m
Longus capitis m
Medulla oblongata, raphe
C1, anterior arch
Pyramids, decussation
Reticular formation
C2, dens
C1, superior articular facet
Internal jugular v
Spinal nucleus of trigeminal n (V)
Deep cervical vv
Cisterna magna
Deep cervical vv
Obliquus capitis superior m
Longissimus capitis m
Posterior atlanto-occipital membrane
Rectus capitis posterior major m
Rectus capitis posterior minor m
right
left
GV 16
Trapezius m
posterior
Semispinalis capitis m

Figure 14-47A. Many of the myofascial elements that cause headache appear in this cross-section, from the rectus capitis posterior major and minor to the larger, stronger, trapezius and semispinalis capitis muscles and more. Even though acupuncture deactivates trigger points well, note the presence of large veins in the region deep to GV 16. This should cause pause before one decides to needle suboccipital sites deeply. Instead, it is safer to consider myofascial release, massage, and laser therapy for access to and relief of deep dorsal cervical myofascial pathology. That said, avoid applying sustained pressure below the occiput that may injure the brainstem or emanating nerves.

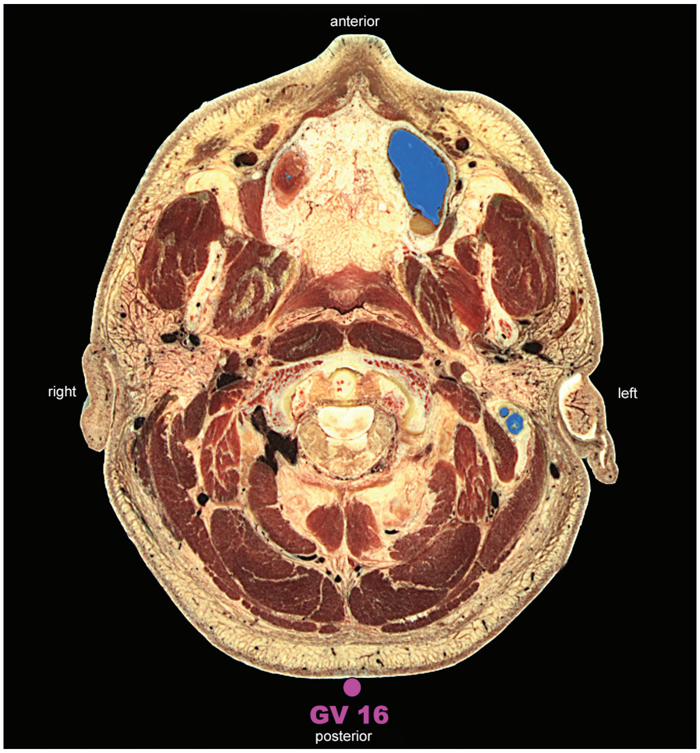

anterior
right
left
GV 16
posterior

Figure 14-47B. This image shows the same cross section as in Figure 14-47A but without labels for closer inspection of the anatomy.

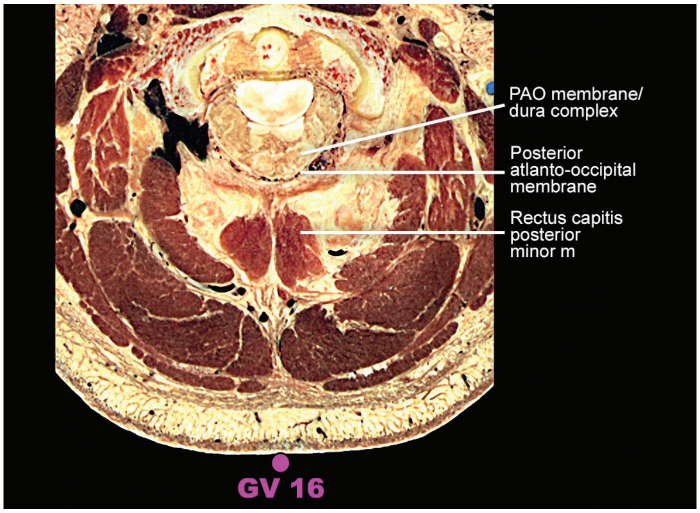

PAO membrane/
dura complex
Posterior
atlanto-occipital
membrane
Rectus capitis
posterior
minor m
GV 16

Figure 14-47C. Got headache? This depiction of the connective tissue bridge between the rectus capitis posterior minor muscle,posterior atlanto-occipital membrane, and spinomedullary dura explains the source of suffering in a significant subset of headache patients and migraineurs.

of intervertebral foramina, allowing communication between intra- and extra-cranial veins. In fact, one could view the venous system of the head, with its extended intracranial, extracranial, and intraosseous (diploic) network, as a single venous plexus.

Indications and Potential Point Combinations

- **Sinus pain:** GV 16, BL 2, GB 14, ST 3, GV 20, LI 4, ST 44.
- **Cervical somatic dysfunction:** GV 16, BL 10, GB 20, GV 14, GB 21, local trigger points.
- **Cervicogenic headache:** GV 16, BL 10, GV 24.5 (Yintang), GV 20, local tender, latent, and active trigger points.
- **Vertigo, dizziness:** GV 16, GB 20, GB 21, GB 34, BL 10, GV 20, temporalis trigger points.

Evidence-Based Applications

- Electroacupuncture at GV 11 and GV 16 suppressed both **hyperemia** and excessive glutamate release during and after transient ischemia in gerbils. Both hyperemia and excessive glutamate after ischemia may be important factors contributing to brain damage via reperfusion injury. This suggests that such suppression contributes to the **neuroprotective** effects of electroacupuncture in cases of ischemic brain damage.[6]
- Electroacupuncture at GB 20 and GV 16 prior to **craniocerebral tumor** surgery may supply Neuroprotective influences for brain tissue.[40]
- Greater occipital nerve stimulation has emerged as a viable treatment for headache due to **occipital neuralgia.**[7]
- Evidence for peripheral sensitization as the etiology of **migraine** pain shows that at least in some cases, the headache phase depends on nociceptive input from perivascular sensory nerve terminals.[8] Nerve terminals related to arteries seem to have more of an impact on pain generation than those from veins. All of the arteries of the scalp (the superficial temporal, posterior auricular, occipital, supraorbital, and frontal arteries) convey pain sensation that arises from various causes, including distension. However, scalp veins do not demonstrate the same sensitivity to pain. Most notably, activated nociceptive periarterial sensory nerve terminals may produce migraine pain along with abnormal central interpretation of normal sensory input within the trigeminal sensory system.
- Some patients with multiple sclerosis exhibit chronic **cerebrospinal venous** insufficiency, characterized by abnormal venous hemodynamics linked to multiple extracranial venous strictures.[9] Where these venous obstructions occur determines the clinical course of the disease. If stimulating GV points can normalize vasomodulatory input, perhaps stimulation along this channel and at affected extracranial sites can influence venous drainage of the central nerve system and benefit MS patients.
- Electroacupuncture at GV 16 and GV 8 improved neuronal regeneration in the striatum of adult rat brains after experimentally-induced **stroke.**[10]
- Electroacupuncture at GV 20, Yintang, GV 16, GV 14, GB 20, PC 6, and SP 6 provided greater clinical improvement than did paroxetine alone for patients with **major depressive disorder.**[41]

References

1. Zhao J and Jiao BJ. Advances in research on the safety of acupuncture for acupoints GV 15, GV 16, and GB 20 in the treatment of Cerebrovascular disease. *Medical Acupuncture*. 15(3). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol15_3/article5.html on 01-10-06.
2. Choo D. Acute intracranial hemorrhage caused by acupuncture. *Headache*. 200;40:397-398.
3. Dean NA and Mitchell BS. Anatomic relation between the nuchal ligament (ligamentum nuchae) and the spinal dura mater in the craniocervical region. *Clinical Anatomy*. 2002;15:182-185.
4. Nash L, Nicholson H, Lee ASJ, et al. Configuration of the connective tissue in the posterior atlanto-occipital interspace. *Spine*. 2005;30(12):1359-1366.
5. Nash L, Nicholson H, Lee ASJ, et al. Configuration of the connective tissue in the posterior atlanto-occipital interspace. *Spine*. 2005;30(12):1359-1366.
6. Pang J, Itano T, Sumitani K, Negi T, and Miyamoto O. Electroacupuncture attenuates both glutamate release and hyperemia after transient ischemia in gerbils. *American Journal of Chinese Medicine*. 2003;31(2):295-303.
7. Henderson JM. Peripheral nerve stimulation for chronic pain. *Current Pain and Headache Reports*. 2008;12:28-31.
8. Oleson J, Burstein R, Ashina M, et al. Origin of pain in migraine: evidence for peripheral sensitization. *Lancet Neurol*. 2009;8:679-690.
9. Zamboni P, Galeotti R, Menegatti E, et al. Chronic cerebrospinal venous insufficiency in patients with multiple sclerosis. *J Neurol Neurosurg Psychiatry*. 2009;80:392-399.
10. Yang Z-J, Shen D-H, Guo X, and Sun F-Y. Electroacupuncture enhances striatal neurogenesis in adult rat brains after a transient cerebral middle artery occlusion. *Acupuncture Electro-Therapeutics Res, Int J*. 2005;30:185-199.
11. Tsai Y-L, Weng M-C, Chen T-W, et al. Correlation between the ossification of nuchal ligament and clinical cervical disorders. *The Kaohsiung Journal of Medical Sciences*. 2012;28(10):538-544.
12. Tsai Y-L, Weng M-C, Chen T-W, et al. Correlation between the ossification of nuchal ligament and clinical cervical disorders. *The Kaohsiung Journal of Medical Sciences*. 2012;28(10):538-544.
13. Paraskevas GK, Raikos A, Martoglou S, et al. Sesamoid ossicles within the nuchal ligament: a report of two cases and review of the literature. *Radiology Case*. 2011;5(8):22-29.
14. Hack GD, Koritzer RT, Robinson WL, et al, Anatomic relation between the rectus capitis posterior minor muscle and the dura mater. *Spine*. 1995;20(23):2484-2486.
15. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J*. 2013;13(5):558-563.
16. Kahkeshani K and Ward PJ. Connection between the spinal dura mater and suboccipital musculature: evidence for the myodural bridge and a route for its dissection – a review. *Clin Anat*. 2012;25(4):415-422.
17. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J*. 2013;13(5):558-563.
18. Scali F, Pontell ME, Enix DE, et al. Histological analysis of the rectus capitis posterior major's myodural bridge. *Spine J*. 2013;13(5):558-563.
19. Hack GD and Hallgren RC. Chronic headache relief after section of suboccipital muscle dural connections: a case report. *Headache*. 2004; 44:84–89.
20. Fernandez-de-las-Penas C, Alonso-Blanco C, Cuadrado ML, et al. Myofascial trigger points in the suboccipital muscles in episodic tension-type headache. *Manual Therapy*. 2006;11:225-230.
21. Oliveira-Campelo NM, Rubens-Rebelatto J, Martin-Vallejo FJ, et al. The immediate effects of atlanto-occipital joint manipulation and suboccipital muscle inhibition technique on active mouth opening and pressure pain sensitivity over latent myofascial trigger points in the masticatory muscles. Journal of Orthopaedic & Sports Physical Therapy. 2010;40(5):310-317.
22. Wrisley DM, Sparto PJ, Whitney SL, et al. Cervicogenic dizziness: a review of diagnosis and treatment. *J Orthop Sports Phys Ther*. 2000;30:755-766.
23. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.
24. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
25. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am*. 2003;36:1041-1053.
26. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci*. 2010;31(Suppl 1):S179-S180.
27. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci*. 2012;33(Suppl 1):S29-S31.
28. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache*. 2008;48(2): 319-327.
29. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia*. 2007;27(2):153-157.
30. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol*. 2010;9(3):285-293.
31. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

32. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

33. Lee SH, Kim ES, and Ech W. Modified C1 lateral mass screw insertion using a high entry point to avoid postoperative occipital neuralgia. *J Clin Neurosci.* 2012; Oct 29. pii: S0967-5868(12)00296-2. doi: 10.1016/j.jocn.2012.01.045.

34. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.

35. Stoker GE, Buchowski JM, and Kelly MP. Dropped head syndrome following multilevel cervical radiofrequency ablation: a case report. *J Spinal Disord Tech*. 2013;26(8):444-448.

36. Tee BL, Tsai LK, Lai CC, et al. The role of the occipital artery in the diagnosis of intracranial dural arteriovenous fistula using duplex sonography. *AJNR AM J Neuroradiol.* 2013;34(3):547-551.

37. Rao VY, Hwang SW, Adesina AM, et al. Thrombosed traumatic aneurysm of the occipital artery: a case report and review of the literature. *Journal of Medical Case Reports.* 2012; 6:203.

38. Pearce JMS. The craniospinal venous system. *European Neurology*. 2006;56:136-138.

39. Andeweg J. The anatomy of collateral venous flow from the brain and its value in aetiological interpretation of intracranial pathology. *Neuroradiology.* 1996;38:621-628.

40. Lu ZH, Bai XG, Xiong LZ, et al. Effect of electroacupuncture preconditioning on serum S100beta and NSE in patients undergoing craniocerebral tumor resection. *Chin J Integr Med.* 2010;16(3):229-233.

41. Qu S-S, Huang Y, Zhang Z-J, et al. A 6-week randomized controlled trial with 4-week follow-up of acupuncture combined with paroxetine in patients with major depressive disorder. *Journal of Psychiatric Research*. 2013;47(6):726-732.

GV 17

Nao Hu “Brain’s Door”

On the midline of the occipital region, in the depression above the external occipital protuberance, 1.5 cun superior to GV 16. Located one-fourth the distance from GV 16 to GV 20. See Figure 7-17 to examine the relationship between GV 17, BL 9, and GV 16.

Fascia

- **Galea aponeurotica (Epicranial aponeurosis):** Dense connective tissue linking the occipital and frontal bellies of the occipitofrontalis muscle. Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. (See Figure 14-49.)

Clinical Relevance: GV 17 can become tender to palpation with occipitofrontalis tension (e.g., in cases of tension headache) that results in traction on the epicranial aponeurosis. GV 17 also exhibits tenderness to palpation in patients with migraine and chronic neck pain. Trigger point pathology in other muscles of the head and neck also refer pain to the occiput. These include the trapezius, sternocleidomastoid, semispinalis, splenius, suboccipital group, occipitalis, digastric and temporalis.

Nerves

- **Third (“Least”) occipital nerve, or TON (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[2]
- **Greater occipital nerve, or GON (C2, (C3)):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic “sling”, close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[3] (The occipital artery appears in Figure 14-49 lateral to GV 17.) As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.
- **Spinal nerves C2-C3, dorsal rami:** Innervate the posterior cranial fossa.

Clinical Relevance: Clinical indications for GV 17, “Brain’s Door” nearly exclusively relate to intracranial or craniocervical pathology. Indications include headache, seizures, vertigo/dizziness, loss of consciousness, cerebrovascular accident (CVA, stroke), agitation, anxiety), pain (cranial, cervical), visual disturbances, vestibular disorders, and sinusitis.

Pain sensation in the posterior fossa and its vasculature travels through a nerve called the recurrent meningeal nerve. This nerve ferries general somatic afferent fibers from the superior vagal ganglion and meningeal rami of the upper three cervical nerves, with C2 predominating. Sympathetic fibers from the superior cervical sympathetic ganglion fibers accompany the recurrent meningeal nerve into the posterior fossa and provide vasomotor control to vessels housed therein.

The recurrent meningeal nerve makes its way along the walls of the sigmoid sinus to supply the dura of the petrous surface of the temporal bone. Branches visit the transverse sinus on their way to the falx cerebelli, occipital sinus, and dura of the suboccipital cerebellar surface.

The upper cervical nerves (i.e., the GON and TON) and the vagus nerve are responsible for producing occipital headache,[4] nausea, and malaise. Trigeminal nerve irritation usually relates to more rostral head pain, but each of these nerves interacts and can aggravate each other through their connections in the trigeminal nucleus caudalis, seen in Figure 14-47A about midway between the rostral and caudal aspects of the head.

Crosstalk between the GON and the trigeminal nerve can contribute to windup in the trigeminocervical complex of the brainstem and cranial spinal cord. Neuromodulation at GV 17 may aid in reducing windup and regional nerve compression.[5]

Neuromodulation of the GON can also help patients with chronic, or refractory, migraine.[6] While surgical implantation of nerve stimulators has been tried for patients with refractory

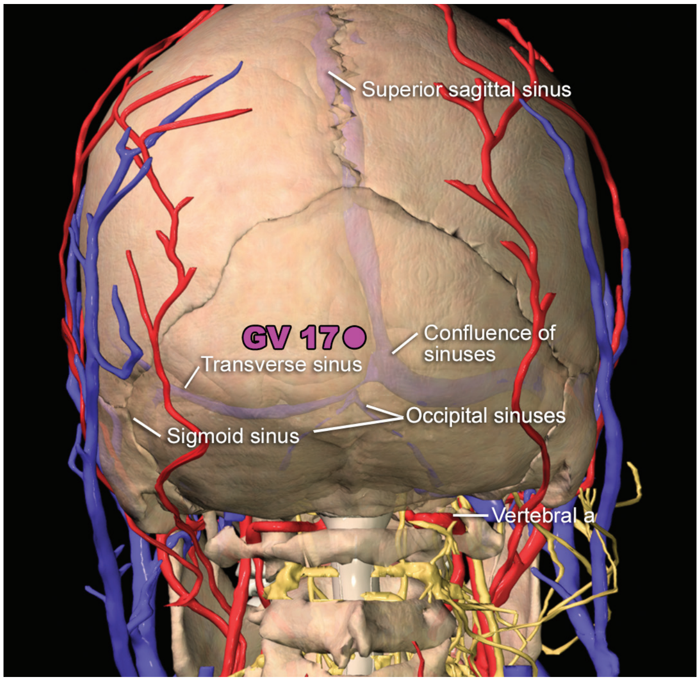


Figure 14-48. GV 17 resides on the occipital bone resembles a doorway to the brain, hence the name “Brain’s Door”. If it did, it the occiput would lower and admit entry to the occipital lobe and various venous sinuses. The superior sagittal dural venous sinus, shown here through the semi-transparent cranium, begins at the foramen cecum where it receives a vein from the nasal cavity. It courses caudad along the midline, traversing the frontal, parietal, and occipital lobes. When it reaches the internal occipital protuberance, it deviates, often to the right, and then bifurcates into two transverse sinuses. The upside-down “T” formed by transverse sinuses, intersects with the superior sagittal sinus at GV 17 near the confluence of sinuses. In addition, the confluence of sinuses connects with the straight and occipital sinuses. The vertebral artery appears here as a reminder of the risk of stroke by dint of upper cervical high-velocity thrusting that traumatizes the artery as it makes a right-angle turn over the atlas.

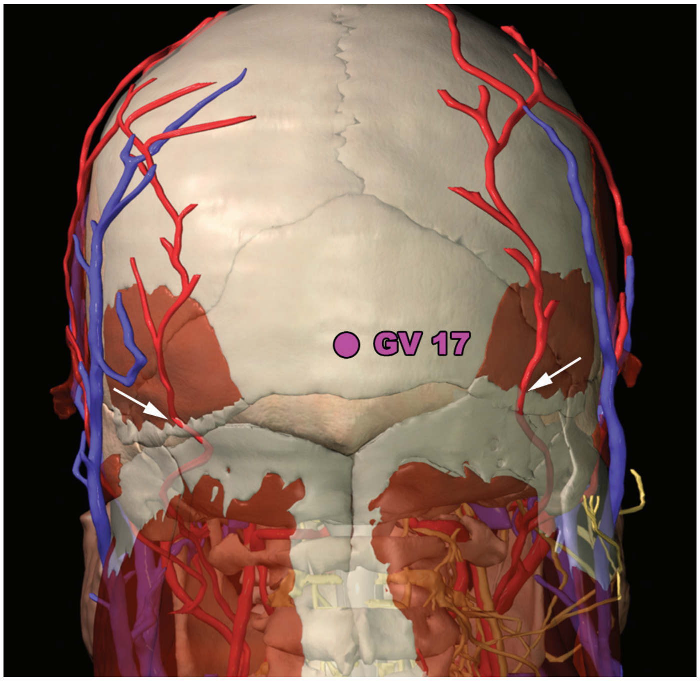


Figure 14-49. Myofascial tension in epicranial structures can compress occipital arteries and nerves. Where they intersect or intertwine, occipital artery pulsations may induce nerve irritation and cause migraine.[17] The arrows in this image show the occipital artery on each side as it emerges from the fascial insertion of the trapezius muscle at the superior nuchal line. This is a common zone of compression for the greater occipital nerve (not shown), both by myofascia and an overlying occipital artery.[18]

headaches of various types such as migraine, hemicrania continua, post-traumatic causes, and cluster headache,[7] acupuncture offers a much less traumatic intervention.[8,9]

Traumatic or degenerative craniocervical or upper cervical spinal disease predisposes patients to develop occipital neuralgia. Some patients experience migraine in conjunction with occipital neuralgia. In contrast to migraine, occipital neuralgia produces a paroxysmal, jabbing pain along the course of the GON or lesser occipital nerve, accompanied by reduced sensation or dysesthesia in the same region.[10] The involved nerves become tender to palpation; the problem resolves temporarily with injection of local anesthetic. Blocking the GON with local anesthetic can diagnose and treat occipital neuralgia, but complications are possible. These include injection of local anesthetic into the artery, a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[11]

As the third (or least) occipital nerve makes its way through layers of nuchal musculature, it may experience compression, leading to a type of occipital neuralgia more common than previously recognized.[12] TON neuralgia mimics GON neuralgia. The risk of third occipital neuralgia increases as a result of its vulnerability to entrapment at the level of the intervertebral disk behind the intervertebral joints. Osteophytes in these joints can produce nerve compression and chronic headache that may remain undiagnosed as a result of clinicians' unfamiliarity with this type of nerve entrapment syndrome.

Figure 14-50 shows the occipital lobe deep to GV 17. This lobe houses the primary visual cortex. Lesions in the occipital lobe can cause visual hallucinations and visual field defects. Flashing lights or images with multiple bright colors (like looking into a scanner as it shines its light onto a page) can trigger occipital lobe seizures. These "photosensitivity seizures" are associated with "flicker stimulation" experienced when watching television, playing video games, or the like.

Neuromodulation at GV 17 may aid in reducing irritability of an occipital lobe epileptic focus. However, while needle acupuncture must work indirectly on the brain, laser therapy influences brain function both directly and indirectly. That is, laser therapy units set at the appropriate power and wavelength deliver photonic stimulation capable of modifying brain function.[13,14,15] Selecting sites for laser photobiomodulation by means of the acupuncture framework[16] standardizes loci and utilizes a system already investigated for its structure-function characteristics.

GV 17 neuromodulation may also impact cerebellar function; their relationship appears in Figure 14-50. The cerebellum refines motor control and influence memory, attention, language, and emotional responses. It contains centers that support balance and spatial orientation, thereby suggesting indications of GV 17 for vestibular dysfunction and disequilibrium, along with GB 20, BL 10, and GV 20.

Vessels

- **Anastomosis between right and left occipital arteries:** Arising from the external carotid artery, each occipital artery courses along a groove in the base of the skull, and ends in the posterior portion of the scalp.
- **Anastomosis between right and left occipital veins:** The occipital veins typically drain into the suboccipital venous plexus, which drains into the vertebral vein and the deep cervical vein, but occasionally it may drain into the internal jugular vein.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults.

The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The occipital artery commonly intersects with the greater occipital nerve. Pulsations in the artery may irritate the nerve and produce head pain. Note in Figure 14-49 how the occipital artery emerges from the fascial insertion of the trapezius muscle at the superior nuchal line. This is one site of neurovascular compression for the greater occipital nerve and occipital artery. Tension in the epicranial aponeurosis heightens the likelihood of headache. As such, GV 17 provides a locus for acupuncture, laser therapy, or soft tissue release of nerve and vessel entrapment.

The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood

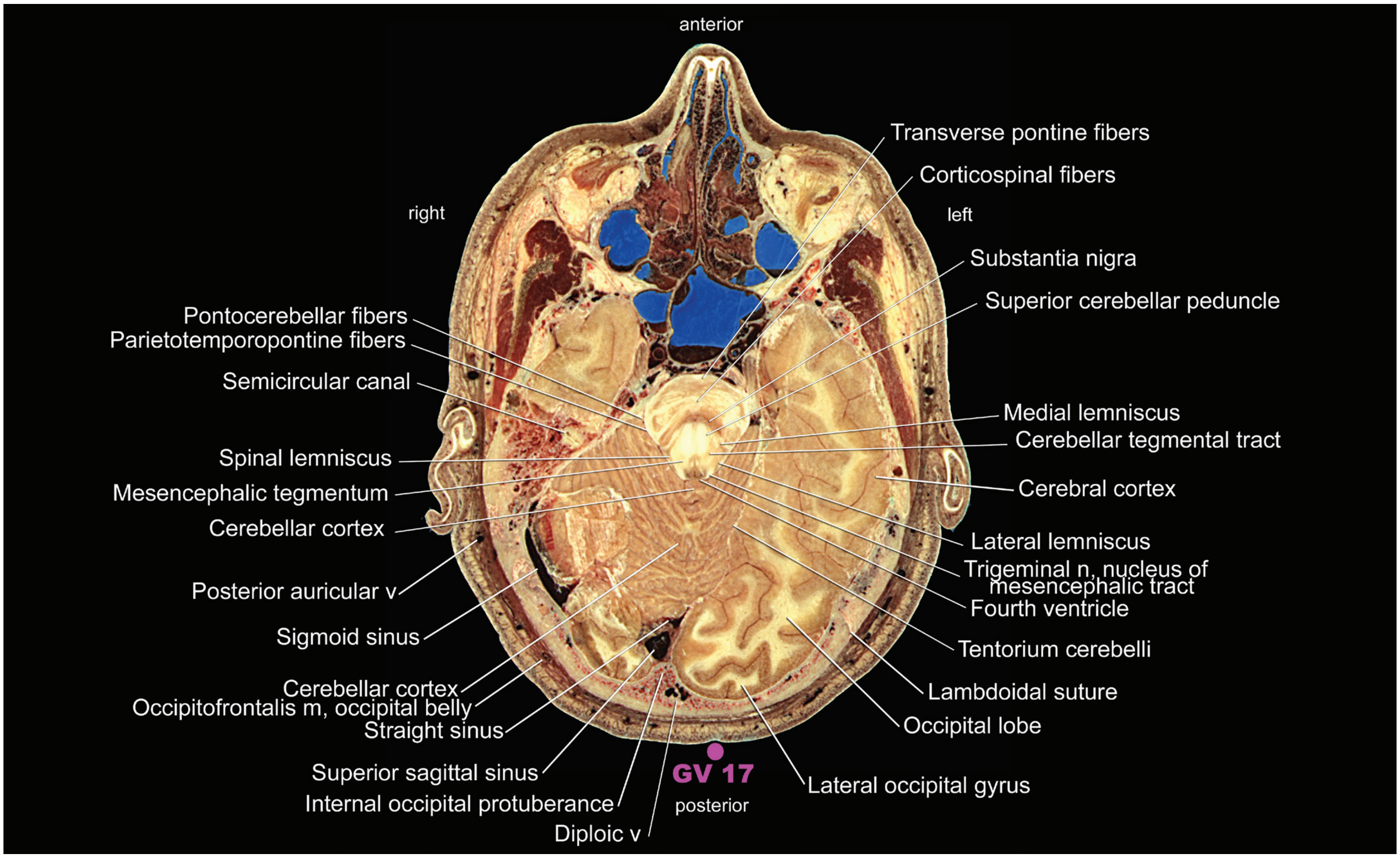

anterior
right
left
Transverse pontine fibers
Corticospinal fibers
Substantia nigra
Superior cerebellar peduncle
Pontocerebellar fibers
Parietotemporopontine fibers
Semicircular canal
Medial lemniscus
Cerebellar tegmental tract
Spinal lemniscus
Mesencephalic tegmentum
Cerebral cortex
Cerebellar cortex
Lateral lemniscus
Trigeminal n, nucleus of mesencephalic tract
Posterior auricular v
Fourth ventricle
Sigmoid sinus
Tentorium cerebelli
Cerebellar cortex
Occipitofrontalis m, occipital belly
Lambdoidal suture
Straight sinus
Occipital lobe
Superior sagittal sinus
GV 17
Lateral occipital gyrus
Internal occipital protuberance
posterior
Diploic v

Figure 14-50. This cross section reveals the deviation of the sagittal venous sinus toward the right at GV 17. It also depicts the proximity of the internal occipital protuberance to the confluence of sinuses.

from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Parts of the cerebrospinal venous system (CSVS), i.e., the vascular basis of the GV channel, appear in Figures 14-48, 14-50, and 14-51. These include the dural venous sinuses and diploic veins as well as, indirectly, various extracranial veins such as the posterior auricular.

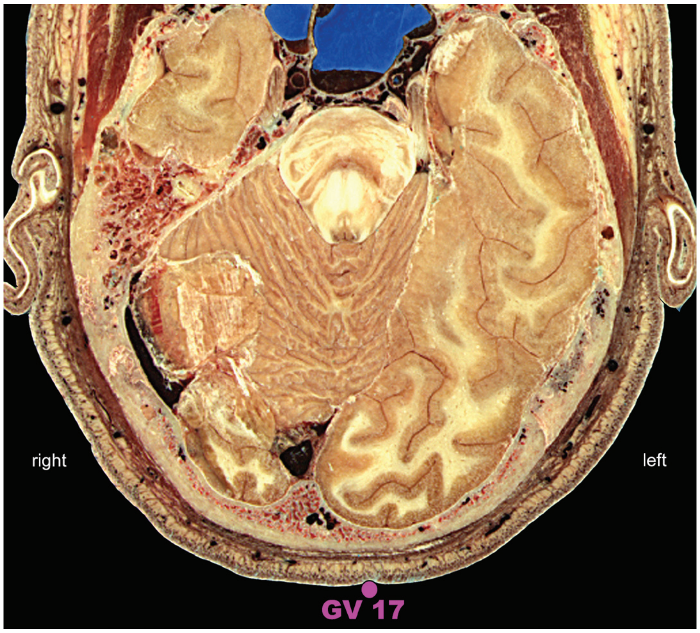

right
left
GV 17

Figure 14-51. Without the labels and lines, this image shows the transition from cerebellum to the occipital lobe, supporting both vestibular and visual indications, respectively, for GV 17.

Indications and Potential Point Combinations

- **Tension headache:** GV 17, GV 20, GV 24.5 (Yintang), GV 14, temporalis trigger points, BL 10, GB 21, LI 4.
- **Vertigo, dizziness:** GV 17, GV 15, GB 8, GB 20, BL 10, LR 3, PC 6.
- **Visual processing disorders:** GV 17, GB 18, BL 9, LR 2, LR 3.

Evidence-Based Applications

- Scalp acupuncture at GV 20, GV 26, and GV 17, three needles in the temporal region, and points defined according to the Yamamoto New Scalp Acupuncture approach reportedly improved language development in children with **autism** in a pilot trial.[1]

References

1. Allam H, Eidine NG, and Helmy G. Scalp acupuncture effect on language development in children with autism: a pilot study. *J Alt Comp Med*. 2008;14(2):109-114.
2. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.
3. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
4. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am*. 2003;36:1041-1053.
5. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci*. 2010;31(Suppl 1):S179-S180.
6. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci*. 2012;33(Suppl 1):S29-S31.
7. Trentman TL and Zimmerman RS. Occipital nerve stimulation: technical and surgical aspects of implantation. *Headache*. 2008;48(2): 319-327.
8. Schwedt TJ, Dodick DW, Hentz J, et al. Occipital nerve stimluation for chronic headache – long-term safety and efficacy. *Cephalalgia*. 2007;27(2):153-157.
9. Goadsby PJ and Sprenger T. Current practice and future directions in the prevention and acute management of migraine. *Lancet Neurol*. 2010;9(3):285-293.
10. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
11. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
12. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.
13. Sharma SK, Kharkwal GB, Sajo M, et al. Dose response effects of 810 nm laser light on mouse primary cortical neurons. *Lasers Surg Med*. 2011;43(8):851-859.
14. Huang YY, Gupta A, Vecchio D, et al. Transcranial low level laser (light) therapy for traumatic brain injury. *J Biophotonics*. 2012;5(11-12):827-837.
15. Xuan Wm Vatansever F, Huang L, et al. Transcranial low-level laser therapy improves neurological performance in traumatic brain injury in mice: effect of treatment repetition regimen. *PLoS One*. 2013;8(1):e53454.
16. Chow R, Yan W, and Armati P. Electrophysiological effects of single point transcutaneous 650 and 808 nm laser irradiation of rat sciatic nerve: a study of relevance for low-level laser therapy and laser acupuncture. *Photomedicine and Laser Surgery*. 2012;30(9):530-535.
17. Janis JE, Hatef DA, Reece EM, et al. Neurovascular compression of the greater occipital nerve: implications for migraine headaches. *Plast Reconstr Surg*. 2010;126(6):1996-2001.
18. Janis JE, Hatef DA, Ducic I, et al. The anatomy of the greater occipital nerve: Part II. Compression point topography. *Plast Reconstr Surg*. 2010;126(5):1563-1572.

GV 18

Qiang Jian "On Rigidity" "Unyielding Space"

On the midline of the occipital region, midway between GV 16 and GV 20. 1.5 cun rostral to GV 17.

Posterior Fontanelle (Babies and young children)

- The fibrous, membrane-covered gap that exists between the parietal bones and the occiput until it closes to become the lambdoidal suture.

Clinical Relevance: Caution with needling and acupressure is required when treating babies and toddlers due to the possible presence of an open posterior fontanelle at GV 18 or just rostral to the point. Usually, the posterior fontanelle closes early in the first year of an infant's life.

Connective Tissues

- **Skin:** This outer layer of the scalp consists of 5 layers: **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium. It ordinarily contains an abundant arterial supply as well as good venous and lymphatic drainage.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves. Lacerations of the scalp bleed profusely as a consequence of abundant arterial anastomoses. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of arterial walls.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides deep to the galea aponeurotica, creating spaces capable of distending with fluid during infection or following trauma.
- **Pericranium:** This external periosteum of the calvaria exhibits continuity with the fibrous tissue inhabiting the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Tissue at GV 18 can become tender to palpation with occipitofrontalis tension, as in tension headache, as well as migraine and chronic neck pain. Trigger point pathology in other muscles of the head and neck also refer pain to the occiput. These include the trapezius, sternocleidomastoid, semispinalis, splenius, suboccipital group, occipitalis, digastric and temporalis.

Nerves

- **Third ("Least") occipital nerve, or TON (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[1]
- **Greater occipital nerve, or GON (C2, (C3)):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[2] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases. See Figure 14-49 to examine this site more closely.
- **Spinal nerves C2-C3, dorsal rami:** Innervate the posterior cranial fossa.

Clinical Relevance: Clinical indications for GV 18, "Unyielding Space" include headache, seizures, anxiety, pain, visual disturbances, and generalized tension.

Pain sensation in the posterior fossa and its vasculature travels through a nerve called the recurrent meningeal nerve. This nerve ferries general somatic afferent fibers from the superior vagal ganglion and meningeal rami of the upper three cervical nerves, with C2 predominating. Sympathetic fibers from the superior cervical sympathetic ganglion fibers accompany the recurrent meningeal nerve into the posterior fossa and provide vasomotor control to vessels housed therein.

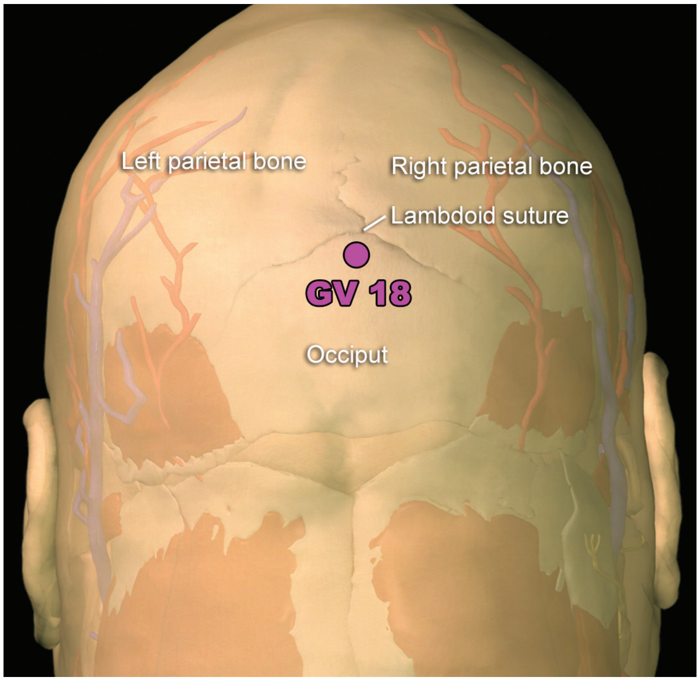


Figure 14-52. GV 18 lands adjacent to the lambdoid suture, i.e., the "lambda"-like suture created by the abutting occipital and parietal bones. This site feels hard and unyielding when palpated, explaining the names, "On Rigidity" and "Unyielding Space". The bone thickens here as well, shown by the cross-section in Figure 14-54.

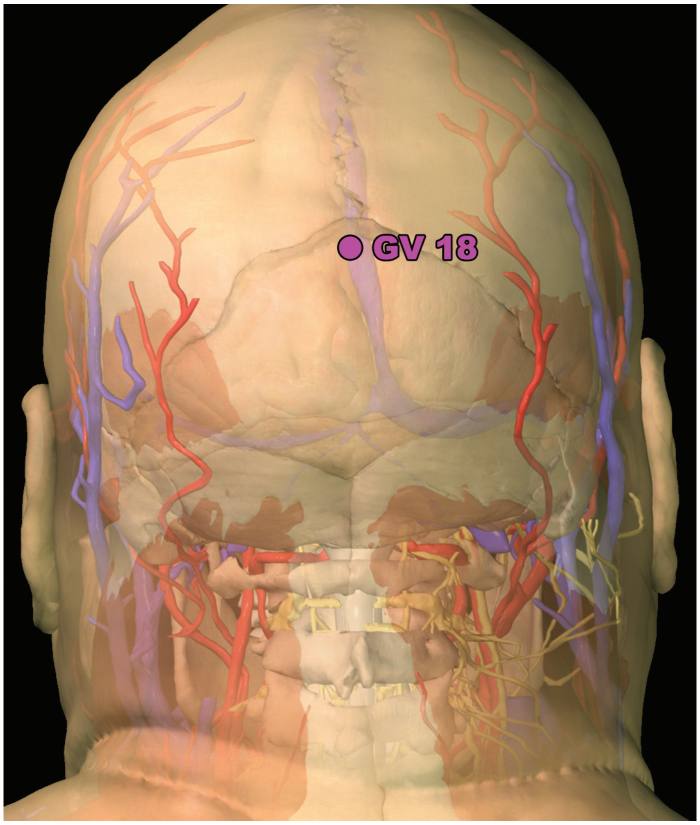


Figure 14-53. GV 18 relates not only to the lambdoid suture but also to the superior sagittal sinus. Thrombosis in any of the cerebral venous sinuses can cause rapidly worsening and severe headache or stroke-like symptoms.[14] Emergency attention is warranted.

The recurrent meningeal nerve makes its way along the walls of the sigmoid sinus to supply the dura of the petrous surface of the temporal bone. Branches visit the transverse sinus on their way to the falx cerebelli, occipital sinus, and dura of the suboccipital cerebellar surface.

When injured or dysfunction, the upper cervical nerves (i.e., the GON and TON) and the vagus nerve cause occipital headache,[3] nausea, and malaise. Trigeminal nerve irritation usually produces headache of a more rostral nature, but each of these nerves interacts and can aggravate the other by means of central nervous interconnections in sites like the trigeminal nucleus caudalis. This nucleus appears in Figure 14-47A about midway between the rostral and caudal limits of the skull. Crosstalk between the GON and the trigeminal nerve can also contribute to windup in the trigeminocervical complex. Neuromodulation through the GON by means of treatment at points like GV 18 can help patients with chronic, or refractory, migraine.[4]

Traumatic or degenerative upper cervical spinal disease predisposes patients to develop occipital neuralgia. Although some patients may experience both migraine and occipital neuralgia, in contrast to migraine, occipital neuralgia produces a characteristic paroxysmal, jabbing pain along the course of the nerve. The pain may be accompanied by reduced sensation or dysesthesia in the occiput.[5] The involved nerves become tender to palpation. Confirming the diagnosis with injection of local anesthetic near the GON can pinpoint and temporarily treat the neuralgia, but risk complications. These include injection of local anesthetic into the occipital artery, production of a Cushingoid response to serial injections of corticosteroids, and cerebral injury if patients have a pre-existing cranial defect from prior surgery or trauma.[6]

As the third (or least) occipital nerve makes its way through layers of nuchal musculature, it may also undergo compression. TON as a cause of occipital neuralgia occurs more commonly than previously recognized.[7] The risk of third occipital neuralgia increases as a result of its vulnerability to entrapment at the level of the intervertebral disk behind the intervertebral joints. Osteophytes in these joints can produce nerve compression and chronic headache that may remain undiagnosed as a result of clinicians' unfamiliarity with this type of nerve entrapment syndrome.

Figure 14-54 shows the occipital lobe deep to GV 18. This lobe houses the primary visual cortex. Lesions in the occipital lobe can cause visual hallucinations and visual field defects.

Flashing lights or images with multiple bright colors (such as those seen when looking into a scanner as it shines its light onto a page) can trigger occipital lobe seizures. These "photosensitivity seizures" stem from "flicker stimulation" as when watching television, playing video games, or the like.

Neuromodulation at GV 18 may aid in reducing irritability of an occipital lobe epileptic focus. While needle acupuncture indirectly alters brain function, laser therapy has the capacity to influence brain function directly as well. That is, photonic stimulation of suitable power and wavelength has been shown to stimulate recovery from injury.[8,9,10] Selecting sites for laser photobiomodulation by introducing acupuncture anatomy[11] standardizes loci and facilitates recognition of structures stimulated.

Vessels

- **Anastomosis between right and left occipital arteries:** Arising from the external carotid artery, each occipital artery courses along a groove in the base of the skull, and ends in the posterior portion of the scalp.
- **Anastomosis between right and left occipital veins:** The occipital veins typically drain into the suboccipital venous plexus, which drains into the vertebral vein and the deep cervical vein, but occasionally it may drain into the internal jugular vein.
- **Superior sagittal sinus:** Begins at the foramen cecum, located at the frontal crest of the frontal bone where it articulates with the ethmoid bone. The superior sagittal sinus drains from rostral to caudal along a groove running inside the frontal and parietal bones. Near the internal occipital protuberance, the superior sagittal sinus drains into the confluence of sinuses and continues with the transverse sinuses, often more closely affiliated with the right one than the left.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary

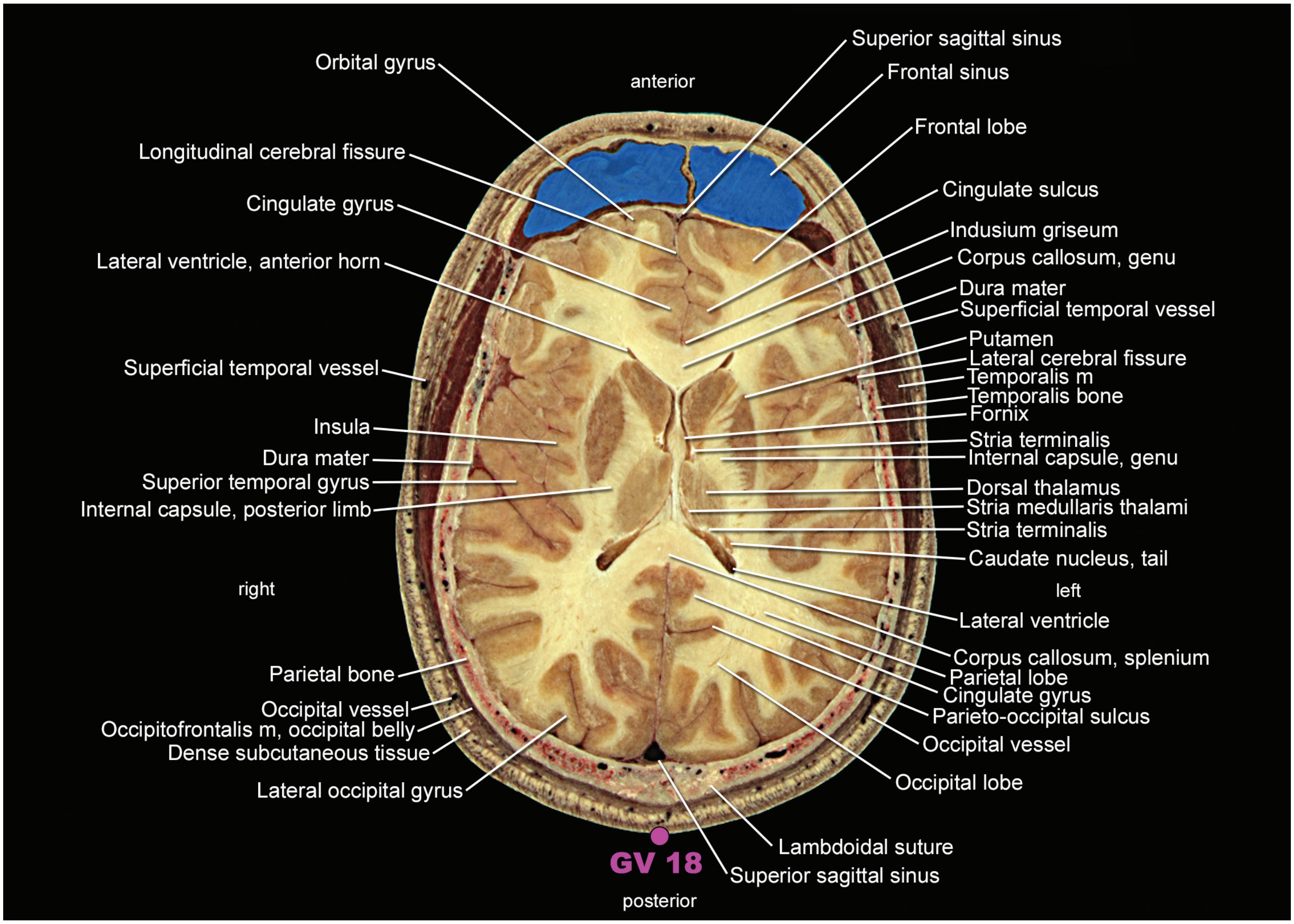

anterior
Orbital gyrus
Longitudinal cerebral fissure
Cingulate gyrus
Lateral ventricle, anterior horn
Superficial temporal vessel
Insula
Dura mater
Superior temporal gyrus
Internal capsule, posterior limb
right
Parietal bone
Occipital vessel
Occipitofrontalis m, occipital belly
Dense subcutaneous tissue
Lateral occipital gyrus
Superior sagittal sinus
Frontal sinus
Frontal lobe
Cingulate sulcus
Indusium griseum
Corpus callosum, genu
Dura mater
Superficial temporal vessel
Putamen
Lateral cerebral fissure
Temporalis m
Temporalis bone
Fornix
Stria terminalis
Internal capsule, genu
Dorsal thalamus
Stria medullaris thalami
Stria terminalis
Caudate nucleus, tail
left
Lateral ventricle
Corpus callosum, splenium
Parietal lobe
Cingulate gyrus
Parieto-occipital sulcus
Occipital vessel
Occipital lobe
Lambdoidal suture
Superior sagittal sinus
GV 18
posterior

Figure 14-54. The occipital lobe of the brain lies deep to GV 18. This suggests that acupuncture, massage, and especially laser therapy may aid in improving visual processing and occipital lobe epilepsy by impacting brain behavior either indirectly through reflex connections or directly, as in photomedicine.

veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus may connect with the nose through an emissary vein, risking transmission of infection from the nose and "danger triangle of the face" (Yintang, GV 24.5) to the meninges and brain. The posterior auricular, occipital, and superficial temporal veins communicate to drain the region caudal to the ear. Blood from this extracranial plexus of veins transmits blood inside the cranium to the sigmoid sinus by means of the mastoid emissary veins. Because emissary veins lack valves, these vessels can transmit both blood and pus through the skull, allowing extracranial sources of infection to enter the intracranial cavity. This fact reinforces the need to follow clean needling practices and to avoid deep scalp insertion as well as traversing infected sites.

Lateral lacunae, also known as the lateral lakes of Trolard, exhibit variable positions but tend to occur near the vertex of the skull, between the coronal and lambdoid sutures. Arachnoid granulations (AG), i.e., herniations of the arachnoid membrane into the dural venous sinuses, allow egress of cerebrospinal fluid from the AG and into the venous system. Unusually large AG's in this region sometimes accompany signs of calvarial remodeling and superior sagittal sinus septation or duplication. Obstruction at the level of the bridging veins and venous lacunae can lead to brain swelling, as in benign intracranial hypertension.[12]

Patients with acute dural sinus thrombosis present commonly with worsening headache, nausea, and photophobia as intracranial venous pressure heightens.[13] The severe and sudden-onset "thunderclap" headache typifies the sinus thrombosis type of pain, taking only seconds to minutes to maximally intensify. Other causes of thunderclap headache include subarachnoid hemorrhage and cervical artery dissection. With sinus thrombosis, actions that raise intracranial pressure such as coughing and Valsalva maneuvers worsen headache.

Other patients with dural sinus thrombosis display signs and symptoms of stroke, including hemiparesis, dysfunction of one or more limbs, or dysphasia. In contrast to the more common "arterial" cause of stroke, sinus thrombosis may not confine its dysfunction to one side of the body.

About 40% of patients with sinus thrombosis have seizures, with the most common population including women around the time of giving birth. This condition is called "sinus thrombosis peripartum". In addition to seizure, patients may display altered mental status and/or weakness. Sinus thrombosis should be included in the differential diagnosis for elderly individuals with mental status change and depressed level of consciousness.

Risk factors for dural sinus thrombosis include coagulopathy, nephrotic syndrome, pregnancy, immediate post-pregnancy period (puerperium), oral contraceptives, meningitis, infection of the upper airways or ear, trauma to the venous sinuses, history of medical procedures to the head or neck, sickle cell anemia, dehydration, blood dyscrasia, chronic inflammatory disease, and homocystinuria.

Individuals with sufficient collateral flow might require only anticoagulant therapy but those who deteriorate and display imaging evidence of venous congestion might need thrombectomy and balloon-assisted thrombolysis in addition to anticoagulation. Laser therapy, acupuncture, and cranial manipulation (including the technique known as the "V-spread" would likely facilitate resolution of a dural sinus thrombosis. However, one should not delay proper diagnosis and treatment. Make the appropriate referral for emergency evaluation as the clinical condition dictates, then introduce physical medicine techniques after the patient receives indicated urgent interventions.

Indications and Potential Point Combinations

- **Tension headache:** GV 18, GV 20, GV 24.5 (Yintang), GV 14, temporalis trigger points, BL 10, GB 21, LI 4.
- **Vertigo, dizziness:** GV 18, GV 15, GB 8, GB 20, BL 10, LR 3, PC 6.
- **Visual processing disorders:** GV 18, GB 18, BL 9, LR 2, LR 3.
- **Neck pain or stiffness:** GV 18, GV 14, BL 10, GB 21, local trigger points.
- **Seizures, agitation:** GV 18, GV 20, BL 10, ST 36, LR 3.

References

1. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.
2. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
3. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am*. 2003;36:1041-1053.
4. Perini F and De Boni A. Peripheral neuromodulation in chronic migraine. *Neurol Sci*. 2012;33(Suppl 1):S29-S31.
5. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
6. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
7. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.
8. Sharma SK, Kharkwal GB, Sajo M, et al. Dose response effects of 810 nm laser light on mouse primary cortical neurons. *Lasers Surg Med*. 2011;43(8):851-859.
9. Huang YY, Gupta A, Vecchio D, et al. Transcranial low level laser (light) therapy for traumatic brain injury. *J Biophotonics*. 2012;5(11-12):827-837.
10. Xuan Wm Vatansever F, Huang L, et al. Transcranial low-level laser therapy improves neurological performance in traumatic brain injury in mice: effect of treatment repetition regimen. *PLoS One*. 2013;8(1):e53454.
11. Chow R, Yan W, and Armati P. Electrophysiological effects of single point transcutaneous 650 and 808 nm laser irradiation of rat sciatic nerve: a study of relevance for low-level laser therapy and laser acupuncture. *Photomedicine and Laser Surgery*. 2012;30(9):530-535.
12. Shakhnovich AR et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochir Suppl*. 1990;51:357-361.
13. Tsai FY, Kostanian V, Rivera M, et al. Cerebral venous congestion as indication for thrombolytic treatment. *Cardiovasc Intervent Radiol*. 2007;30:675-687.
14. Miller CP, Stedman J, Nagaratnam K, et al. Headache in a young male: the clot thickens. *BMJ Case Rep*. 2013; May 22. pii: bcr2013009672. doi: 10.1136/bcr-2013-009672.

GV 19

Hou Ding "Behind the Crown" "Behind the Vertex"

On the midline of the interparietal region, 1.5 cun rostral to GV 18, 1.5 cun caudal to GV 20. Located one-fourth the distance from GV 20 to GV 16. See Figure 14-52 to examine the relationships of the parietal bones to the occiput.

Cranial Suture

- **Sagittal suture:** This midline cranial suture serves as a rough external landmark for the underlying superior sagittal venous sinus. (See Figures 14-56 and 14-57.) At its caudal extent, however, the superior sagittal venous sinus often deviates to the right of the midline, draining into the right transverse sinus.[1]

Cranial sutures remain patent throughout brain growth; some or all may remain flexible, or unossified, throughout life. They act as active growth centers and interact with the dura by means of mechanical and biochemical reciprocity.[2]

Sutures of the vertebrate skull consist of two bone ends and intervening fibrous tissue, thereby constituting a fibrous joint.[3] More than merely bone articulations, the sutures exist as sites of primary osteogenesis, housing osteoprogenitor tissue that proliferates, differentiates, and functions at the bone margins.

Clinical Relevance: Cranial sutures accommodate changes in the size and conformation of the skull. Even in the adult, sutural mobility allows the cranium to expand and contract with intracranial pressure changes. Unossified sutures also modulate forces induced on the skull by temporal muscle contraction during mastication or teeth clenching.[4]

Maladaptive strain patterns in tissues that pull on cranial sutures can invoke pain and neurovascular dysfunction if the sensory nerves and vessels within the sutures become compressed. Nociceptors that supply the sutures arise from the meninges and relay intracranial and extracranial signals back and forth.[5,6] In other words, meningeal nociceptors send fibers through the suture to supply extracranial tissue, including periosteum on the skull surface. In the case of the sagittal suture, these nociceptors occur along the GV line. Sensory fibers along the lambdoid, coronal, and squamous sutures of the calvarium do the same.[7]

Bidirectional communication mediated by meningeal nociceptors explains why myofascial tension and inflammation in the temporalis, occipitofrontalis, and epicranial aponeurosis can trigger intracranial pain. Disturbances in the skin, connective tissue, and periosteum may also incite headache. Conversely, some patients with migraine complain that their skull feels "broken" or "crushed" when they undergo a severe episode.[8]

Dural neural supply of cranial sutures introduces additional nerve pathways by which neuromodulation fosters analgesia. Given that the caudal dura receives vagal afferents, extracranial meningeal fibers that exit through the sagittal suture at GV 19, GV 20, and possibly GV 18 at its caudal extent, ferry neuromodulation through vagal pathways. This helps why patients become relaxed with acupuncture at these sites. In contrast, acupuncture, massage, or acupressure at GV 21 would affect trigeminal fibers more strongly, though crosstalk between the trigeminal and vagus nerves still allows for vagal neuromodulation. GV 20, or "Hundred Convergences", receives both trigeminal and vagal input, accounting for its claim to fame as a strong relaxation point.

Connective Tissues

- **Skin:** This outer layer of the scalp consists of 5 layers: **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium. It ordinarily contains an abundant arterial supply as well as good venous and lymphatic drainage.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, rich with cutaneous nerves. Lacerations of the scalp bleed profusely as a consequence of abundant arterial anastomoses. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of arterial walls.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvarium and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides deep to the galea aponeurotica, creating spaces capable of distending with fluid during infection or after trauma.
- **Pericranium:** This external periosteum of the calvarium exhibits continuity with the fibrous tissue inhabiting the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way

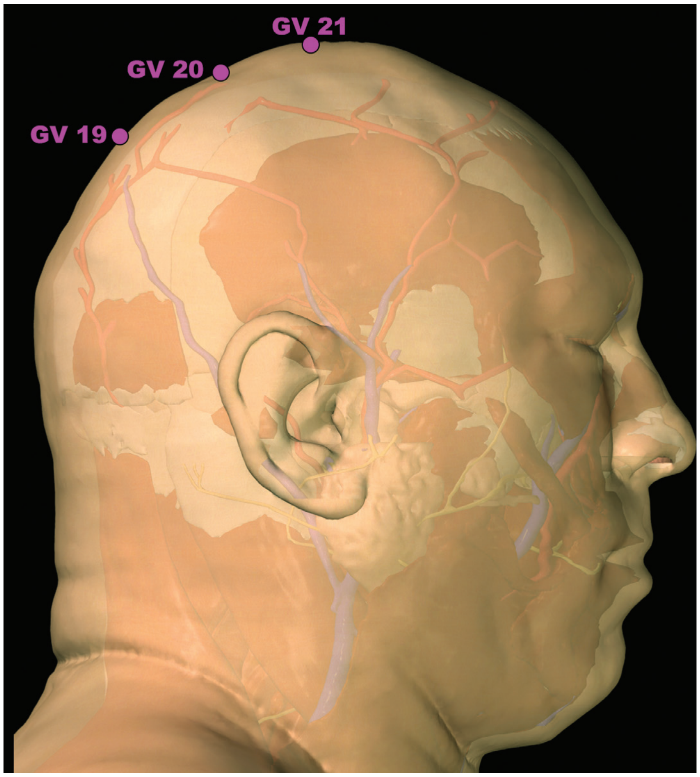


Figure 14-55. GV 19, "Behind the Crown", sits caudal to GV 20 while GV 21, is called "Before the Crown". Thus, the ancient acupuncturists considered GV 20 to identify the the crown or vertex of the head, even though GV 20 does not sit at the highest point of the skull.

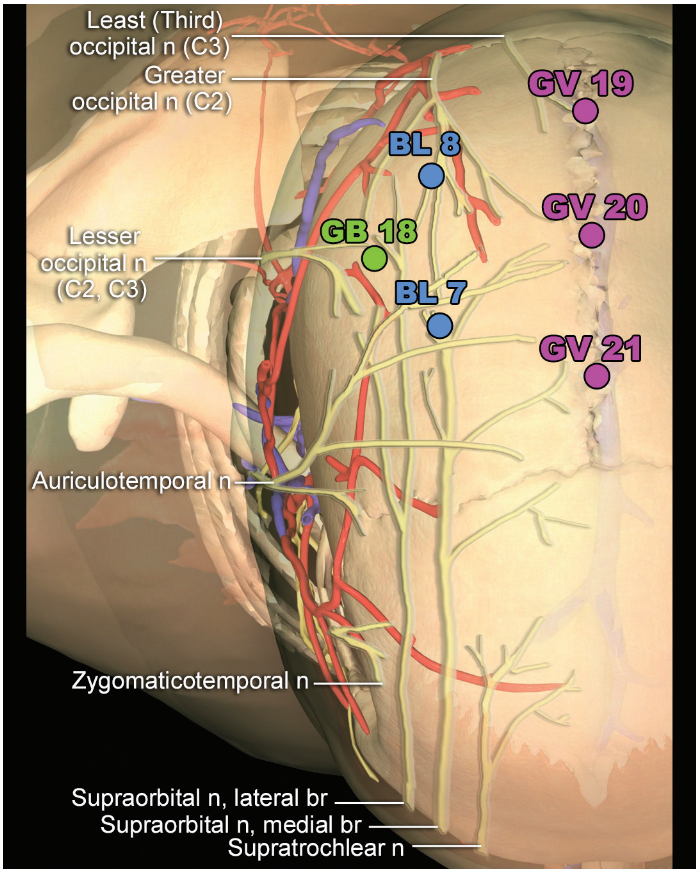

Least (Third) occipital n (C3)
Greater occipital n (C2)
GV 19
BL 8
GV 20
Lesser occipital n (C2, C3)
GB 18
BL 7
GV 21
Auriculotemporal n
Zygomaticotemporal n
Supraorbital n, lateral br
Supraorbital n, medial br
Supratrochlear n

Figure 14-56. GV 19, GV 20, and GV 21 overlie the sagittal cranial suture as well as the superior sagittal sinus. Developmental, mechanical, and neural connections between the dura, cranial sutures, and dural venous sinuses heighten the likelihood that acupuncture and related techniques will influence cerebral venous drainage and CSF flow through neuromodulation.

of emissary veins that course through calvarial foramina.

Tissue at GV 19 can become tender to palpation with occipitofrontalis tension, as in tension headache, as well as migraine and chronic neck pain. Trigger point pathology in other muscles of the head and neck also refer pain to the back of the head. These include the trapezius, sternocleidomastoid, semispinalis, splenius, suboccipital group, occipitalis, digastric and temporalis.

Nerves

- **Third ("Least") occipital nerve, or TON (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[9]
- **Greater occipital nerve, or GON (C2, (C3)):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[10] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.

Clinical Relevance: Neuroanatomically, the upper cervical nerves supply sensation to the somatic structures, sending occipital nerves along the back of the head.

These nerves crosstalk with the vagus that then supplies the meninges in the posterior cranial fossa. The hypoglossal nerve provides meningeal branches to this region, too, joining a branch from the ventral ramus of C1. The facial nerve supplies the occipitofrontalis muscle. The impact of stimulating points on the head in order to mitigate head pain becomes clear when considering the extensive communication network between cranial nerves V, VII, X, and XII, along with interactions between these nerves and the upper cervical spinal cord segments.

Delineating the interrelationships of cranial, cervical, and autonomic nerves responsible for head pain and cranial dysfunction allows for a fuller understanding of the beneficial influence of neuromodulation on specific forms of headache. Isolating, to the degree possible, which components of the myofascial, cranial nerves, autonomic nervous system, and spinal cord segments gives one the ability to target acupuncture, massage, and laser therapy to the appropriate instigator(s). Trigeminal autonomic cephalalgias (TACs) comprise cluster headache, paroxysmal hemicranias, and short-lasting unilateral neuralgiform headache with conjunctival injection and tearing (SUNCT), short-lasting unilateral neuralgiform headache attaches with cranial autonomic features (SUNA), and hemicrania continuua.

Involvement of the trigeminovascular system is a main feature of TACs.[11] That is, in TACs, nociceptive afferent input from cranial vessels and the dura mater travels through the ophthalmic division of the trigeminal nerve to the trigeminocervical complex. From here, nociceptive impulses travel to the thalamus and cortex and result in pain perception. Stimulation of meningeal afferent nerves by dint of acupuncture at GV 19, GV 20, and GV 21 neuromodulates the trigeminovascular system, activating reflexes in the trigeminocervical complex that synapse in the superior salivatory nucleus housed within the pons. From the superior salivatory nucleus, cranial parasympathetic fibers course with either 1) the greater petrosal nerve after synapsing in the sphenopalatine ganglion, or 2) the facial nerve en route to the lacrimal gland. Endogenous neuromodulation of the trigeminocervical complex and superior salivary nucleus may result from activation of the periaqueductal grey, locus coeruleus, nucleus raphe magnus, and hypothalamus.

Overstimulation of the trigeminocervical complex also occurs in cases of temporomandibular dysfunction and cervical spine dysfunction.[12]

Occipital nerve stimulation treats not only occipital neuralgia but also other primary headache conditions as well, including migraine and cluster headache.[13] Acupuncture and related physical medicine techniques have the advantage over nerve ablation and neurostimulator procedures by being less invasive and avoiding the painful and cost of implantation. In addition, they address myofascial sources of pain rather than worsening them by traumatizing tissues. While medications may provide some pain relief, neuroanatomic acupuncture treats the source whereas drugs either may not work or cause insufferable or otherwise adverse side effects.

Occipital nerve stimulation activates pain modulation pathways in the spinal cord and brainstem. Mechanoreceptor stimulation of the occipital nerves (the greater, lesser, and least or third) reaches the C2 and C3 spinal cord segments and trigeminocervical complex. From here, information ascends to the rostral ventromedial medulla, dorsolateral pontomesencephalic tegmentum, periaqueductal gray, thalamus, and cortex. Endogenous analgesic pathways from brainstem to spinal cord modulate pain processing through inhibitory anti-nociceptive projections to the cervical dorsal horn.

Postcraniotomy pain and headache can be severe and disabling due to the abundant supply of sensory fibers in the cranial dura mater.[14] Nerve supply to the dura of the head has been a matter of some debate. Some claim that the trigeminal nerve simply supplies supratentorial structures while the vagus nerve supplies infratentorial regions, but further investigation suggests that dural innervation has far more complexity.

Kemp et al.[15] outlined the innervation pattern as follows: the anterior and posterior ethmoidal nerves supply the anterior third of the falx cerebri, fibers from the ophthalmic division of the trigeminal nerve supply the mid-falx cerebri, and the nervus tentoria of Arnold (a branch of ophthalmic division of the trigeminal) supplies the posterior third of the falx cerebri. Sympathetic fibers from the superior cervical ganglion innervate the superior sagittal sinus as well as other regions of the supratentorial dura mater.

Fibers from the ophthalmic division of the trigeminal nerve reach the tentorium cerebelli. The middle cranial fossa is supplied by the mandibular division of the trigeminal nerve and the nervus meningeus medius from the maxillary division of the trigeminal nerve.

The posterior fossa receives innervation from the several sources, including the facial, glossopharyngeal, and vagus nerves. In addition, branches of the sympathetic trunk (coursing through the superior cervical ganglion) innervate the posterior cranial fossa as do meningeal branches of the upper three cervical spinal nerves. Recurrent branches of the vagus nerves supply the inferior wall of the transverse sinus and falx cerebri. The hypoglossal may contribute fibers to the dura in the posterior fossa as well.

As far back as 1941, neurosurgeons found possible correspondence between irritation of sites along the dura and specific areas of head pain.[16] It behooves clinicians to closely examine and palpate patients' calvaria for treatment and prevention of head pain by considering the neuroanatomic pathways involved. Accurate neuroanatomic localization fosters accurate neuromodulation.

Vessels

- **Anastomosis between right and left occipital arteries:** Arising from the external carotid artery, each occipital artery courses along a groove in the base of the skull, and ends in the posterior portion of the scalp.
- **Anastomosis between right and left occipital veins:** The occipital veins typically drain into the suboccipital venous plexus, which drains into the vertebral vein and the deep cervical vein, but occasionally it may drain into the internal jugular vein.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.
- **Superior sagittal (longitudinal) sinus:** The superior sagittal sinus forms along the convex surface of the falx cerebri and follows the GV line along its entire length. Triangular in shape, the sinus widens at its caudal extent in the vicinity of GV 19, GV 20, and GV 21. See Figure 14-48 to examine the superior sagittal sinus and its connections with the confluence of sinuses and the transverse sinuses.

Venous blood draining from the brain flows through superior cerebral veins, into the dural sinuses, and finally into the internal jugular vein. Venous lacunae communicate with the superior sagittal sinus on either side; their sizes vary and include a small frontal, a large parietal, and an intermediate-size occipital lacuna. Veins from the diploe and dura mater, as well as from the pericranium, empty into the superior sagittal sinus as well after passing through parietal foramina.

Clinical Relevance: Extracranial nerve stimulation by means of acupuncture and related techniques may affect the rate or amount of blood flow in the sagittal suture by neuromodulating local autonomic fibers. Neuromodulation may also influence cerebrospinal fluid (CSF) flow. CSF drains into the superior sagittal sinus through arachnoid granulations, otherwise known as arachnoid villi.

In several regions of the skull, the superior sagittal sinus connects with the extracranial veins through emissary veins. This risks transmission of infection from scalp or face to meninges and brain. At or near GV 19, the parietal emissary vein links the superior sagittal sinus with the occipital vein.[17] Within the cranial bones, parietal emissary veins interface with the diploic veins as well. An example of the diploic vessels appears in Figure 14-57. This extensive connectivity of intracranial and extracranial veins by means of emissary veins supports brain cooling.

Lateral lacunae, also known as the lateral lakes of Trolard, occur at variable positions but tend to manifest near the vertex of the skull between the coronal and lambdoid sutures, coinciding with area described by GV 19 through GV 21.

Arachnoid granulations (AG), i.e., herniations of the arachnoid membrane into the dural venous sinuses, allow egress of cerebrospinal fluid from the AG and into the venous system. Unusually large AG's in this region sometimes signify calvarial remodeling and superior sagittal sinus septation or duplication. Obstruction at the level of the bridging veins and venous lacunae may promote brain swelling, as in benign intracranial hypertension.[18]

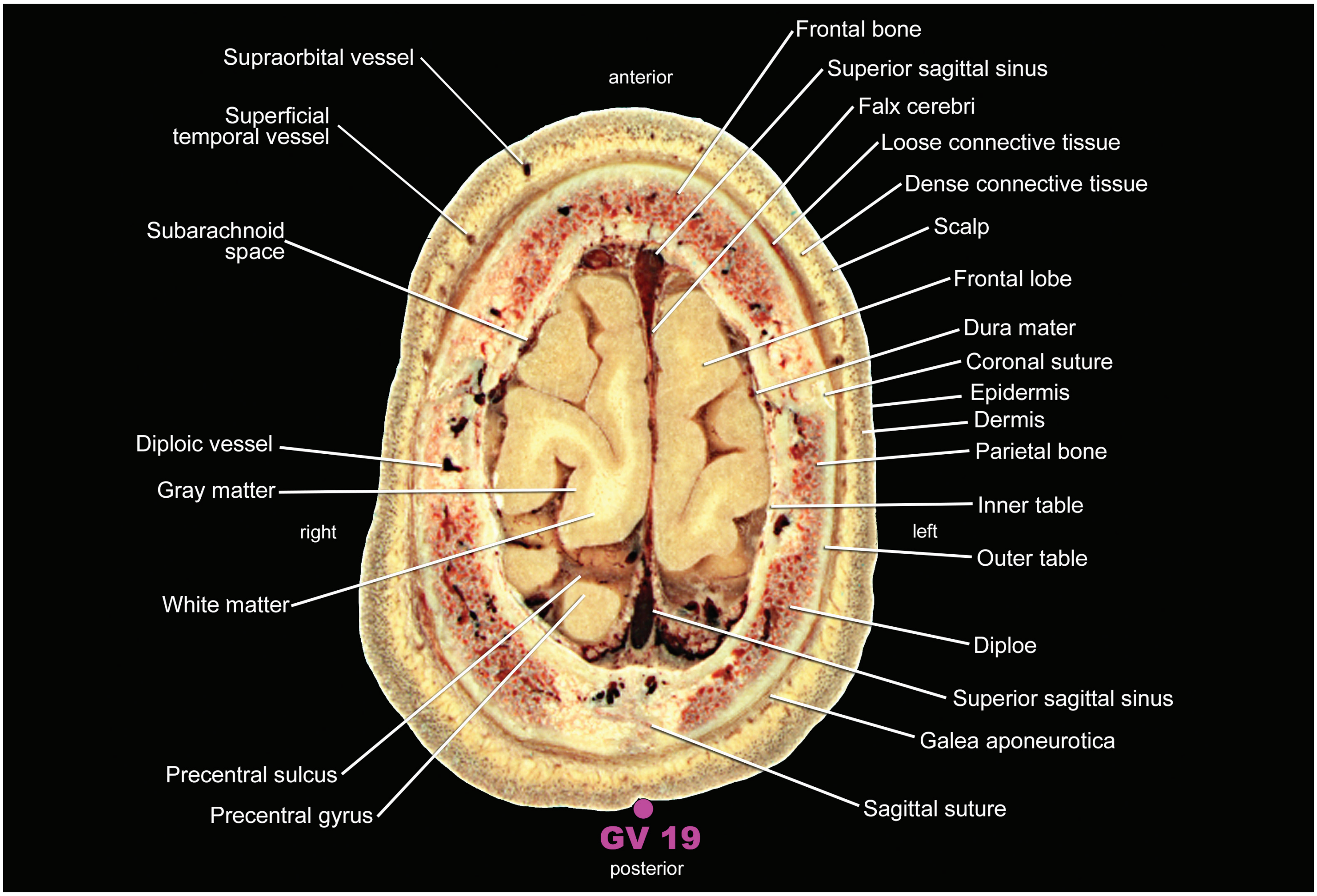

Supraorbital vessel
anterior
Frontal bone
Superior sagittal sinus
Falx cerebri
Superficial temporal vessel
Loose connective tissue
Dense connective tissue
Subarachnoid space
Scalp
Frontal lobe
Dura mater
Coronal suture
Epidermis
Dermis
Diploic vessel
Parietal bone
Gray matter
Inner table
right
left
Outer table
White matter
Diploe
Superior sagittal sinus
Galea aponeurotica
Precentral sulcus
Sagittal suture
Precentral gyrus
GV 19
posterior

Figure 14-57. This cross-section deep to GV 19 exposes the relationship between the extracranial tissue at the point to the sagittal suture, diploic vessels, lateral lacunae, and the superior sagittal sinus. When one considers the neural links between meningeal sensory neurons, sutural neurovascular elements, and extracranial collaterals of meningeal nerves, the potential for neuromodulation of intracranial blood and CSF flow becomes clear.

Patients with acute dural sinus thrombosis may complain of headache that worsens as intracranial venous pressure increases.[19] The severe and sudden-onset “thunderclap” headache typifies the sinus thrombosis type of pain, taking only seconds to minutes to maximally intensify. Additional causes of thunderclap headache include subarachnoid hemorrhage and cervical artery dissection. With sinus thrombosis, actions that raise intracranial pressure such as coughing and Valsalva maneuvers worsen headache. Some patients report visual disturbances and exhibit papilledema because of elevated intracranial pressure.[20]

Other patients with dural sinus thrombosis display signs and symptoms of stroke, including hemiparesis, dysfunction of one or more limbs, or dysphasia. In contrast to the more common “arterial” cause of stroke, paresis or paralysis from sinus thrombosis may extend beyond one side of the body.

About 40% of patients with sinus thrombosis have seizures, with the most common population including women around the time of giving birth. This condition is called “sinus thrombosis peripartum”. In addition to seizure, patients may display altered mental status and/or weakness. Sinus thrombosis should be included in the differential diagnosis for elderly individuals with mental status change and depressed level of consciousness.

Risk factors for dural sinus thrombosis include coagulopathy, nephrotic syndrome, pregnancy, immediate post-pregnancy period (puerperium), oral contraceptives, meningitis, infection of the upper airways or ear, trauma to the venous sinuses, history of medical procedures to the head or neck, sickle cell anemia, dehydration, blood dyscrasia, chronic inflammatory disease, and homocystinuria.

Individuals with sufficient collateral flow might require only anticoagulant therapy but those who deteriorate and display imaging evidence of venous congestion might need thrombectomy and balloon-assisted thrombolysis in addition to anticoagulation. Laser therapy, acupuncture, and cranial manipulation (including the technique known as the “V-spread” would likely facilitate resolution of a dural sinus thrombosis. However, one should not delay proper diagnosis and treatment. Make the appropriate referral for emergency evaluation as the clinical condition dictates, then introduce physical medicine techniques after the patient receives indicated urgent interventions.

Indications and Potential Point Combinations

- **Tension headache radiating to the vertex:** GV 19, GV 20, GV 21, BL 7, BL 8, GB 14, temporalis trigger points, BL 10, GB 21, LI 4. Acupressure in a “V spread” fashion along the cranial sutures.
- **Neck pain or stiffness:** GV 19, GV 14, BL 10, GB 21, local trigger points.

- **Stress headache:** Acupressure, osteopathic cranial manipulation focused on GV 19, GV 20, and GV 21, as well as GV 24.5 and GV 14. Include other regions as the patient's presentation and myofascial palpation findings suggest.

References

1. Tubbs RS, Salter G, Elton S, Grabb PA, and Oakes WJ. Sagittal suture as an external landmark for the superior sagittal sinus. *J Neurosurg*. 2001;94:985-987.
2. Gagan JR et al. Cellular dynamics and tissue interactions of the dura mater during head development. *Birth Defects Research (Part C)*. 2007;81:297-304
3. Rice DP. Developmental anatomy of craniofacial sutures. In: Rice DP (ed). *Craniofacial Sutures, Development, Disease and Treatment*. Front Oral Biol. Basel, Karger, 2008, volume 12, pp. 1-21.
4. Rice DP. Developmental anatomy of craniofacial sutures. In: Rice DP (ed). *Craniofacial Sutures, Development, Disease and Treatment*. Front Oral Biol. Basel, Karger, 2008, volume 12, pp. 1-21.
5. Retzlaff EW, Mitchell FL Jr, Upledger JE, et al. Neurovascular mechanisms in cranial sutures. *J Am Osteopath Assoc.* 1980; 80:218-219 (abst).
6. Retzlaff EW, Jones L, Mitchell FL Jr, et al. Possible autonomic innervation of cranial sutures of primates and other animals. *Brain Res.* 1973;58:470-477.
7. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol*. 2009;515(3):331-348.
8. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol*. 2009;515(3):331-348.
9. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine.* 2011;15:71-75.
10. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.
11. Akerman S, Holland PR, Summ O, et al. A translational in vivo model of trigeminal autonomic cephalalgias: therapeutic characterization. *Brain*. 2012;135:3664-3675.
12. Weber P, Correa EC, Ferreira Fdos S, et al. Cervical spine dysfunction signs and symptoms in individuals with temporomandibular disorder. *J Soc Bras Fonoaudiol.* 2012;24(2):134-139.
13. Paemeleire K and Bartsch T. Occipital nerve stimulation for headache disorders. *Neurotherapeutics: The Journal of the American Society for Experimental NeuroTherapeutics*. 2010;7(2):213-219.
14. Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. World Neurosurg. 2012;78(5):505-510.
15. Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. World Neurosurg. 2012;78(5):505-510.
16. Ray BS and Wolff HG. Experimental studies on headache: pain-sensitive structures of the head and their significance in headache. *Arch Surg*. 1941;41:813-856. Cited in: Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. World Neurosurg. 2012;78(5):505-510.
17. Mortazavi MM, Tubbs RS, Riech S, et al. Anatomy and pathology of the cranial emissary veins: a review with surgical implications. *Neurosurgery.* 2012;70:1312-1319.
18. Shakhnovich AR et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochir Suppl.* 1990;51:357-361.
19. Tsai FY, Kostanian V, Rivera M, et al. Cerebral venous congestion as indication for thrombolytic treatment. *Cardiovasc Intervent Radiol.* 2007;30:675-687.
20. Gupta RK et al. Superior sagittal sinus thrombosis presenting as a continuous headache: a case report and review of the literature. *Cases Journal.* 2009;2:9361.

GV 20

Bai Hui "100 Convergences"

Draw an imaginary line from the lobe of the ear to its highest point on the helix. Where the continuation of this line meets the midline, you will find GV 20, as shown in Figure 14-58. Note that GV 20 does not designate the highest point of the cranium.

In a depression 5 cun behind the anterior hairline and 7 cun anterior to the posterior hairline. Also located 8 cun posterior to the glabella and 6 cun superior to the external occipital protuberance.

Cranial Suture

- **Sagittal suture at the level of right and left parietal foramina:** This midline cranial suture serves as a rough external landmark for the underlying superior sagittal sinus. At its caudal extent, the superior sagittal sinus often deviates to the right, tending to drain more frequently into the right transverse sinus.[1] The parietal foramina, which may be paired, occur near the sagittal suture and transmit emissary veins, connecting the scalp to the superior sagittal sinus.

Clinical Relevance: Cranial sutures allow for changes in the size and conformation of the skull. When maintained in the adult, sutural mobility accommodates cranial expansion and contraction with intracranial pressure changes. In addition, flexible sutures modulate strain placed on the skull by calvarial muscle contraction during mastication.

Myofascial dysfunction that pulls on cranial sutures can invoke pain and neurovascular dysfunction by compressing nerves and vessels. Sutural compaction activates extracranial nociceptors of meningeal origin that supply the sutures. These fibers relay signals back and forth across the calvarium.[29,30] Sensory fibers that innervate the lambdoid, coronal, and squamous sutures of the calvarium do the same.[31]

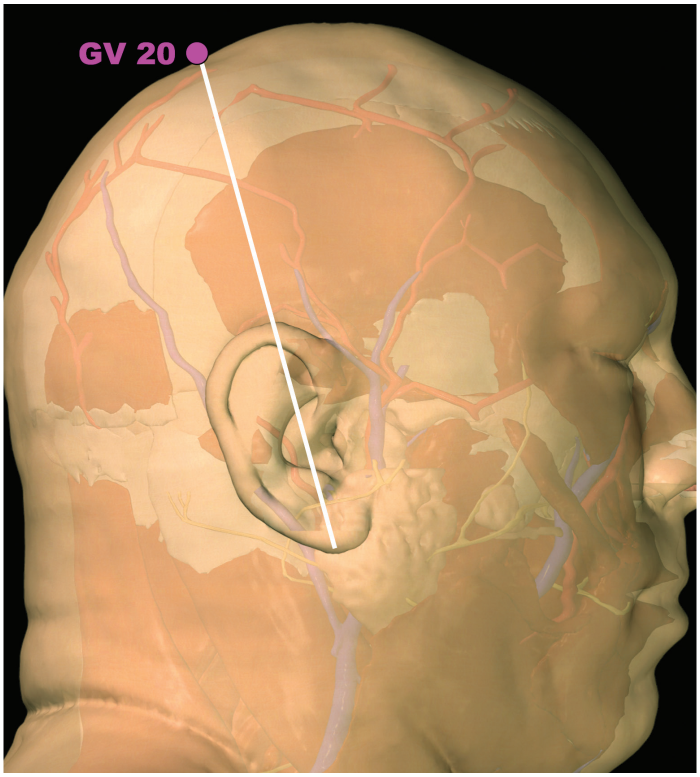


Figure 14-58. Locate GV 20 by connecting, at the midline, lines drawn from earlobe to the highest point on the helix. Here, the white line illustrates the angle from earlobe to GV 20.

Bidirectional communication mediated by meningeal nociceptors helps to explain how myofascial tension and inflammation in the temporalis, occipitofrontalis, and epicranial aponeurosis incites intracranial pain. Disturbances in the skin, connective tissue, and periosteum may in turn also instigate headache. Conversely, some patients with migraine, considered a source of intracranial pain, complain that their skull hurts, and not their "brain".[32]

The fact that nociceptors from the dura innervate cranial sutures introduces opportunities for neuromodulation, either directly along the GV line as in the case of the sagittal suture, or indirectly through cervical and trigeminal nerves that cross talk with dural fibers. GV 20, called "Hundred Convergences", interacts with both trigeminal and vagal extracranial afferents, accounting for its notoriety as a strong point that calms patients. Note the number of nerves that reach for the point as shown in Figure 14-59B.

Connective Tissues

Connective Tissues of the **"SCALP"** consists of 5 layers, i.e., **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium

- **Skin:** Contains an abundant arterial supply as well as good venous and lymphatic drainage capacity.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides beneath the galea aponeurotica, affording many potential spaces that may distend with fluid following infection or trauma.
- **Pericranium:** This is the external periosteum of the calvaria, continuous with the fibrous tissue in the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Lacerations of the scalp may bleed profusely as a consequence of the abundance of arterial anastomoses in the scalp. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of the artery walls.

Tension from the galea aponeurotica onto or around nerves predisposes these vulnerable structures to entrapment syndromes. Treatment involves releasing connective tissue locally at locations such as GV 20, as well as deactivating trigger points in the frontalis (e.g., GB 14) and the occipitalis (e.g., BL 9) muscles. Lateral pull from the temporalis fascia accentuates tension in the epicranial aponeurosis and predisposes patients to headache syndromes. It may also irritate the lesser occipital nerve, which appears in Figure 14-59B.

Nerves

- **Third ("Least") occipital nerve, or TON (C3):** Innervates the skin of the medial occipital and cervical regions. This dorsal ramus of the C3 spinal nerve separates into a complex system of branches after emerging from the articular pillar of the C3 vertebra. It divides into medial and lateral branches, with the medial further separating into deep and superficial divisions.[33]
- **Lesser occipital nerve, or LON (C2, C3):** Supplies sensation to the scalp on the lateral aspect of the head, caudal to the auricle. The LON also innervates the skin of the caudal or convex portion of the auricle and communicates with the mastoid branch of the greater auricular nerve. May arise from the GON.
- **Greater occipital nerve, or GON (C2, (C3)):** Supplies cutaneous sensation to the posterior scalp. Arises from the dorsal root of the second cervical spinal nerve. A communicating branch from C3 may join the GON. The nerve ascends in the caudal neck and head over the dorsal surface of the rectus capitis posterior major muscle. It pierces the fleshy fibers of the semispinalis capitis, runs a short distance rostrad and laterad but remains deep at this point to the trapezius muscle. It becomes subcutaneous just caudal to the superior nuchal line by passing above an aponeurotic "sling", close to the midline, consisting of the combined origins of the trapezius and sternocleidomastoid muscles, medial to the occipital artery.[34] As the GON passes through these various layers of muscle and fascia, the risk of entrapment increases.
- **Spinal nerves C2 and C3:** Innervate the scalp caudal to the auricles; the dorsal roots of C2 and C3 innervate the caudal cranial fossa.
- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the skin anterior to the ear, along the posterior temporal region, the tragus, and part of the helix of the auricle. Provides sensation to the roof of the external acoustic meatus and the upper portion of the tympanic membrane.
- **Supraorbital nerve (CN V_1):** The supraorbital nerve is a continuation of the frontal nerve, innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva, and provides sensation to the forehead skin and vertex.

Clinical Relevance: GV 20 receives innervation from both trigeminal and cervical spinal nerve extracranial and intracranial sources. That is, the sagittal suture (related to GV 19, GV 20, and GV 21) receives nerve fibers from superficial trigeminal and cervical nerves as well as intracranial meningeal afferent fibers. Furthermore, the three most cranial cervical spinal nerve roots communicate with the trigeminal nerve system by converging onto neurons in the spinal nucleus of the trigeminal nerve.[35] This explains the widespread sensory, motor, and autonomic phenomena that arise in various headache states, including migraine and occipital neuralgia.

Delineating the interrelationships of cranial, cervical, and autonomic nerves responsible for head pain and cranial dysfunction allows for a fuller understanding of the beneficial influence of neuromodulation on specific forms of headache. Isolating, to the degree possible, which components of the myofascial, cranial nerves, autonomic nervous system, and spinal cord segments gives one the ability to target acupuncture, massage, and laser therapy to the appropriate instigator(s). Trigeminal autonomic cephalalgias (TACs) comprise cluster headache, paroxysmal hemicranias, and short-lasting unilateral neuralgiform headache with conjunctival injection and tearing (SUNCT), short-lasting unilateral neuralgiform headache attaches with cranial autonomic features (SUNA), and hemicrania continuua.

Involvement of the trigeminovascular system is a main feature of TACs.[36] That is, in TACs, nociceptive afferent input from cranial vessels and the dura mater travels through the ophthalmic division of the trigeminal nerve to the trigeminocervical complex. From here, nociceptive impulses travel to the thalamus and cortex and result in pain perception. Stimulation of meningeal afferent nerves by dint of acupuncture at GV 19, GV 20, and GV 21 neuromodulates the trigeminovascular system, activating reflexes in the trigeminocervical complex that synapse in the superior salivatory nucleus housed within the pons. From the superior salivatory nucleus, cranial parasympathetic fibers course with both 1) the greater petrosal nerve after synapsing in the sphenopalatine ganglion, and 2) the facial nerve en route to the lacrimal gland. Endogenous neuromodulation of the trigeminocervical complex and superior salivary nucleus may result from activation of the periaqueductal grey, locus coeruleus, nucleus raphe magnus, and hypothalamus.

Overstimulation of the trigeminocervical complex can occur in cases of temporomandibular dysfunction and cervical spine dysfunction.[37]

Occipital nerve stimulation treats not only occipital neuralgia but also other primary headache conditions, including migraine and cluster headache.[38] Acupuncture and related physical medicine techniques have the advantage over nerve ablation and neurostimulator procedures by being less invasive and avoiding the painful and cost of implantation. In addition, they address myofascial sources of pain rather than worsening them by traumatizing tissues. While medications may provide some pain relief, neuroanatomic acupuncture treats the source whereas drugs either may not work or cause insufferable or otherwise adverse side effects.

Occipital nerve stimulation activates endogenous pain modulation pathways in the spinal cord and brainstem. Mechanoreceptor stimulation of the occipital nerves (i.e., the greater, lesser, and least or third) reaches both spinal cord in the C2 and C3 and brainstem at the trigeminocervical complex. Neural signals then ascend to the rostral ventromedial medulla, dorsolateral pontomesencephalic tegmentum, periaqueductal gray, thalamus, and cortex. Endogenous analgesic pathways from brainstem to spinal cord modulate pain processing through inhibitory anti-nociceptive projections to the cervical dorsal horn.

Post-craniotomy pain and headache can be severe and disabling due to the abundant supply of sensory fibers in the cranial dura mater.[39] Nerve supply to the dura of the head has been a matter of some debate. Some claim that dural sensation simply takes the form of trigeminal supply of supratentorial structures and vagal supply of infratentorial regions, but further investigation suggests far more complexity, as follows.[40] The anterior and posterior ethmoidal nerves supply the anterior third of the falx cerebri, fibers from the ophthalmic division of the trigeminal nerve supply the mid-falx cerebri, and the nervus tentoria of Arnold (a branch of ophthalmic division of the trigeminal) supplies the posterior third of the falx cerebri. Sympathetic fibers from the superior cervical ganglion innervate the superior sagittal sinus as well as other regions of the supratentorial dura mater.

Fibers from the ophthalmic division of the trigeminal nerve reach the tentorium cerebelli. The middle cranial fossa is supplied by the mandibular division of the trigeminal nerve and the nervus meningeus medius from the maxillary division of the trigeminal nerve.

The posterior fossa receives innervation from the several sources, including the facial, glossopharyngeal, and vagus nerves. In addition, branches of the sympathetic trunk (coursing through the superior cervical ganglion) innervate the posterior cranial fossa as do meningeal branches of the upper three cervical spinal nerves. Recurrent branches of the vagus nerves supply the inferior wall of the transverse sinus and falx cerebri. The hypoglossal may contribute fibers to the dura in the posterior fossa as well.

As far back as 1941, neurosurgeons found possible correspondence between irritation of sites along the dura and specific areas of head pain.[41] It behooves clinicians to closely examine and palpate patients' calvaria for treatment and prevention of head pain by considering the neuroanatomic pathways involved. Accurate neuroanatomic localization fosters accurate neuromodulation.

The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[42] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The

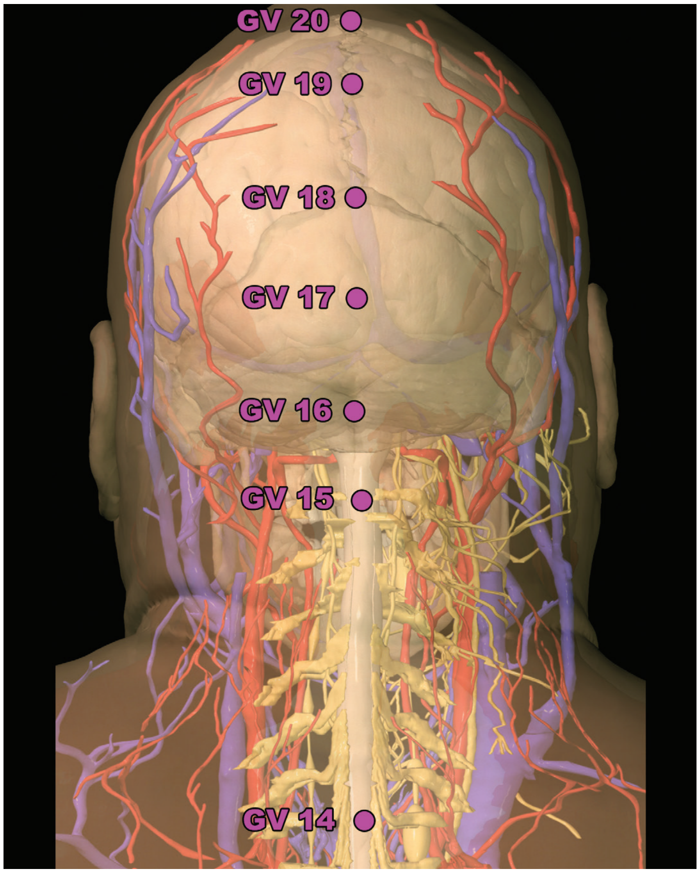


Figure 14-59A. This caudal view of the head and neck exposes the neurovascular supply of the brain in all its splendor, with GV 20 at the crown.

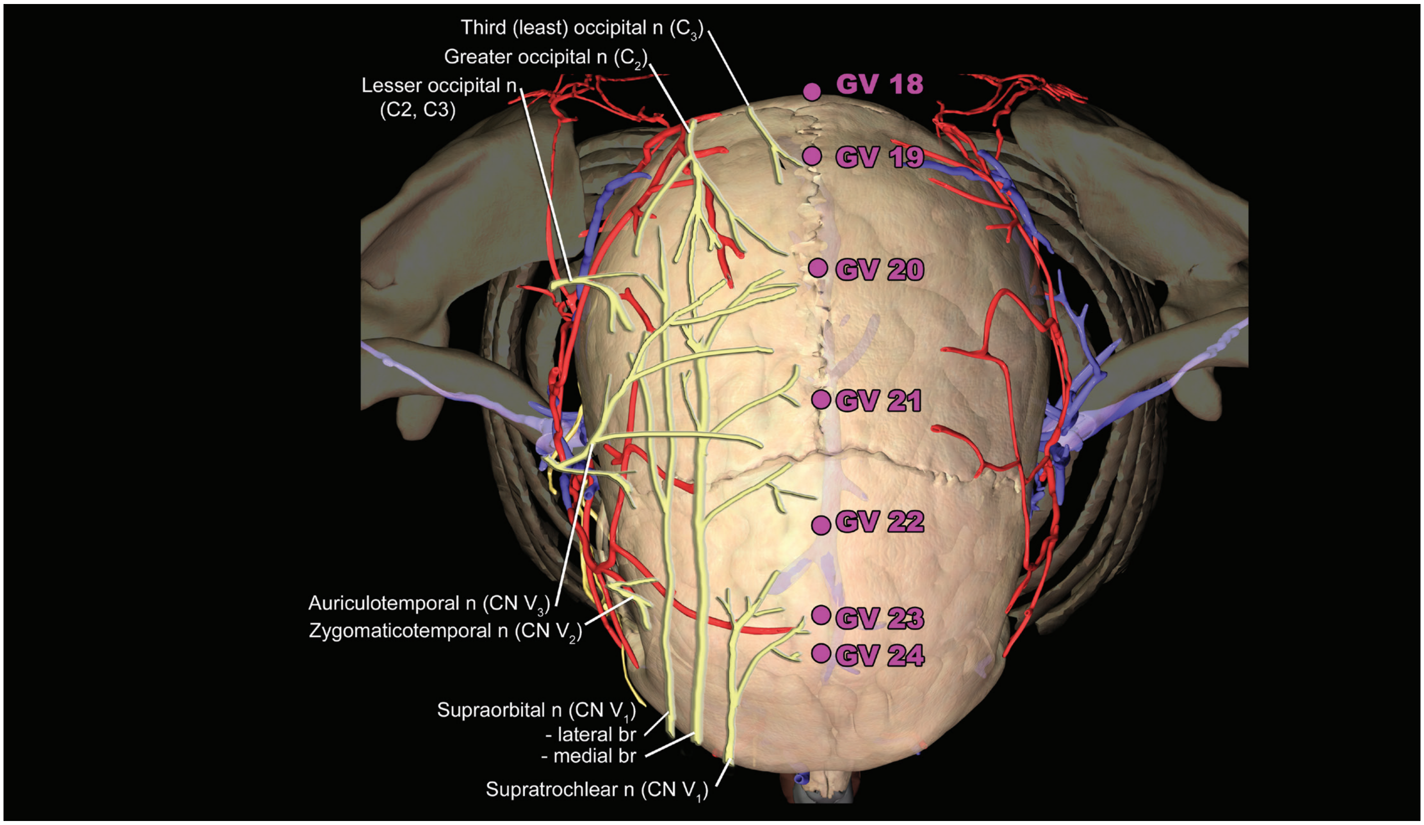

Third (least) occipital n (C$_3$)
Greater occipital n (C$_2$)
Lesser occipital n (C2, C3)
GV 18
GV 19
GV 20
GV 21
GV 22
GV 23
GV 24
Auriculotemporal n (CN V$_3$)
Zygomaticotemporal n (CN V$_2$)
Supraorbital n (CN V$_1$)
- lateral br
- medial br
Supratrochlear n (CN V$_1$)

Figure 14-59B. The name, "Hundred Convergences" for GV 20 describes the meeting of many channels, i.e. neurovascular pathways. As shown here, occipital nerves from C2 and C3 converge with trigeminal nerve branches from each of the three divisions of the trigeminal nerve. Upper cervical spinal nerves communicate with the vagus nerve, as do trigeminal pathways. This explains the application of GV 20 for vagal-responsive conditions, including seizures, anxiety, depression, and stress-related malfunctions such as erectile dysfunction.

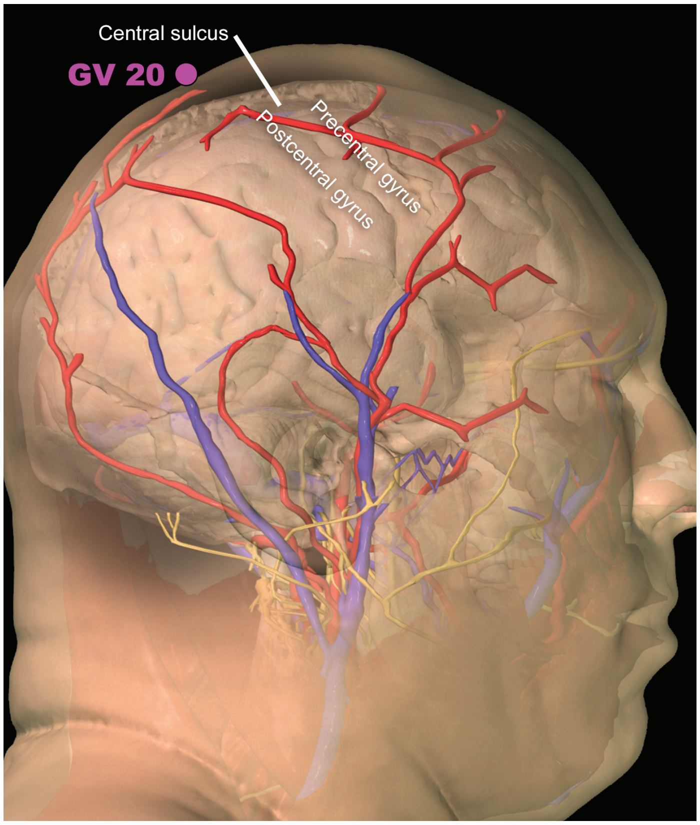


Figure 14-59C. Knowing where the central sulcus resides in relation to GV 20 could prove beneficial for the treatment of brain disorders with laser therapy.[62]

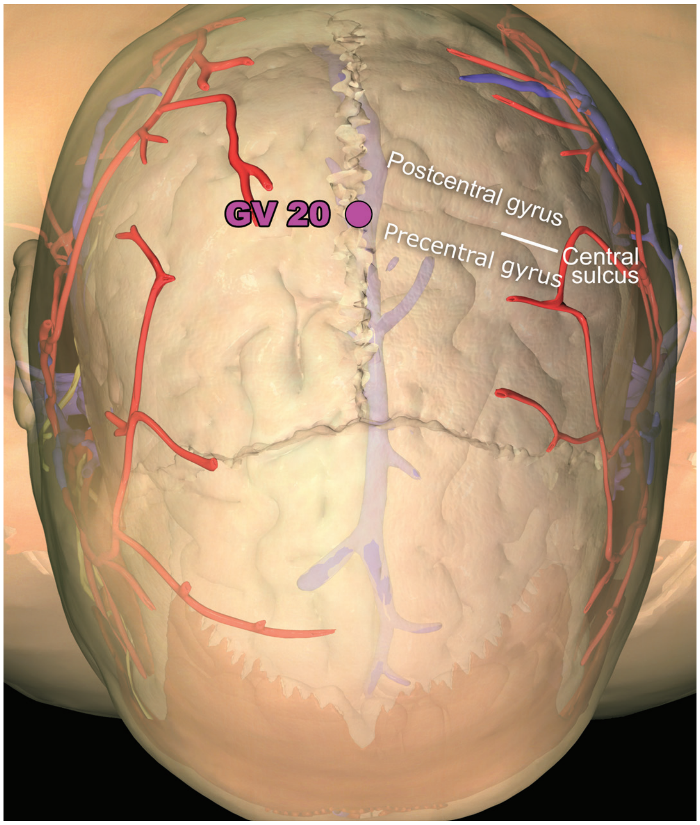


Figure 14-59D. This view from the vertex depicts the relationships of GV 20 to the central sulcus, a landmark that separates the parietal lobe from the frontal lobe. The precentral gyrus contains the primary motor cortex while the postcentral gyrus houses the somatosensory cortex. Brain anatomy underlying acupuncture points becomes especially important when introducing laser therapy as a direct means of brain neuromodulation.

numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB points on the side of the head and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[43] From a trigger point perspective, although muscles are largely absent from the vertex, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head, surrounding GV 20. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature.

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible, pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait. GV 20 often serves as an ancillary point for balance problems along with various GB and other GV points.

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function. Afferent information makes its way to the nucleus raphe magnus in the reticular formation via the spinal tract of V. These inputs can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send nociceptive input that may sensitize neural pathways related to auriculotemporal nerve pathways. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or "resting" activity within the reticular formation. Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input ferried through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[44] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through sympathotrigeminal reflexes.

Similar syndromes to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch). Dry needling of BL 2, BL 7, GV 21, GV 20, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Anastomosis between right and left parietal branches of the superficial temporal arteries:** The superficial temporal arteries begin as terminal branches of the external carotid arteries and ascend anterior to the ear, course over the temporal region, and terminate in the scalp. They bring blood circulation to the facial muscles and the skin of the frontal and temporal regions of the scalp.
- **Anastomosis between right and left parietal tributaries of the superficial temporal veins:** The superficial temporal veins originate from the widespread plexus of veins coursing on the side of the scalp and along the zygomatic arch. The parietal tributaries drain the parietal region and unite with the frontal branches anterior to the auricle. They then cross the temporal root of the zygoma and travel from the temporal region to the parotid gland. They then join the maxillary vein posterior to the neck of the mandible and become the retromandibular vein.
- **Anastomosis between right and left supraorbital arteries:** The supraorbital arteries arise from the ophthalmic arteries and pass through the supraorbital foramina to supply the forehead and scalp.
- **Anastomosis between right and left supraorbital veins:** The supraorbital veins drain the rostral superficial scalp through the supraorbital and supratrochlear veins, which unite at the medial angle of the eye to form the angular vein. The angular vein becomes the facial vein at the inferior orbital margin.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus closely follows the course of the GV line as indicated in Figure 14-59A. Embryologically, the superior sagittal sinus begins as two parallel structures that merge. The lateral lacunae that lie on either side of the sinus may represent remnants of the early double plexus. Their locations vary. The lacunae function as autoregulators of blood flow as they control venous outflow resistance. Pathology within the lateral lacunae of the sagittal sinus compromises this draining activity. This may lead to brain swelling by reducing venous outflow. Lateral lacunae stenosis, which occurs in young women with endocrine disorders, can lead to benign intracranial hypertension.[45]

Arachnoid villi (or arachnoid granulations) are protrusions of the arachnoid layer of the meninges, through the dura mater, and into the venous sinuses of the brain. The arachnoid villi provide an exit route for cerebrospinal fluid (CSF) from the brain and into the venous system. The largest arachnoid villi occur along the superior sagittal venous sinus.

Under normal circumstances, CSF draining from arachnoid villi keeps intracranial pressure from building.

Pain-sensitive fibers from the ophthalmic division of the trigeminal nerve supply sensation to the venous sinuses. These sinuses include the superior sagittal sinus, the meningeal arteries, and much of the supratentorial dura. Trigeminal fibers also supply the circle of Willis and other cerebral arteries as they join fibers from the sympathetic plexus.

Trigeminal nerve irritation is central in the pathophysiology of head and facial pain.[46]

Supraorbital vessels anastomose with superficial temporalis vasculature. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

Indications and Potential Point Combinations

- **Mental and emotional conditions, insomnia, agitation:** GV 20, HT 3, HT 7, PC 6, ST 36.
- **Headache:** GV 20, GV 24.5, BL 10, GV 21, local trigger points.
- **Dizziness:** GV 20, GV 14, GB 20, GB 34, BL 10, temporalis trigger points, LR 3.
- **Hemiplegia:** GV 20, BL 7, TH 20, ST 36, appropriate points according to neurologic dysfunction.
- **Seizures:** GV 20, BL 7, BL 8, BL 10, HT 7, ST 36, LR 3, LI 4.
- **Prolapse of uterus, rectum:** GV 20, GV 1, GV 2, GV 3, BL 35.
- **Hemorrhoids:** GV 20, GV 1, GV 2, BL 35.
- **Urinary incontinence:** GV 20, BL 31-34, KI 3, CV 3, SP 6.

Evidence-Based Applications

- A Chinese trial reported that acupuncture at GV 20, ST 40, GB 20, LU 7, and GV 14 benefited patients with **vertebrobasilar ischemic vertigo.**[2]

- Acupuncture at GV 20 increases **cerebral blood flow.**[47]
- Acupuncture at GV 20 markedly **decreases arterial stiffness** and wave reflection as indicated by the augmentation index, likely through neurovascular modulators.[48]
- **Autonomic neuromodulation** by means of SiShenCong (GV 20 plus four points 1 cun away from GV 20 in cranial, caudal, and bilateral directions) enhanced cardiac vagal and suppressed sympathetic activities in humans.[3]
- Acupuncture at GV 4, GV 9, GV 10, GV 11, GV 14, and GV 20 helped relieve symptoms related to **narcotic drug withdrawal.**[4]
- Electroacupuncture at GV 20, Sishencong, Li 4, PC 6, LR 3, and SP 6 along with psychotherapy improved the cognitive function of patients with **internet addiction.**[49]
- Electroacupuncture at GV 20, GV 24.5, and either (GB 34 + SP 6), (PC 6 + SP 6), or (KI 3 + SP 6) – depending on the type of **depression** – treated depression as effectively as tricyclic antidepressant medication.[5]
- Laser acupuncture significantly outperformed sham laser for the treatment of **mild to moderate depression** with the following points: LR 8, LR 14, CV 14, CV 15, HT 7, SP 6, LI 4, and GV 20.[6]
- A Chinese study reported benefits of acupuncture at LI 4, LR 3, GV 20, and Yintang along with ear acupuncture for patients with **depressive neurosis.**[7]
- Teleacupuncture at GV 20 reduced mean heart rate and increased total heart rate variability significantly in patients with **depression.**[50]
- Electroacupuncture at GV 20, Sishencong, GV 24, and GB 20 produced more significant changes in earthquake-caused **posttraumatic stress disorder** than paroxetine.[51]
- Acupuncture at GV 20 and Extra point 6 significantly reduced **anxiety** related to dental treatment.[52]
- Stimulation of GV 20 in a chronic **cerebral hypoperfusion and cerebral infarct** rat model for 20 minutes a day for 3 days weekly over 4 weeks increased dopamine levels in the brain and reduced brain atrophy after cerebral infarct. This suggested that GV 20 stimulation offered **neuroprotection** after injury.[8]
- Electroacupuncture at GV 20 and GB 7 improved cerebral motor plasticity after **ischemic stroke,** possibly by activating motor regions such as the insula, putamen, and cerebellum.[53]
- Electroacupuncture at GV 20 and Yintang (GV 24.5) caused changes in the frontal lobe, cingulate gyrus, and cerebellum, perhaps linking these sites to benefits of treating these points, especially for patients with **psychiatric disorders.**[54]
- EA at GV 2, GV 14, GV 20, GV 24.5, prevented tissue shrinkage of the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and perirhinal cortex. EA at ST 36 and SP 6 prevented tissue shrinkage in all of the aforementioned regions except for the dorsal hippocampus. EA to GV 2 + GV 14 + GV 20 + GV 24.5 or ST 36 + SP 6 reduced the cognitive deficits in pilocarpine-epileptic rats. Administration of p-chlorophenylalanine, a compound that depletes serotonin, negated the behavioral and some of the histologic changes due to EA. This suggests that the functional recovery exhibited by the rats may have been influenced through serotonergic pathways affected by acupuncture and subsequent **neuroprotective** benefits.[9]
- A Chinese study compared the effects of needling GV 20, GV 26, and HT 7 on positron emission computerized tomography (PET) and single photo emission computerized tomography (SPECT) scans.[10] Brain sites activated by needling GV 20 might increase patients' activity in **temporal and spatial orientation and certain cognitive activities.** This was based on findings associated glucose metabolism or blood flow in the frontal, temporal, and parietal lobes.
- Acupuncture at LR 3, SP 6, ST 36, CV 12, LI 4, PC 6, GB 20, GB 14, Taiyang, and GV 20 provided greater effectiveness in prophylaxis of **migraine** compared to flunarizine.[11]
- Acupuncture at LR 3, SP 6, LI 4, GB 20, GV 20, and Taiyang outper formed transcutaneous electrical nerve stimulation and laser therapy in reducing the frequency of **migraine,** although all three treatments were effective.[12]
- Acupuncture at GV 20, GB 20, GB 8, LR 2, PC 6, SP 6, and ashi points plus a Chinese herbal decoction reduced and shortened the duration of **vascular headache** according to a Chinese report.[13]
- Acupressure at GV 20, GB 20, BL 2, TH 21, GB 5, and other sites more effectively benefited patients with **chronic headache** than did the administration of muscle relaxant medication for the same duration. The effect of trigger point acupressure lasted for six months.[55]
- Electroacupuncture at LI 4, LU 7, GV 14, GV 20, the thoracolumbar midline point San Tai and the lumbosacral midline point Baihui (veterinary) demonstrated a reduction of minimum alveolar concentration (MAC) of isoflurane by 16.7% in dogs. **Acupuncture-assisted anesthesia** thus potentiated the anesthetic effects of volatile anesthetic agents.[14]
- Electroacupuncture at GV 20, Yintang, auricular Shenmen, Sishencong, and Anmian provided some benefit over placebo acupuncture for patients with **insomnia.**[56]
- Needling the local points ST 3, ST 5, ST 6, ST 7, SI 17, LI 18, TH 17, and GV 20, plus the distal points HT 7, PC 6, LI 3, LI 4, LI 11, TH 5, ST 36, SP 6, GB 41, LR 3, KI 3, and KI 5, provided significant long-term relief of **xerostomia** due to either primary or secondary Sjögren's syndrome, irradiation, or other causes.[15]
- Three out of three RCTs supported effectiveness of acupuncture for the treatment of **temporomandibular disorders,** prompting the following treatment recommendation: ST 6, ST 7, SI 18, GV 20, GB 20, BL 10, and LI 4.16
- Electroacupuncture applied to GV 20 in spontaneously **hypertensive** rats attenuated early stage blood pressure elevation and enhanced plasma levels of nitric oxide and nitric oxide synthase values in the mesenteric resistance artery.[17]
- Acupuncture at LI 4, LI 11, BL 13, BL 17, BL 20, ST 36, SP 6, SP 10, and GV 20 provided an **immunomodulatory** effect for patients with **lichen ruber planus.**[18]
- Acupuncture at BL 15, BL 23, BL 32, GV 20, HT 7, PC 6, LR 3, SP 6, and SP 9 significantly improved **postmenopausal** hot flushes and sweating episodes.[19]
- Electroacupuncture at CV 4, GV 20, SP 6, KI 3, and HT 7 may have afforded a modulating positive effect on psychogenic and non-psychogenic **erectile dysfunction.** It improved the quality of erection and restored sexual activity in 39% of patients.[20]
- Acupuncture at CV 4, BL 23, BL 32, LR 3, KI 3, ST 29, ST 36, SP 10, SP 6, and GV 20 resulted in improvement in **sperm quality,** specifically in the ultrastructural integrity of spermatozoa.[21]

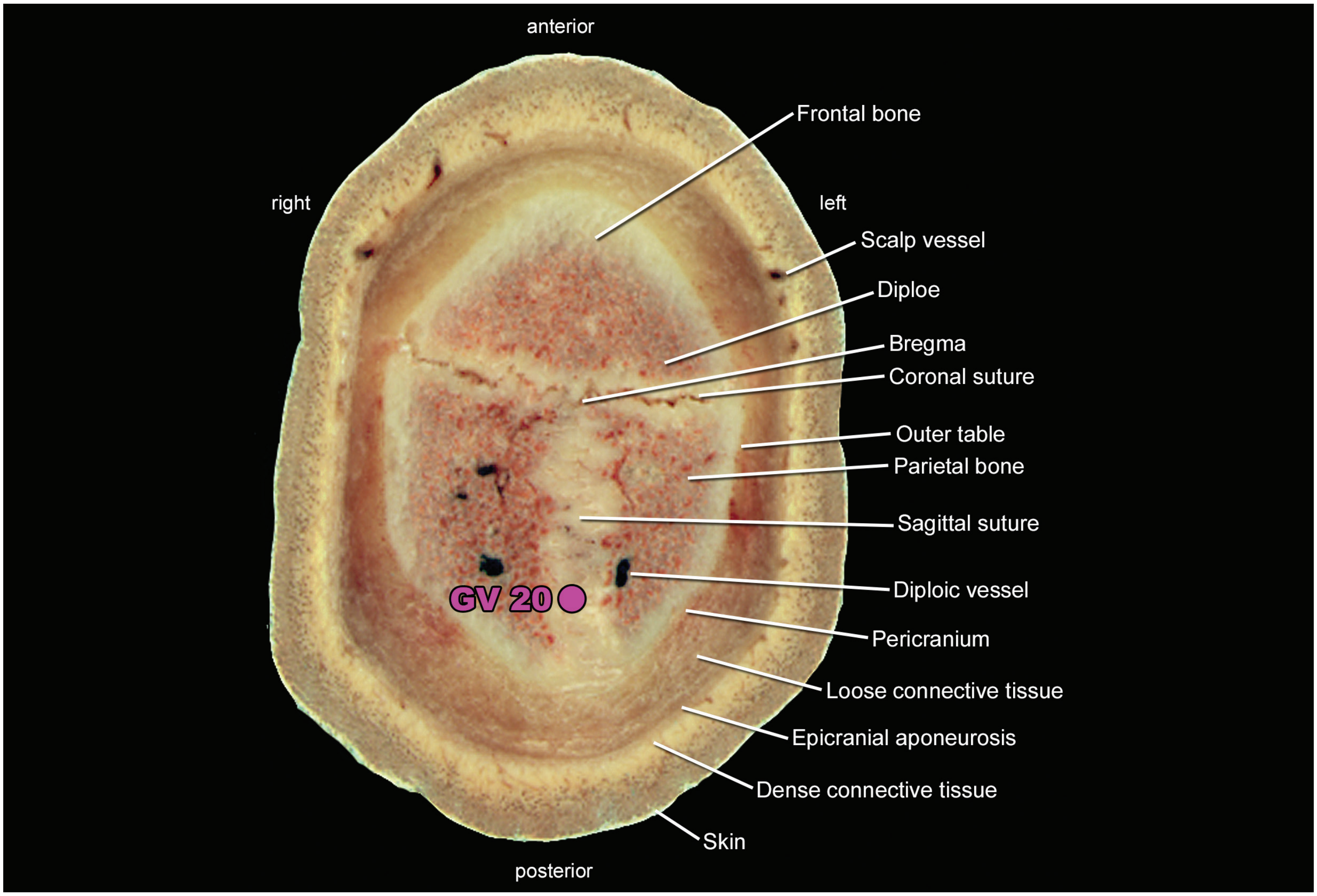


Figure 14-60. This cross section at the level of the bone and pericranium illustrates the highly vascular nature of the skull, not only at the sutures but within the bones as well.

- Electroacupuncture (at ST 29 and TH 5 to LI 4) with manual acupuncture at GV 20 and ST 36 serve as an effective **analgesic during oocyte aspiration;** these analgesic effects equal those of conventional analgesics.[22] Neuropeptide Y (NPY) concentrations in follicular fluid were higher in the electroacupuncture group than in the medication group; NPY may be important for human ovarian steroidogenesis.[23]
- Electroacupuncture (at BL 23, BL 28, SP 6, and SP 9) in combination with manual acupuncture (at PC 6, TH 5, and GV 20) induced regular ovulations in some women with **polycystic ovary syndrome,** thereby offering an alternative to pharmacologic induction of ovulation.[24]
- Acupuncture at GV 20, CV 6, ST 29, SP 8, PC 6, LR 3, auricular points Shenmen and Brain on the left ear, auricular points Uterus and Endocrine on the right ear (before embryo transfer) and LI 4, SP 10, ST 36, SP 6, KI 3, and the aforementioned auricular points on the opposite ears (after embryo transfer) resulted in higher numbers of **live births following in vitro fertilization.**[57]
- Acupuncture at GV 20, Yintang (GV 24.5), PC 6, HT 7, and CV 17 significantly reduced **anxiety** symptoms in women undergoing in vitro fertilization.[58]
- Case series reported successful treatment of **enuresis, urinary incontinence, and urinary retention** with GV 20.[25]
- Acupressure at GV 4, GV 15, GV 20, BL 23, BL 28, BL 32, HT 7, HT 9, ST 36, SP 4, SP 6, SP 12, CV 2, CV 3, CV 6, KI 3, and KI 5 may be a suitable alternative to oxybutinin in the treatment of **enuresis.**[26]
- Acupuncture at GV 20 and LR 3, local points, and either BL 60 + SI 3, BL 22 –> BL 26, the gluteus minimus tendon, or the symphysis pubis, provided effective relief of **pelvic and low back pain in late pregnancy.**[27]
- Manual acupuncture at GV 20, LI 4, CV 3, CV 4, CV 6, BL 23, SP 6, and auricular points allowed women with primary **dysmenorrhea** to reduce reliance on medication to control symptoms by means of neuroendocrine modulation.[28]
- Acupuncture at GV 20, ST 36, SP 6, LR 3, PC 6, CV 2, CV 6, CV 12, LI 4, and LI 11 provided effective relief of myalgia, mastalgia, and dysmenorrheal complaints in patients with **premenstrual syndrome.**[59]
- Acupuncture at GV 20, SP 4, and PC 6 alleviated **refractory nausea, abdominal pain, and bloating.**[60]
- Acupuncture at GV 20 and thirteen other sites may assist in improving exercise performance and **post-exercise recovery.**[61]

References

1. Tubbs RS, Salter G, Elton S, Grabb PA, and Oakes WJ. Sagittal suture as an external landmark for the superior sagittal sinus. *J Neurosurg.* 2001;94:985-987.
2. Huang Q. Fifty cases of vertebrobasilar ischemic vertigo treated by acupuncture. *J Trad Chin Med.* 2009;29(2):87-89.
3. Wang JD, Kuo TBJ, and Yang CCH. An alternative method to enhance vagal activities and suppress sympathetic activities in humans. *Autonomic Neuroscience: Basic and Clinical.*

2002;100:90-95.

4. Zeng X, Lei L, and Lu Y. Treatment of heroinism with acupuncture at points of the Du channel. *Journal of Traditional Chinese Medicine*. 2005;25(3):166-170.

5. Han C, Li X, Luo H, Zhao X, and Li X. Clinical study on electro-acupuncture treatment for 30 cases of mental depression. *Journal of Traditional Chinese Medicine*. 2004;24(3):172-176.

6. Quah-Smith JI, Tang WM, and Russell J. Laser acupuncture for mild to moderate depression in a primary care setting – a randomized controlled trial. *Acupuncture in Medicine*. 2005;23(3):103-111.

7. Fu W-B, Fan L, Zhu X-P, et al. Depressive neurosis treated by acupuncture for regulating the liver – a report of 176 cases. *J Trad Chin Med*. 2009;29(2):83-86.

8. Chuang C-M, Hsieh C-L, Li T-C, et al. Acupuncture stimulation at Baihui acupoint reduced cerebral infarct and increased dopamine levels in chronic cerebral hypoperfusion and ischemia-reperfusion injured Sprague-Dawley rats. *Am J Chin Med*. 2007;35(5):779-791.

9. Guilherme dos Santos Jr. J. Tabosa A, Hoffman Martins do Monte F, Blanco MM, de Oliveira Freire A, and Mello LE. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neuroscience Letters*. 2005;384:234-238.

10. Huang Y, Lai XS, and Tang AW. Comparative study of the specificities of needling acupoints DU 20, DU 26 and HT 7 in intervening vascular dementia in different areas in the brain on the basis of scale assessment and cerebral functional imaging. *Chin J Integr Med*. 2007;13(2):103-108.

11. Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, and Benedetto C. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache*. 2002;42:855-861.

12. Allais G, De Lorenzo C, Quirico PE, Lupi G, Airola G, Mana O, and Benedetto C. Non-pharmacological approaches to chronic headaches: transcutaneous electrical nerve stimulation, lasertherapy, and acupuncture in transformed migraine treatment. *Neurol Sci*. 2003;24:S138-S142.

13. He Q-Y, Liang J, Zhang Y, et al. Thirty-two cases of vascular headache treated by acupuncture combined with Chinese herbal decoction. *J Trad Chin Med*. 2009;29(4):253-257.

14. Culp LB, Skarda RT, and Muir WW 3rd. Comparisons of the effects of acupuncture, electroacupuncture, and transcutaneous cranial electrical stimulation on the minimum alveolar concentration of isoflurane in dogs. *Am J Vet Res*. 2005;66(8):1364-1370.

15. Blom M and Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Diseases*. 2000;6:15-24.

16. Rosted P. Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies. *Oral Diseases*. 2001;7:109-115.

17. Hwang HS, Kim YS, Ryu YH et al. Electroacupuncture delays hypertension development through enhancing NO/NOS activity in spontaneously hypertensive rats. *eCAM*. 2008. Doi:10.1093/ecam/nen064.

18. Iliev E, Popov J, and Nikolov K. Evaluation of clinical and immunological parameters in patients with lichen rubber planus treated with acupuncture. *Acupuncture in Medicine*. 1995;13(2):91-92.

19. Wyon Y, Lindgren R, Lundeberg T, and Hammar M. Effects of acupuncture on climacteric vasomotor symptoms, quality of life, and urinary excretion of neuropeptides among postmenopausal women. *Menopause: The Journal of the North American Menopausal Society*. 1995;2(1):3-12.

20. Kho HG, Sweep CGJ, Chen X, Rabsztyn PRI, and Meuleman EJH. The use of acupuncture in the treatment of erectile dysfunction. *International Journal of Impotence Research*. 1999;11:41-46.

21. Pei J, Strehler E, Noss U, Abt M, Piomboni P, Baccetti B, and Sterzik K. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic male infertility. *Fertility and Sterility*. 2005;84(1):141-147.

22. Stener-Victorin E, Waldenström U, Nilsson L, Wikland M, Janson PO. A prospective randomized study of electro-acupuncture versus alfentanil as anaesthesia during oocyte aspiration in in-vitro fertilization. *Human Reproduction*. 1999;14(10):2480-2484.

23. Stener-Victorin E, Waldenström U, Wikland M, Nilsson L, Hägglund L, and Lundeberg T. Electro-acupuncture as a preoperative analgesic method and its effects on implantation rate and neuropeptide Y concentrations in follicular fluid. *Human Reproduction*. 2003;18(7):1454-1460.

24. Stener-Victorin E, Waldenström U, Tagnfors U, Lundeberg T, Lindstedt G, and Janson PO. Effects of electro-acupuncture on anovulation in women with polycystic ovary syndrome. *Acta Obstet Gynecol Scand*. 2000;79:180-188.

25. Zhang D and Lu Y. Clinical application of the point Baihui. *Journal of Traditional Chinese Medicine*. 2002;22(3):224-227.

26. Yuksek MS, Erdem AF, Atalay C, and Demirel A. Acupressure versus oxybutinin in the treatment of enuresis. *Journal of International Medical Research*. 2003;31:552-556.

27. Kvorning N, Homberg C, Grennert L, Aberg A, and Akeson J. Acupuncture relieves pelvic and low-back pain in late pregnancy. *Acta Obstet Gynecol Scand*. 2004;83:246-250.

28. Habek D, Habek JC, Bobic-Vukovic M, et al. Efficacy of acupuncture for the treatment of primary dysmenorrhea. *Gynakol Geburtshilfliche Rundsch*. 2003;43:250-253.

29. Retzlaff EW, Mitchell FL Jr, Upledger JE, et al. Neurovascular mechanisms in cranial sutures. *J Am Osteopath Assoc*. 1980; 80:218-219 (abst).

30. Retzlaff EW, Jones L, Mitchell FL Jr, et al. Possible autonomic innervation of cranial sutures of primates and other animals. *Brain Res*. 1973;58:470-477.

31. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol*. 2009;515(3):331-348.

32. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol*. 2009;515(3):331-348.

33. Tubbs RS, Mortazavi MM, Loukas M, et al. Anatomical study of the third occipital nerve and its potential role in occipital headache/neck pain following midline dissections of the craniocervical junction. *J Neurosurg Spine*. 2011;15:71-75.

34. Ward JB. Greater occipital nerve block. *Seminars in Neurology*. 2003;23(1):59-61.

35. Saracco MG, Valfre W, Cavallini M, et al. Greater occipital nerve block in chronic migraine. *Neurol Sci*. 2010;31(Suppl 1): S179-S180.

36. Akerman S, Holland PR, Summ O, et al. A translational in vivo model of trigeminal autonomic cephalalgias: therapeutic characterization. *Brain*. 2012;135:3664-3675.

37. Weber P, Correa EC, Ferreira Fdos S, et al. Cervical spine dysfunction signs and symptoms in individuals with temporomandibular disorder. *J Soc Bras Fonoaudiol*. 2012;24(2):134-139.

38. Paemeleire K and Bartsch T. Occipital nerve stimulation for headache disorders. *Neurotherapeutics: The Journal of the American Society for Experimental NeuroTherapeutics*. 2010;7(2):213-219.

39. Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. *World Neurosurg*. 2012;78(5):505-510.

40. Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. *World Neurosurg*. 2012;78(5):505-510.

41. Ray BS and Wolff HG. Experimental studies on headache: pain-sensitive structures of the head and their significance in headache. *Arch Surg*. 1941;41:813-856. Cited in: Kemp WJ, Tubbs RS, and Cohen-Gadol AA. The innervation of the cranial dura mater: neurosurgical case correlates and a review of the literature. *World Neurosurg*. 2012;78(5):505-510.

42. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol*. 2012;71(3):187-193.

43. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg*. 2012;130:336-341.

44. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia*. 2012. DOI: 10.1177/0333102412459575

45. Shakhnovich AT et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochirurgica*. 1990;Suppl 51:357-361.

46. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am*. 2003;36:1041-1053.

47. Byeon HS, Moon SK, Park SU, et al. Effects of GV 20 acupuncture on cerebral blood flow velocity of middle cerebral artery and anterior cerebral artery territories, and CO2 reactivity during hypocapnia in normal subjects. *J Altern Complement Med*. 2011; 17(3):219-224.

48. Satoh H. Acute effects of acupuncture treatment with Baihui (GV 20) on human arterial stiffness and wave reflection. *J Acupunct Meridian Stud*. 2009;2(2):103-104.

49. Zhu TM, Liu H, Jin RJ, et al. Effects of electroacupuncture combined psycho-intervention on cognitive function and event-related potentials P300 and mismatch negativity in patients with internet addiction. *Chin J Integr Med*. 2012;18(2):146-151.

50. Litscher G, Cheng G, Wang L, et al. Biomedical teleacupuncture between China and Austria using heart rate variability – Part 2: Patients with depression. *Evid Based Complement Alternat Med*. 2012;2012:145904. doi: 10.1155/2012/145904.

51. Wang Y, Hu YP, Wang WC, et al. Clinical studies on treatment of earthquake-caused posttraumatic stress disorder using electroacupuncture. *Evid Based Complement Alternat Med*. 2012;2012:431279. doi: 10.1155/2012/431279.

52. Rosted P, Bundgaard M, Gordon S, et al. Acupuncture in the management of anxiety related to dental treatment: a case series. *Acupunct Med*. 2010;28(1):3-5.

53. Fang Z, Ning J, Xiong C, et al. Effects of electroacupuncture at head points on the function of cerebral motor areas in stroke patients: a PET study. *Evid Based Complement Alternat Med*. 2012;2012:902413. doi: 10.1155/2012/902413.

54. Zheng Y, Qu S, Wang N, et al. Post-stimulation effect of electroacupuncture at Yintang (EX-HN3) and GV 20 on cerebral functional regions in healthy volunteers: a resting functional MRI study. *Acupunct Med*. 2012;30(4):307-315.

55. Hsieh LL, Liou HH, Lee LH, et al. Effect of acupressure and trigger points in treating headache: a randomized controlled trial. *Am J Chin Med*. 2010;38(1):1-14.

56. Yeung WF, Chung KF, Zhang SP, et al. Electroacupuncture for primary insomnia: a randomized controlled trial. *Sleep*. 2009;32(8):1039-1047.

57. Hullender Rubin LE, Opsahl MS, Taylor-Swanson L, et al. Acupuncture and in vitro fertilization: a retrospective chart review. *J Altern Complement Med*. 2013;19(7):637-643.

58. Isoyama D, Cordts EB, de Souza van Niewegen AM, et al. Effect of acupuncture on symptoms of anxiety in women undergoing in vitro fertilization: a prospective randomised controlled study. *Acupunct Med*. 2012;30(2):85-88.

59. Anil A, Peker T, Goktas T, et al. Importance of acupuncture on premenstrual syndrome. *Clin Exp Obstet Gynecol*. 2012;39(2):209-213.

60. Ouyang A and Xu L. Holistic acupuncture approach to idiopathic refractory nausea, abdominal pain and bloating. *World J Gastroenterol*. 2007;13(40):5360-5366.

61. Urroz P, Colagiuri B, Smith CA, et al. Effect of acute acupuncture treatment on exercise performance and postexercise recovery: a systematic review. *J Altern Complement Med*. 2013;19(1):9-16.

62. Shen E-Y, Chen F-J, Chen Y-Y, et al. Locating the acupoint Baihui (GV 20) beneath the cerebral cortex with MRI reconstructed 3D neuroimages. *Evidence-Based Complementary and Alternative Medicine*. 2011; 2011:362494.

GV 21

Qian Ding "In Front of the Crown" "Before the Vertex"

On the parietal region on the midsagittal line, 1.5 cun rostral to GV 20, 3.5 cun caudal to the rostral hairline.

Location Tip: Divide the distance between GV 20 and the rostral hairline into thirds. GV 21 lies just caudal to the junction between the most caudal and middle thirds. See Figure 14-61B.

If the anterior hairline is poorly demarcated, designate the hairline's location 3 cun superior to the glabella.

Cranial Suture

- **Sagittal suture:** This midline cranial suture serves as a rough external landmark for the underlying superior sagittal sinus. At its caudal extent, the superior sagittal sinus often deviates to the right, tending to drain more frequently into the right transverse sinus.[1]

Clinical Relevance: Cranial sutures allow for changes in the size and conformation of the skull. When maintained in the adult, sutural mobility accommodates cranial expansion and contraction with intracranial pressure changes. In addition, flexible sutures modulate strain placed on the skull by calvarial muscle contraction during mastication.

Myofascial dysfunction that pulls on cranial sutures can invoke pain and neurovascular dysfunction by compressing nerves and vessels. Sutural compaction activates extracranial nociceptors of meningeal origin that supply the sutures. These fibers relay signals back and forth across the calvarium.[2,3] Sensory fibers that innervate the lambdoid, coronal, and squamous sutures of the calvarium do the same.[4]

Bidirectional communication mediated by meningeal nociceptors helps to explain how myofascial tension and inflammation in the temporalis, occipitofrontalis, and epicranial aponeurosis incites intracranial pain. Disturbances in the skin, connective tissue, and periosteum may in turn also instigate headache. Conversely, some patients with migraine, considered a source of intracranial pain, complain that their skull hurts, and not their "brain".[5]

The fact that nociceptors from the dura innervate cranial sutures introduces opportunities for neuromodulation, either directly along the GV line as in the case of the sagittal suture, or indirectly through cervical and trigeminal nerves that cross talk with dural fibers. GV 20, called "Hundred Convergences", interacts with both trigeminal and vagal extracranial afferents, accounting for its notoriety as a strong point that calms patients. GV 21, in contrast, relates more closely with trigeminal rather than upper cervical nerves, as its "In Front of the Crown" position brings it out of occipital nerve territory. (See Figure 14-61A.)

Connective Tissues

Connective Tissues of the **"SCALP"**, consisting of 5 layers, i.e., **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium

- **Skin:** Contains an abundant arterial supply as well as good venous and lymphatic drainage capacity.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides beneath the galea aponeurotica, affording many potential spaces that may distend with fluid following infection or trauma.
- **Pericranium:** This is the external periosteum of the calvaria, continuous with the fibrous tissue in the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Lacerations of the scalp may bleed profusely as a consequence of the abundance of arterial anastomoses in the scalp. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of the artery walls.

Nerves

- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the skin anterior to the ear, along the posterior temporal region, the tragus, and part of the helix of the auricle. Provides sensation to the roof of the external acoustic meatus and the upper portion of the tympanic membrane.
- **Supraorbital nerve (CN V_1):** The supraorbital nerve is a continuation of the frontal nerve, innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva, and provides sensation to the forehead skin and vertex.

Clinical Relevance: The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[6] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB points on the side of the head and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[7] From a trigger point perspective, although muscles are largely absent from the vertex, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head, from GV 19 to GV 21. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature.

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible, pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait.

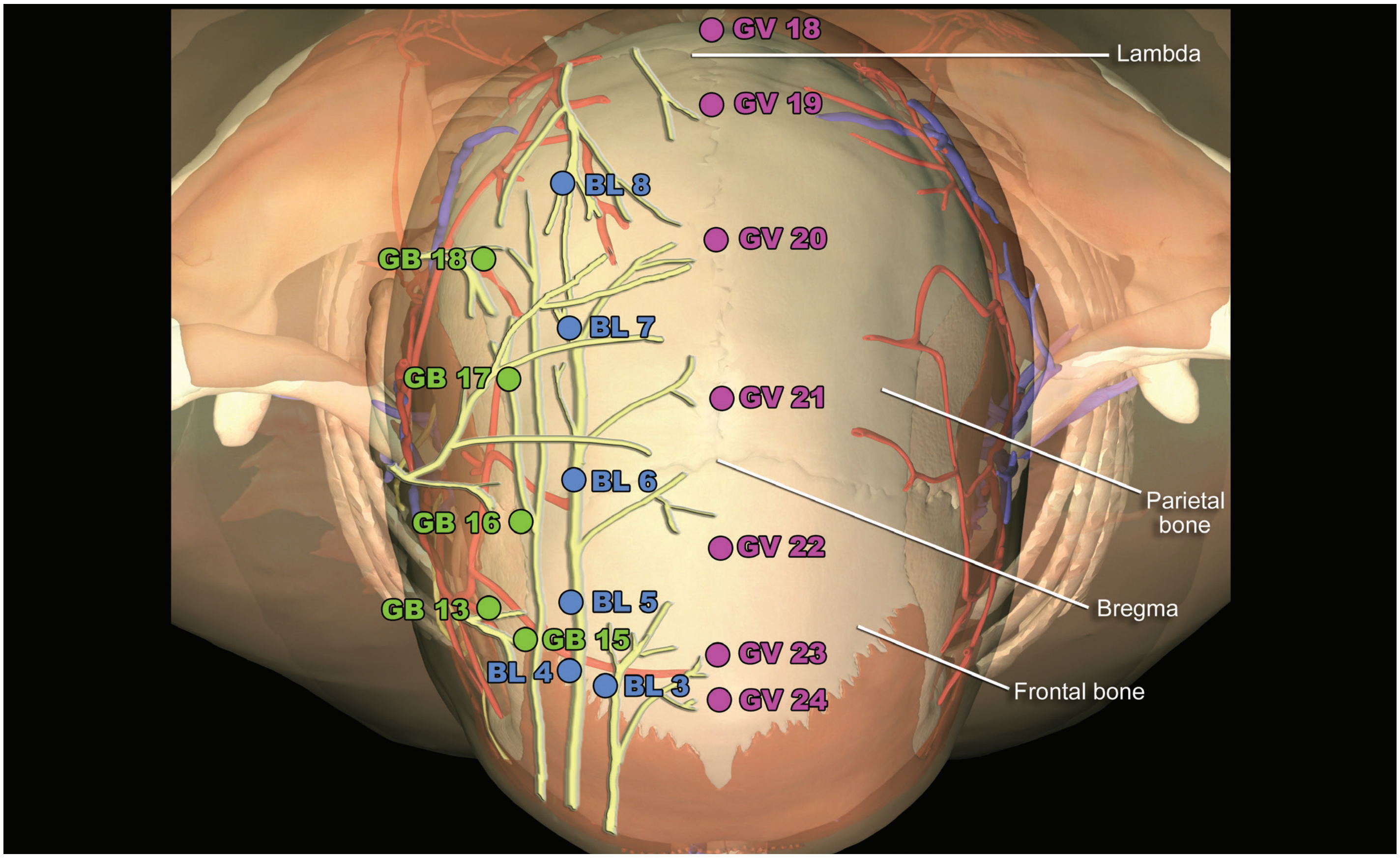


Figure 14-61A. The view of the vertex shows the interrelationships of points on the scalp. With GV 20 stipulated as the vertex, GV 21 becomes "Before the Vertex" and GV 19 "Behind the Vertex". Palpation along the sagittal suture, from lambda to bregma, may reveal tenderness in patients with headache. Pain may originate from extracranial myofascial dysfunction, sutural irritation, or dural irritation.

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function. Afferent information makes its way to the nucleus raphe magnus in the reticular formation via the spinal tract of V. These inputs can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send nociceptive input that may sensitize neural pathways related to auriculotemporal nerve pathways. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or "resting" activity within the reticular formation. Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input ferried through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of

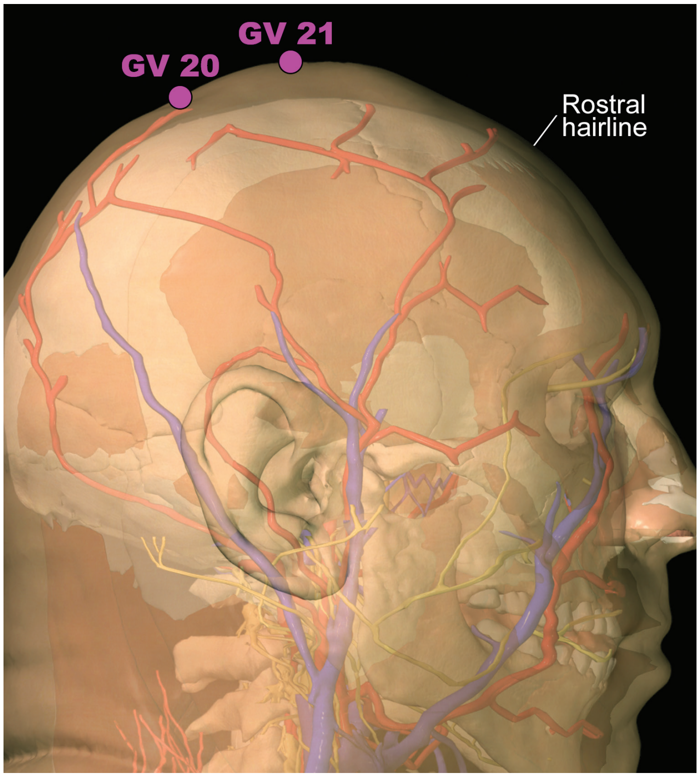


Figure 14-61B. Despite the name "Before the Vertex" for GV 21, this lateral view of the head reveals that GV 21, not GV 20, sits at the highest spot on the cranium. GV 21 resides one-third the distance from GV 20 to the rostral (anterior) hairline.

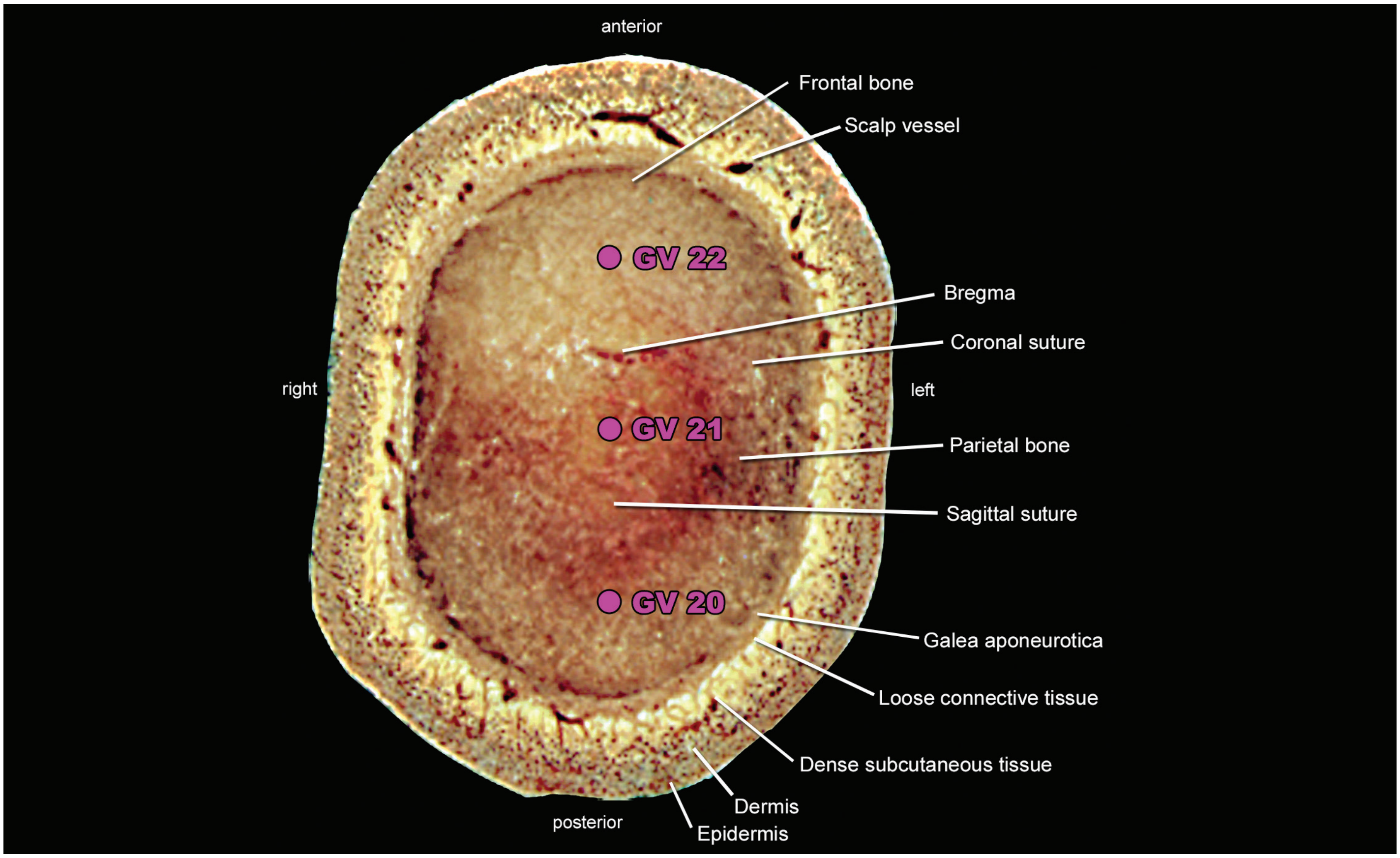


Figure 14-62. Scalp lacerations bleed profusely. Examine the prolific vasculature occupying the dense connective tissue in this cross-section at the vertex.

the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[8] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through trigeminosympathetic reflexes.

Similar syndromes to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch). Dry needling of BL 2, BL 7, GV 21, GV 20, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

Vessels

- **Anastomosis between right and left parietal branches of the superficial temporal arteries:** The superficial temporal arteries begin as terminal branches of the external carotid arteries and ascend anterior to the ear, course over the temporal region, and terminate in the scalp. They bring blood circulation to the facial muscles and the skin of the frontal and temporal regions of the scalp.
- **Anastomosis between right and left parietal tributaries of the superficial temporal veins:** The superficial temporal veins originate from the widespread plexus of veins coursing on the side of the scalp and along the zygomatic arch. The parietal tributaries drain the parietal region and unite with the frontal branches anterior to the auricle. They then cross the temporal root of the zygoma and travel from the temporal region to the parotid gland. They then join the maxillary vein posterior to the neck of the mandible and become the retromandibular vein.
- **Anastomosis between right and left supraorbital arteries:** The supraorbital arteries arise from the ophthalmic arteries and pass through the supraorbital foramina to supply the forehead and scalp.
- **Anastomosis between right and left supraorbital veins:** The supraorbital veins drain the rostral superficial scalp through the supraorbital and supratrochlear veins, which unite at the medial angle of the eye to form the angular vein. The angular vein becomes the facial vein at the inferior orbital margin.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular

veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus closely follows the course of the GV line as indicated in Figure 14-61A. Embryologically, the superior sagittal sinus begins as two parallel structures that merge. The lateral lacunae that lie on either side of the sinus may represent remnants of the early double plexus. Their locations vary. The lacunae function as autoregulators of blood flow as they control venous outflow resistance. Pathology within the lateral lacunae of the sagittal sinus compromises this draining activity. This may lead to brain swelling by reducing venous outflow. Lateral lacunae stenosis, which occurs in young women with endocrine disorders, can lead to benign intracranial hypertension.[9]

Arachnoid villi (or arachnoid granulations) are protrusions of the arachnoid layer of the meninges, through the dura mater, and into the venous sinuses of the brain. The arachnoid villi provide an exit route for cerebrospinal fluid (CSF) from the brain and into the venous system. The largest arachnoid villi occur along the superior sagittal venous sinus. Under normal circumstances, CSF draining from arachnoid villi keeps intracranial pressure from building.

Pain-sensitive fibers from the ophthalmic division of the trigeminal nerve supply sensation to the venous sinuses. These sinuses include the superior sagittal sinus, the meningeal arteries, and much of the supratentorial dura. Trigeminal fibers also supply the circle of Willis and other cerebral arteries as they join fibers from the sympathetic plexus. Trigeminal nerve irritation is central in the pathophysiology of head and facial pain.[10]

Supraorbital vessels anastomose with superficial temporalis vasculature. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

Indications and Potential Point Combinations

- **Headache referring to the vertex:** GV 21, GV 20, BL 7, BL 6, BL 10, LU 7, LI 4.
- **Vertigo, dizziness:** GV 21, GV 20, BL 10, GB 20, GB 18, LR 3, ST 36.
- **Seizures:** GV 21, BL 6, BL 8, BL 60, GV 20, ST 11, CV 17, ST 36.

References

1. Tubbs RS, Salter G, Elton S, Grabb PA, and Oakes WJ. Sagittal suture as an external landmark for the superior sagittal sinus. *J Neurosurg.* 2001;94:985-987.

2. Retzlaff EW, Mitchell FL Jr, Upledger JE, et al. Neurovascular mechanisms in cranial sutures. *J Am Osteopath Assoc.* 1980; 80:218-219 (abst).

3. Retzlaff EW, Jones L, Mitchell FL Jr, et al. Possible autonomic innervation of cranial sutures of primates and other animals. *Brain Res.* 1973;58:470-477.

4. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol.* 2009;515(3):331-348.

5. Kosaras B, Jakubowski M, Kainz V, et al. Sensory innervation of the calvarial bones of the mouse. *J Comp Neurol.* 2009;515(3):331-348.

6. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.

7. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.

8. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575

9. Shakhnovich AT et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochirurgica.* 1990;Suppl 51:357-361.

10. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am.* 2003;36:1041-1053.

GV 22

Xin Hui "Fontanelle Meeting"

On the midsagittal line, 3 cun rostral to GV 20.

Measure the distance between GV 20 and the rostral hairline; GV 22 lands, 0.5 cun rostral to the midpoint of this distance.

One cun posterior to GV 23.

Forbidden to needle in small children.

Anterior Fontanelle (in juvenile patients)

- Whereas cranial sutures in the adult harbor narrow seams of fibrous connective tissue between the flat bones of the skull, the fontanelles consist of fibrous, membrane-covered gaps between three or more juxtaposed cranial bones. The superior sagittal dural venous sinus resides beneath the anterior and posterior fontanelles.

This "soft spot" found on a baby's head allows the plates of the skull to move and thereby accommodate the spatial restrictions imposed by the birth canal. Fontanelles ordinarily close by the second year of life in human children; cranial sutures and sutural intersections replace them. Newborn skulls exhibit six fontanelles: a small posterior fontanelle at lambda (where the two parietal bones join the occipital bone near GV 18); the large, diamond- or rhomboid-shaped anterior fontanelle at the juncture of the two parietal bones with the paired frontal bones); two sphenoid fontanelles located where the sphenoid, parietal, temporal, and frontal bones intersect; and finally, the two mastoid fontanelles that appear between the temporal, occipital, and parietal bones. Eventually, these fontanelles close and leave behind cranial intersections, or sutures, as seen in Figure 14-63.

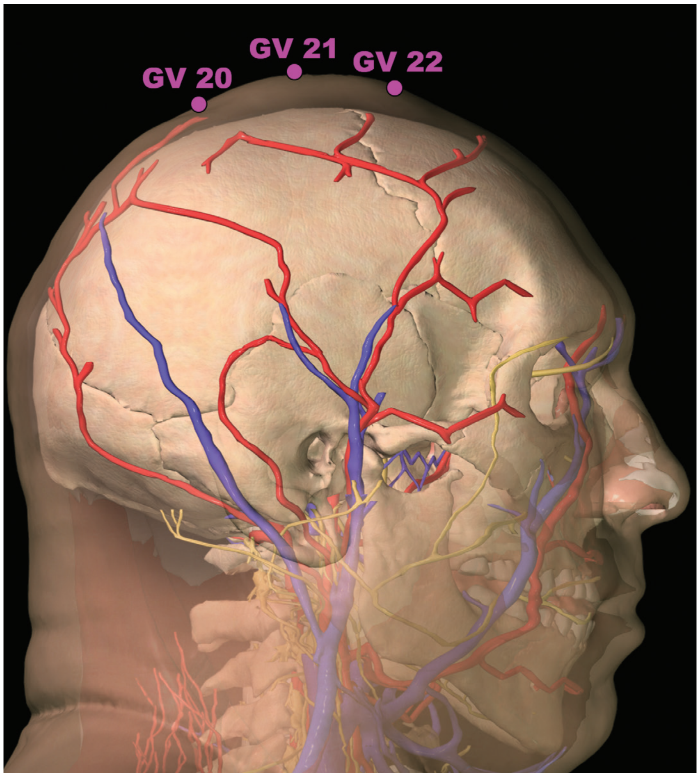


Figure 14-63. By GV 22, the GV channel has moved from the parietal to the frontal bone. No longer does the GV line fall along a suture. This limits the ability to neuromodulate extracranial collaterals of meningeal nociceptors. However, stimulation of GV 22 does activate branches of the ophthalmic division of the trigeminal nerve by way of the supraorbital nerve, thereby neuromodulating the ophthalmic division, which also supplies the dura.

The term "fontanelle" originated from the acknowledgement that fontanelles exhibit pulsations when palpated; their rhythm seems to coincide with the arterial pulse. Fontanelle means "little fountain" and reflects the movement of fluid found at this site. In addition, the condition commonly known as "water on the brain", i.e., hydrocephalus, manifests as a bulge at the fontanelle(s), caused by elevated intracranial pressure.

Other causes of abnormally large fontanels include hypothyroidism, Down syndrome, achondroplasia, and rickets. A bulging anterior fontanelle may occur due to elevated intracranial pressure, and tumors within or atop the calvarium.[1]

Clinical Relevance: Before needling GV 22, GV 23, or the anywhere over the calvarium, ensure through palpation that the brain is protected by bone. Fontanelles may enlarge or never close due to various causes, including Down syndrome, hydrocephalus, intrauterine growth retardation, or premature birth, among others. Furthermore, cranial defects may follow neurosurgical procedures. Obtain information about prior neurosurgical events during the history and ascertain cranial integrity through palpation prior to inserting needles at GV, BL, ST, or GB points.

Connective Tissues

Connective Tissues of the **"SCALP"**, consisting of 5 layers, i.e., **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium

- **Skin:** Contains an abundant arterial supply as well as good venous and lymphatic drainage capacity.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides beneath the galea aponeurotica, affording many potential spaces that may distend with fluid following infection or trauma.
- **Pericranium:** This is the external periosteum of the calvaria, continuous with the fibrous tissue in the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Lacerations of the scalp may bleed profusely as a consequence of the abundance of arterial anastomoses in the scalp. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of the artery walls.

Nerves

- **Auriculotemporal nerve (CN V_3):** Provides sensory innervation to the skin anterior to the ear, along the posterior temporal region, the tragus, and part of the helix of the auricle. Provides sensation to the roof of the external acoustic meatus and the upper portion of the tympanic membrane.

- **Supraorbital nerve (CN V_1):** The supraorbital nerve is a continuation of the frontal nerve, innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva, and provides sensation to the forehead skin and vertex.

Clinical Relevance: The auriculotemporal nerve supplies sensation by means of numerous branches to the TMJ, the temporal region, and components of the external ear, including the pinna or auricle, the external acoustic meatus, and the parotid gland.[2] Its hitchhiking parasympathetic fibers from the glossopharyngeal nerve supply excretory influence to the buccal and labial glands. The numerous branches and hardworking muscles of mastication, compounded by the complex formation of the TMJ and vascular network in the infratemporal fossa create a "perfect storm" for nerve entrapment. Auriculotemporal nerve entrapment can cause TMJ pain syndromes, headaches, and pain or paresthesias in the external acoustic meatus and auricle.

Compression of the auriculotemporal nerve by preauricular fascial bands or intersecting superficial temporal vessels can occur at GB points on the side of the head and elsewhere along the neurovascular course. Tension and pressure applied to these crossovers may cause headache and act as an anatomical trigger for migraine.[3] From a trigger point perspective, although muscles are largely absent from the vertex, dysfunction in the sternocleidomastoid (sternal head) and the splenius capitis sometimes refer pain to the top of the head, from GV 19 to GV 22. As such, patients presenting with vertex pain may be harboring trigger points in the cervical musculature.

The auriculotemporal nerve also impacts balance. Stomatognathic disorders, i.e., problems with mouth, teeth, mandible, pharynx, and other structures associated with mastication, speech, and deglutition, negatively impact posture, balance, and gait.

Muscle reflex responses controlling balance and equilibrium depend on input into the reticular formation from several sources. Afferents arise from trigeminal, auditory, proprioceptive, visual, vestibular, cutaneous, and autonomic pathways. The extensive reticular formation in the brainstem integrates this information, couples it with input from the brain, and forwards it to brainstem nuclei that oversee sensation, motor activity, and autonomic function. Afferent information makes its way to the nucleus raphe magnus in the reticular formation via the spinal tract of V. These inputs can influence reflex arcs and motor responses from the face and cranium.

Painful dentition and abnormal TMJ mechanics send nociceptive input that may sensitize neural pathways related to auriculotemporal nerve pathways. These facilitated reflexes between the reticulospinal and nucleus raphe magnus tracts may lead to involuntary rhythmic tremors, gait disturbances, and postural imbalance. In this way, afferent impulses transmitted through trigeminal nerve circuitry have the capacity to change tonic or "resting" activity within the reticular formation. Altered tonic activity impacts the nature of eye movements, posture, respiration, arousal, sleep, pain, vasomotor tone, cardiac output, feeding, and homeostasis in general.

Taking all of these reflexes into account, trigeminal nerve input ferried through the auriculotemporal nerve works alongside sensory, oculomotor, and vestibular afferents to manage a variety of highly coordinated activities.

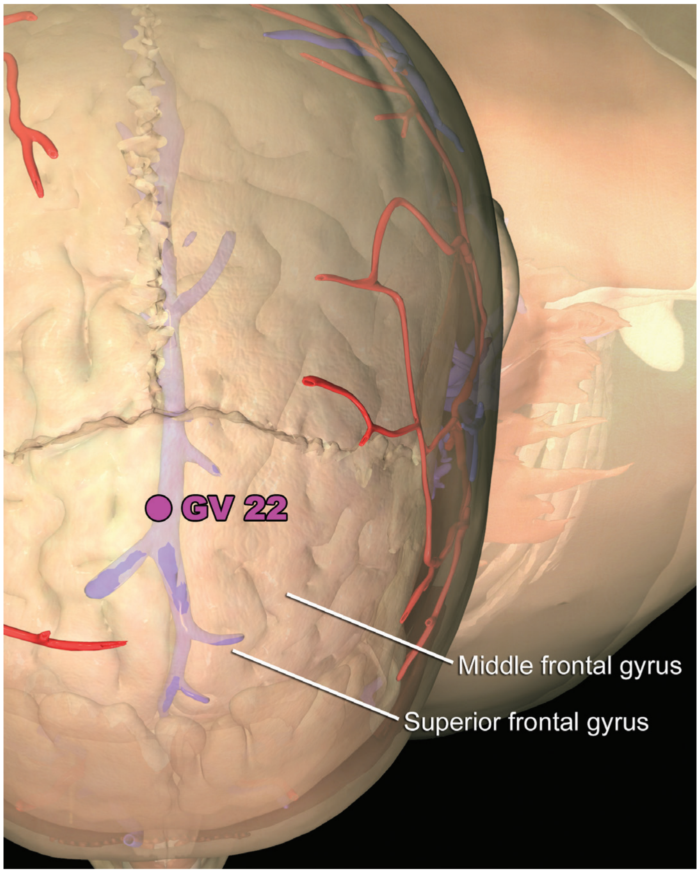


Figure 14-64. The name "Fontanelle Meeting" for GV 22 describes its relationship to the anterior fontanelle, explaining why needling this point is contraindicated in babies or young children with an open anterior fontanelle. Before the sutures ossify and join the frontal bones with the parietal, GV 22 coincides with the "soft spot" of the skull.

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[4] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, overlapping migrainous features exhibited in some patients, depending on the extent of vascular involvement through trigeminosympathetic reflexes.

Similar syndromes to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch). Dry needling of BL 2, BL 7, GV 21, GV 22, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

The superior frontal gyrus, labeled in Figure 14-64, contributes to higher cognitive function and working memory, highlighting the role of the frontal cortex in the highest level of executive processing. It also participates in spatially oriented processing.[5] However, it appears that the lateral, but not the medial, aspect of the superior frontal gyrus belongs to the working memory network. This becomes relevant when neurosurgeons remove low-grade gliomas affecting the superior frontal gyrus, as well as opportunities for laser therapy neuromodulation for supporting function during high cognitive demand or restoring memory after brain injury. Remember, too, that laser therapy and other forms of neuromodulation may improve local blood supply and drainage, thereby affecting circulation and oxygen delivery to the superior frontal gyrus by dint of treatment at GV 22.

Vessels

- **Anastomosis between right and left parietal branches of the superficial temporal arteries:** The superficial temporal arteries begin as terminal branches of the external carotid arteries and ascend anterior to the ear, course over the temporal region, and terminate in the scalp. They bring blood circulation to the facial muscles and the skin of the frontal and temporal regions of the scalp.
- **Anastomosis between right and left parietal tributaries of the superficial temporal veins:** The superficial temporal veins originate from the widespread plexus of veins coursing on the side of the scalp and along the zygomatic arch. The parietal tributaries drain the parietal region and unite with the frontal branches anterior to the auricle. They then cross the temporal root of the zygoma and travel from the temporal region to the parotid gland. They then join the maxillary vein posterior to the neck of the mandible and become the retromandibular vein.
- **Anastomosis between right and left supraorbital arteries:** The supraorbital arteries arise from the ophthalmic arteries and pass through the supraorbital foramina to supply the forehead and scalp.
- **Anastomosis between right and left supraorbital veins:** The supraorbital veins drain the rostral superficial scalp through the supraorbital and supratrochlear veins, which unite at the medial angle of the eye to form the angular vein. The angular vein becomes the facial vein at the inferior orbital margin.
- **Emissary veins:** These veins connect the dural venous sinuses with the extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus closely follows the course of the GV line as indicated in Figure 14-61A. Embryologically, the superior sagittal sinus begins as two parallel structures that merge. The lateral lacunae that lie on either side of the sinus may represent remnants of the early double plexus. Their locations vary. Lacunae function as autoregulators of blood flow as they control venous outflow resistance. Pathology within the lateral lacunae of the sagittal sinus compromises this draining activity. This may lead to brain swelling by reducing venous outflow. Lateral lacunae stenosis, which occurs in young women with endocrine disorders, can lead to benign intracranial hypertension.[6]

Arachnoid villi (or arachnoid granulations) are protrusions of the arachnoid layer of the meninges, through the dura mater, and into the venous sinuses of the brain. The arachnoid villi provide an exit route for cerebrospinal fluid (CSF) from the brain and into the venous system. The largest arachnoid villi occur along the superior sagittal venous sinus. Under normal circumstances, CSF draining from arachnoid villi keeps intracranial pressure from building.

Pain-sensitive fibers from the ophthalmic division of the trigeminal nerve supply sensation to the venous sinuses. These sinuses include the superior sagittal sinus, the meningeal arteries, and much of the supratentorial dura. Trigeminal fibers also supply the circle of Willis and other cerebral arteries as they join fibers from the sympathetic plexus. Trigeminal nerve irritation is central in the pathophysiology of head and facial pain.[7] Neuromodulation of trigeminal nerve function by dint of acupuncture and related techniques to rostral GV points over the calvarium may improve blood flow to and from the brain.

Supraorbital vessels anastomose with superficial temporalis vasculature. Myofascial restriction in the occipitofrontalis and accompanying fascial planes compresses vessels against the skull, reducing tissue oxygenation and irritating nerves.

Indications and Potential Point Combinations

- **Headache:** Palpate in the vicinity of GV 22 and other points along the sagittal suture in patients complaining of headache at the vertex. Consider BL 10, GB 21, LI 4, and additional trigger points pertinent to the patient's pain problem.
- **Seizures:** GV 22, GV 20, ST 11, ST 36, GB 13, BL 10, LR 2.
- **Rhinitis:** GV 22, GV 24.5 (Yintang), LI 20, ST 44.
- **Anosmia:** GV 22, GV 23, GV 20, BL 6, LI 20.
- **Hangover headache:** GV 22, GV 24.5, GV 20, Taiyang (center of temporal region), GB 14, LI 4, PC 6, ST 36, LR 3.

References

1. Kiesler J and Ricer R. The abnormal fontanel. *American Family Physician.* 2003;67(12):2547-2552.
2. Komarnitki I, Andrzejczak-Sobocinska A, Tomczyk J, et al. Clinical anatomy of the auriculotemporal nerve in the area of the infratemporal fossa. *Folia Morphol.* 2012;71(3):187-193.
3. Chim H, Okada HC, Brown MS, et al. The auriculotemporal nerve in etiology of migraine headaches: compression points and anatomical variations. *Plast Reconstr Surg.* 2012;130:336-341.
4. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
5. Du Boisgueheneuc F, Levy R, Volle E, et al. Functions of the left superior frontal gyrus in humans: a lesion study. *Brain.* 2006;129:3315-3328.
6. Shakhnovich AT et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. Acta Neurochirurgica. 1990;Suppl 51:357-361.
7. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am.* 2003;36:1041-1053.

GV 23

Shang Xing "Upper Star"

On the frontal region, on the midsagittal line, 4 cun rostral to GV 20. Approximately 1 cun behind the anterior hairline or 0.5 cun posterior to GV 24.

Connective Tissues

Connective Tissues of the **"SCALP"**, consisting of 5 layers, i.e., **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium

- **Skin:** Contains an abundant arterial supply as well as good venous and lymphatic drainage capacity.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides beneath the galea aponeurotica, affording many potential spaces that may distend with fluid following infection or trauma.
- **Pericranium:** This is the external periosteum of the calvaria, continuous with the fibrous tissue in the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Lacerations of the scalp may bleed profusely as a consequence of the abundance of arterial anastomoses in the scalp. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of the artery walls.

Nerves

- **Supratrochlear nerve (CN V$_1$):** The supratrochlear nerve is a branch of the frontal nerve that ascends medial to the supraorbital nerve and subsequently divides into two or more branches. It provides skin sensation in the region extending from the mid-forehead to the area near the hairline.
- **Supraorbital nerve (CN V$_1$):** The supraorbital nerve is a continuation of the frontal nerve, innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva, and provides sensation to the forehead skin and vertex.

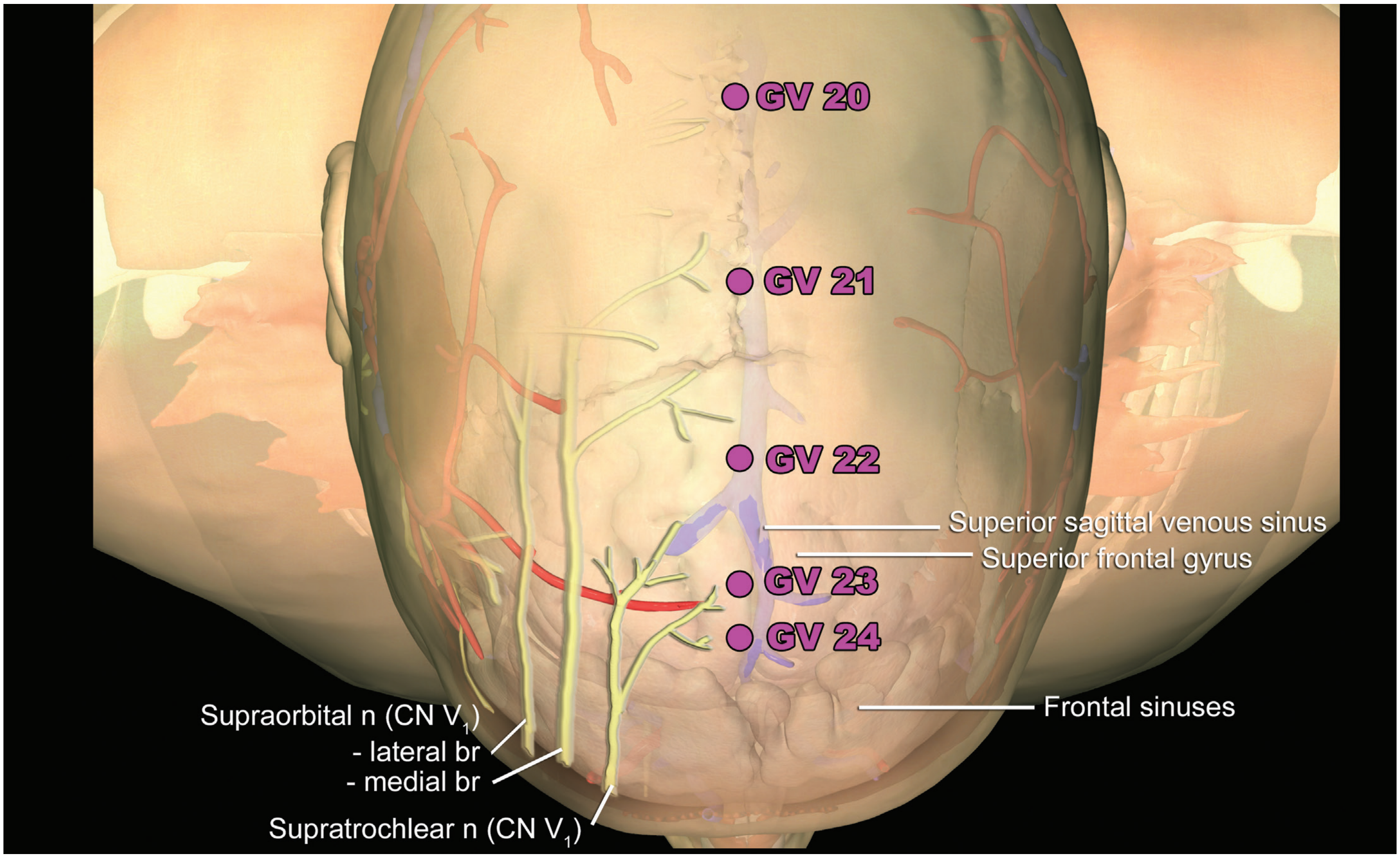


Figure 14-65. The dual supraorbital and supratrochlear innervation of GV 23 builds a somatic afferent conduit for neuromodulates of pain and autonomic dysfunction affecting the frontal sinuses, eyes, rostral dura, and local soft tissues. GV 23 also relates to the prefrontal cortex in the rostral portion of the frontal lobes. The superior frontal gyrus, i.e., that section adjacent to GV 23, carries out executive function and participates in working memory. Executive function allows an individual to control conflicting thoughts and desires that, if left unchecked, might lead to socially unacceptable outcomes. Meditation and exercise deregulate or down-regulate activity in the prefrontal cortex. In so doing, these processes invite altered states of consciousness known as "transient hypofrontality", considered a possible prerequisite for creativity.[14,15] Thus, neuromodulation at GV 23 and GV 24 may benefit the prefrontal cortex by increasing cognitive flexibility rather than by merely affecting its behavior in a unidirectional fashion (i.e., up or down).

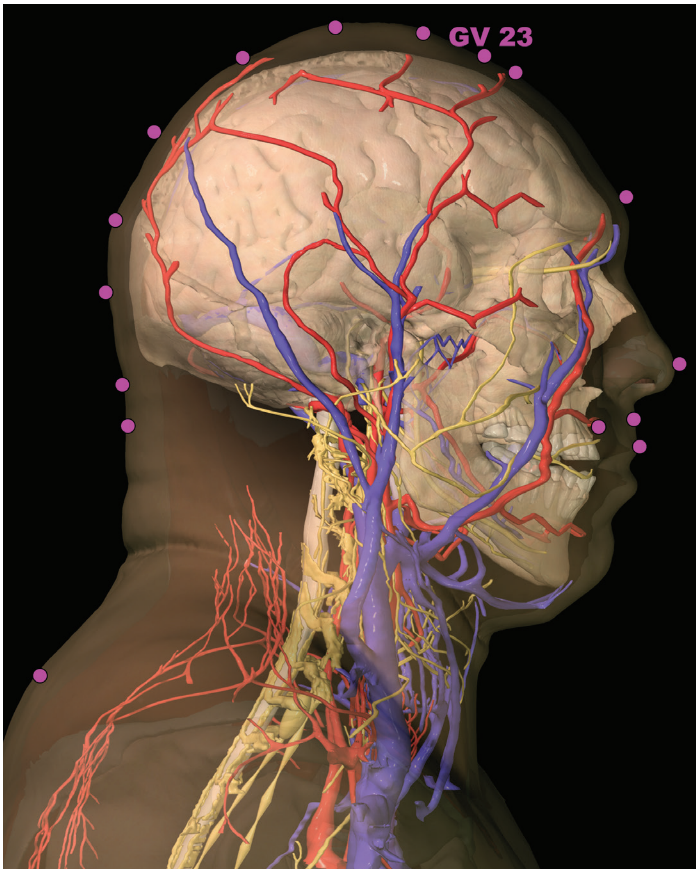


Figure 14-66. GV 23, the "Upper Star", appears here as a star in the upper portion of the GV constellation. Chinese medicine frequently includes astrological connotations and metaphors.

Clinical Relevance: Supraorbital/supratrochlear neuralgia, along with Infraorbital neuralgia and ophthalmic division trigeminal neuralgia, comprise neuralgic etiologies of pain in the periorbital tissues and forehead.[2]

Dysfunction in the supratrochlear nerve increases risk of migraine headache.[3] Peripheral nerve block of the supratrochlear, supraorbital, auriculotemporal, and the occipital nerves has been used to treat a variety of headache disorders, suggesting a role for acupuncture and related techniques in neuromodulating these pathways noninvasively for similar headache relief and clinical benefit.

Compression of the supratrochlear nerve by a tense corrugator muscle, frontalis, or procerus muscle may also precipitate migraine, arguing for alleviation of this pressure through acupuncture, manual therapy, and/or laser therapy well before attempting surgical decompression with corrugator supercilii transection, botulinum toxin injection, or other invasive maneuvers.[4,5,6]

Stimulation of the supraorbital and supratrochlear nerves can aid patients with otherwise intractable trigeminal autonomic cephalalgias (TAC).[7] While implanted stimulators may work, why not try for relief with noninvasive neuromodulation first?

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[8] Sensory dysfunctions associated with SON include hypoesthesia, parasthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, as well as migrainous features in some patients, depending on the extent of vascular involvement through trigeminosympathetic reflexes.

Syndromes similar to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch). Dry needling of BL 2, BL 7, GV 23, GV 24, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

The superior frontal gyrus, labeled in Figure 14-65, contributes to higher cognitive function and working memory, highlighting the role of the frontal cortex in executive processing. It also participates in spatially oriented processing.[9] However, it appears that the lateral, but not the medial, aspect of the superior frontal gyrus participates more strongly in the working memory network. This becomes relevant when neurosurgeons remove low-grade gliomas near the superior frontal gyrus. It also informs approaches involving laser therapy neuromodulation for brain injury. Laser therapy and other forms of neuromodulation may also improve local blood supply and venous drainage, supporting circulation and oxygen delivery to the superior frontal gyrus via GV 23 activation.

Vessels

- **Anastomosis between right and left supraorbital arteries:** The supraorbital arteries arise from the ophthalmic arteries and pass through the supraorbital foramina to supply the forehead and scalp.
- **Anastomosis between right and left supraorbital veins:** The supraorbital veins drain the rostral superficial scalp through the supraorbital and supratrochlear veins, which unite at the medial angle of the eye to form the angular vein. The angular vein becomes the facial vein at the inferior orbital margin.
- **Anastomosis between right and left supratrochlear arteries:** The supratrochlear arteries originate from the ophthalmic arteries and pass from the supraorbital margin to the scalp and the forehead.
- **Anastomosis between the right and left supratrochlear veins:** These veins begin on the forehead and scalp as a venous plexus and communicate with the superficial temporal veins and the supraorbital veins.
- **Emissary veins:** Emissary veins connect the dural venous sinuses to extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number. Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina

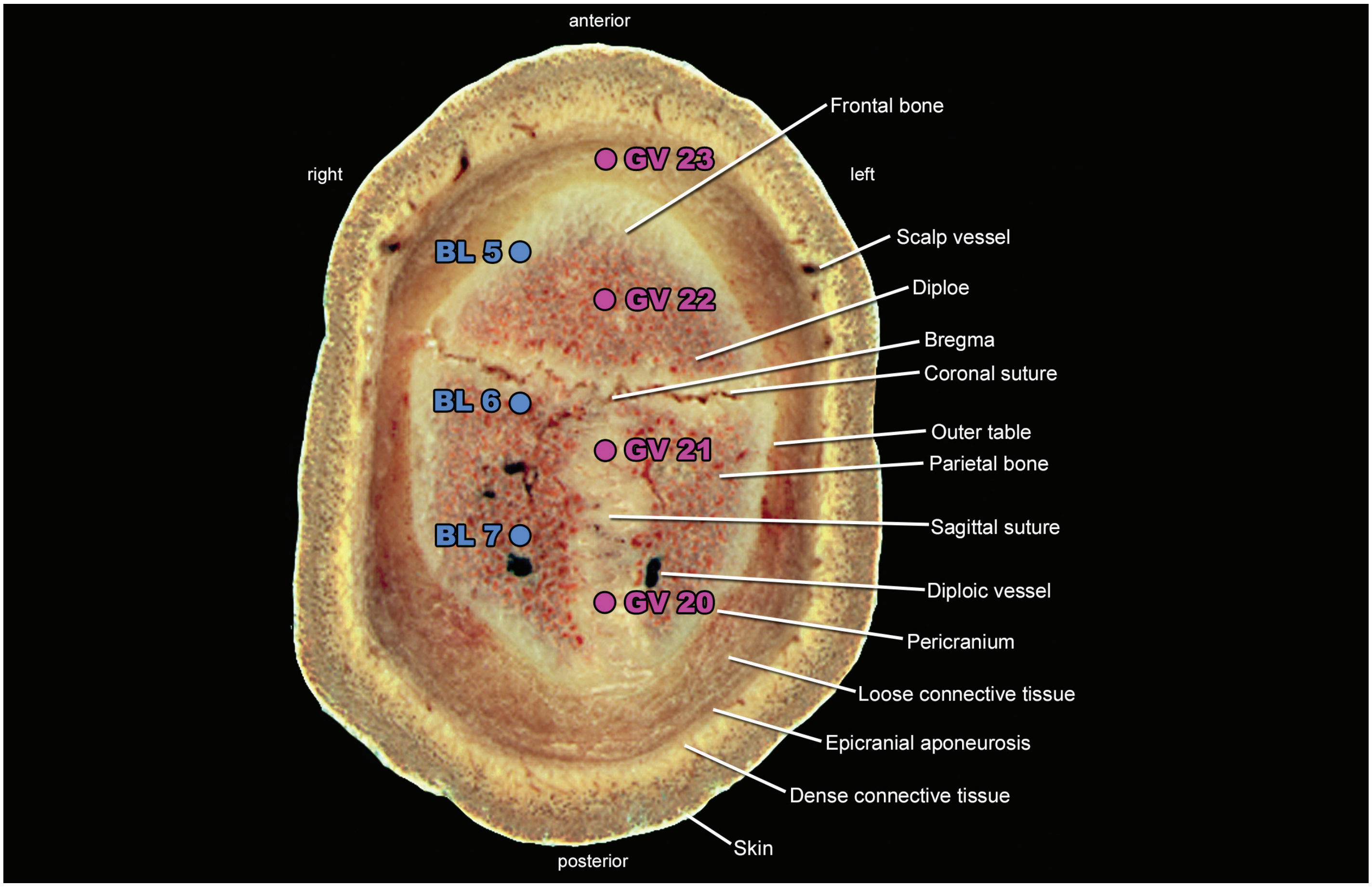


Figure 14-67. At GV 23, the GV channel begins its descent onto the face. In so doing, its neuromodulatory influence gains focus on facial, ocular, and upper respiratory dysfunction rather than brain behavior.

in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus closely follows the course of the GV line as indicated in Figure 14-65. Embryologically, the superior sagittal sinus begins as two parallel structures that merge. The lateral lacunae that lie on either side of the sinus may represent remnants of the early double plexus. Their locations vary.

Lacunae function as autoregulators of blood flow as they control venous outflow resistance. Pathology within the lateral lacunae of the sagittal sinus compromises this draining activity. This may lead to brain swelling by reducing venous outflow. Lateral lacunae stenosis, which occurs in young women with endocrine disorders, can lead to benign intracranial hypertension.[10]

Arachnoid villi (or arachnoid granulations) are protrusions of the arachnoid layer of the meninges, through the dura mater, and into the venous sinuses of the brain. The arachnoid villi provide an exit route for cerebrospinal fluid (CSF) from the brain and into the venous system. The largest arachnoid villi occur along the superior sagittal venous sinus. Under normal circumstances, CSF draining from arachnoid villi keeps intracranial pressure from building.

Pain-sensitive fibers from the ophthalmic division of the trigeminal nerve supply sensation to the venous sinuses. These sinuses include the superior sagittal sinus, the meningeal arteries, and much of the supratentorial dura. Trigeminal fibers also supply the circle of Willis and other cerebral arteries as they join fibers from the sympathetic plexus.

Trigeminal nerve irritation is central in the pathophysiology of head and facial pain.[11] Neuromodulation of trigeminal nerve function by dint of acupuncture and related techniques to rostral GV points over the calvarium may improve blood flow to and from the brain.

Supraorbital vessels anastomose with superficial temporal vasculature. Note in Figure 14-65 the proximity of a frontal branch of the superficial temporal artery to the supraorbital and supratrochlear nerves. Conceivably, myofascial restriction in the occipitofrontalis and fascial planes could compress the vessel and nearby nerves, leading to reduced tissue oxygenation and neural irritation. Given that pulsations in the occipital artery incite neuropathic pain in overlapping occipital nerves, perhaps, pulsations in the superficial temporal artery could aggravate supraorbital or supratrochlear neuralgia where the two intersect.

Indications and Potential Point Combinations

- **Frontal sinusitis:** GV 23, GV 24.5, GB 14, BL 2, Taiyang, LI 4.
- **Epistaxis:** GV 23, GV 21, LI 20, LI 4.
- **Rhinitis:** GV 23, LI 20, LI 4.

- **Frontal headache:** GV 23, GV 24.5, BL 2, GB 14, GB 20, local tender trigger points, LI 4 or LU 7.
- **Eye pain:** GV 23, BL 2, TH 23, GB 1, GB 20, ST 36.
- **Anosmia:** GV 23, GV 22, GV 24.5, LI 20, ST 3.

Evidence-Based Applications

- A Chinese paper reported improvement in **facial spasm, trigeminal neuralgia, and "stubborn" facial paralysis** with GV 23, Yintang (GV 24.5), GB 20, GB 12, and BL 10. Putatively, stimulation at these points improved cerebral blood supply and vertebral basilar artery blood flow as well as relaxation of smooth muscle in cerebrovascular structures.[1]
- Acupuncture at GV 23, BL 2, GB 14, TH 23, Yintang (GV 24.5), ST 1, GB 20, LI 4, and LI 11 significantly improved ocular surface disease index and tear film break up time in patients with **dry eye.**[12]
- Acupuncture at GV 23, LI 20, LI 4, and Yintang significantly improved forced expiratory volume and asthma-related complaints in a patient with persistent **allergic rhinitis** complicated by **rhinosinusitis and asthma.**[13]

References

1. Liu Z and Fang G. Mind-refreshing acupuncture therapy for facial spasm, trigeminal neuralgia and stubborn facial paralysis. *J Tradit Chin Med.* 2004;24(3):191-192.
2. Pareja JA and Cuadrado ML. Lacrimal neuralgia: So far, a missing cranial neuralgia. *Cephalalgia.* 2013;33(14):1198-1202.
3. Delion AL. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg.* 2013;131(5):844e-847e.
4. Janis JE, Hatef DA, Hagan R, et al. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg.* 2013; 131(4):743-750.
5. De Ru JA, Schellekens PP, and Lohuis PJ. Corrugator supercilii transection for headache emanating from the frontal region: a clinical evaluation of ten patients. *J Neural Transm.* 2011;118(11):1571-1574.
6. Kim CC, Bogart MM, Wee SA, et al. Predicting migraine responsiveness to botulinum toxin type A injections. *Arch Dermatol.* 2010;146(2):159-163.
7. Vaisman J, Markley H, Ordia J, et al. The treatment of medically intractable trigeminal autonomic cephalalgias with supraorbital/supratrochlear stimulation: a retrospective case series. *Neuromodulation.* 2012;15(4):374-380.
8. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia.* 2012. DOI: 10.1177/0333102412459575
9. Du Boisgueheneuc F, Levy R, Volle E, et al. Functions of the left superior frontal gyrus in humans: a lesion study. *Brain.* 2006;129:3315-3328.
10. Shakhnovich AT et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochirurgica.* 1990;Suppl 51:357-361.
11. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am.* 2003;36:1041-1053.
12. Kim T-H, Kang JW, Kim KH, et al. Acupuncture for the treatment of dry eye: a multicenter randomised controlled trial with active comparison intervention (artificial teardrops). *PLoS One.* 7(5): e36638. doi:10.1371/journal.pone.0036638.
13. Kim AR, Choi JY, Kim JI, et al. Acupuncture treatment of a patient with persistent allergic rhinitis complicated by rhinosinusitis and asthma. *Evid Based Complement Alternat Med.* 2011;2011:798081.
14. Dietrich A. Functional anatomy of altered states of consciousness: the transient hypofrontality hypothesis. *Conscious Cogn.* 2003;12(2):231-256.
15. Dietrich A. Neurocognitive mechanisms underlying the experience of flow. *Conscious Cogn.* 2004;13(4):746-761.

GV 24

Shen Ting "Courtyard of the Spirit"

On the frontal region, on the midsagittal line, 4.5 cun anterior to GV 20, approximately 0.5 cun behind the anterior hairline.

Connective Tissues

Connective Tissues of the **"SCALP"**, consisting of 5 layers, i.e., **S**kin, **C**onnective tissue (dense), **A**poneurosis, **L**oose connective tissue, and **P**ericranium

- **Skin:** Contains an abundant arterial supply as well as good venous and lymphatic drainage capacity.
- **Dense connective tissue:** Comprises the thick and well-vascularized subcutaneous layer, richly supplied with cutaneous nerves.
- **Galea aponeurotica (epicranial aponeurosis):** This strong, tendinous sheet, or aponeurosis, covers the calvaria and connects the occipitalis, superior auricular, and frontalis muscles; the collective term for this structure is the "epicranius muscle".
- **Loose connective tissue:** Resides beneath the galea aponeurotica, affording many potential spaces that may distend with fluid following infection or trauma.
- **Pericranium:** This is the external periosteum of the calvaria, continuous with the fibrous tissue in the cranial sutures.

Clinical Relevance: Scalp needling requires caution; the loose connective tissue layer constitutes the "danger area of the scalp", as infection from this layer may enter the cranium by way of emissary veins that course through calvarial foramina.

Lacerations of the scalp may bleed profusely as a consequence of the abundance of arterial anastomoses in the scalp. These arteries fail to retract when cut because the dense connective tissue in the scalp maintains patency of the artery walls.

The location of GV 24 at the myotendinous junction of the frontalis muscle and galea aponeurotica highlights its potential for helping alleviate tension headache.

Nerves

- **Supratrochlear nerve (CN V_1):** The supratrochlear nerve is a branch of the frontal nerve that ascends medial to the supraorbital nerve and subsequently divides into two or more branches. It provides skin sensation in the region extending from the mid-forehead to the area near the hairline.
- **Supraorbital nerve (CN V_1):** The supraorbital nerve is a continuation of the frontal nerve, innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva, and provides sensation to the forehead skin and vertex.

Clinical Relevance: Supraorbital/supratrochlear neuralgia, along with infraorbital neuralgia and ophthalmic division trigeminal neuralgia, comprise neuralgic etiologies of pain in the periorbital tissues and forehead.[3]

Dysfunction in the supratrochlear nerve increases risk of migraine headache.[4] Peripheral nerve block of the supratrochlear, supraorbital, auriculotemporal, and the occipital nerves has been used to treat a variety of headache disorders, suggesting a role for acupuncture and related techniques in neuromodulating these pathways noninvasively for similar headache relief and clinical benefit.

Compression of the supratrochlear nerve by a tense corrugator muscle, frontalis, or procerus muscle may also precipitate migraine, arguing for alleviation of this pressure through acupuncture, manual therapy, and/or laser therapy well before attempting surgical decompression with corrugator supercilii transection, botulinum toxin injection, or other invasive maneuvers.[5,6,7]

Stimulation of the supraorbital and supratrochlear nerves can aid patients with otherwise intractable trigeminal autonomic cephalalgias (TAC).[8] While implanted stimulators may work, why not try for relief with noninvasive neuromodulation first?

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[9] Sensory dysfunctions associated with SON include hypoesthesia, paresthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, as well as migrainous features in some patients, depending on the extent of vascular involvement through trigeminosympathetic reflexes.

Syndromes similar to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch). Dry needling of BL 2, BL 7,

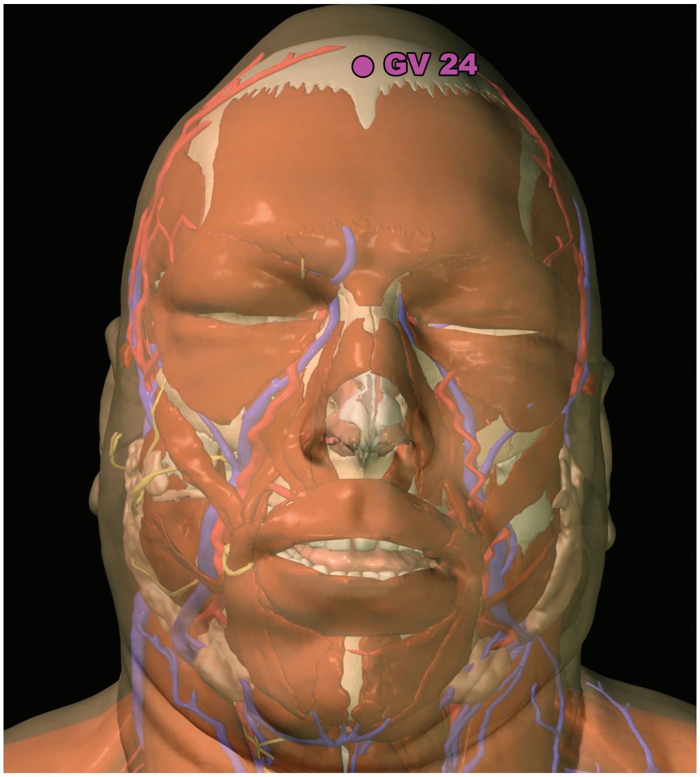


Figure 14-68. At certain times during the development of Chinese medical thought, some considered the original spirit to reside within the brain. As such, the forehead, as hallway, opens into the courtyard, or calvarium, that contains the brain or spirit.

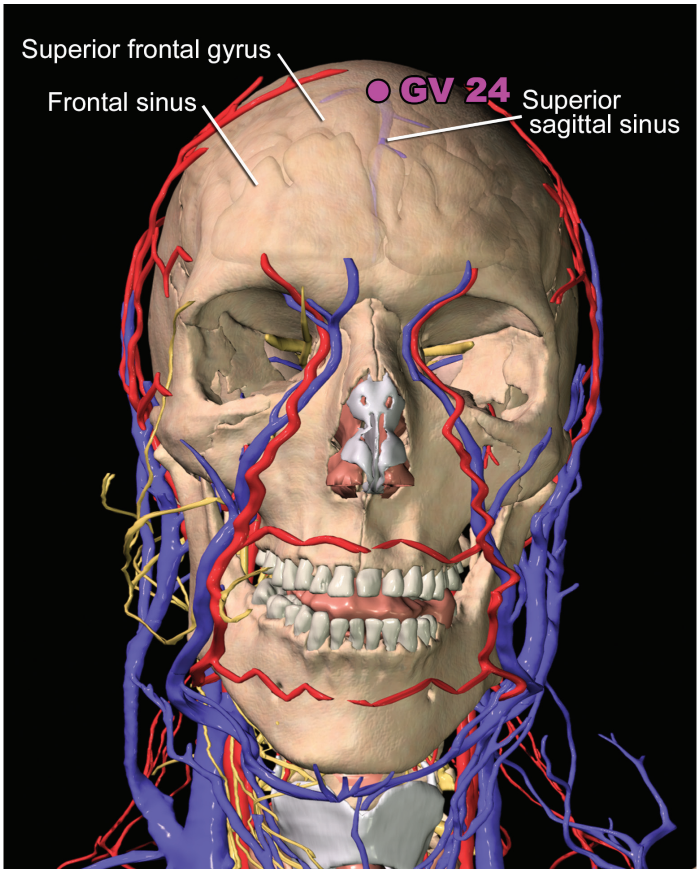


Figure 14-69. GV 24 sits close to the frontal sinuses of the skull, the superior sagittal venous dural sinus of the brain, and the superior frontal gyrus of the frontal lobe. Neural linkages from GV 24 to these sites open neuromodulatory opportunities of frontal sinus pain, sluggish venous outflow from the brain, and problems with executive control or inability to relax (i.e., the "cognitive flexibility" dimension of frontal lobe processing).

GV 23, GV 24, and other points along the course of the supraorbital nerve alleviate neuropathic pain and trigger point contributions. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

The prefrontal cortex, appearing at the rostral region of the frontal lobe in Figure 14-70, contributes to higher cognitive function and working memory. It also participates in executive function and spatially oriented processing.[10] Executive function allows an individual to control conflicting thoughts and desires that, if left unchecked, might lead to socially unacceptable outcomes. The lateral aspect of the superior frontal gyrus may be more important for the working memory network. This becomes relevant when neurosurgeons remove low-grade gliomas near the superior frontal gyrus. It also informs approaches involving laser therapy neuromodulation for brain injury. Laser therapy and other forms of neuromodulation may also improve local blood supply and venous drainage, supporting circulation and oxygen delivery to the superior frontal gyrus via GV 24 activation.

Meditation and exercise deregulate or down-regulate activity in the prefrontal cortex. In so doing, these processes invite altered states of consciousness known as "transient hypofrontality", considered a possible prerequisite for creativity.[11,12] Thus, neuromodulation at GV 23 and GV 24 may benefit the prefrontal cortex by increasing cognitive flexibility rather than by merely affecting its behavior in a unidirectional fashion (i.e., up or down).

Finally, while an acupuncture needle stimulating the surface at GV 24 would not directly impact cerebrospinal venous flow, reflexes mediated through the trigeminal nerve and the autonomic nervous system may indirectly influence venous outflow from the brain.

Vessels

- **Anastomosis between right and left supraorbital arteries:** The supraorbital arteries arise from the ophthalmic arteries and pass through the supraorbital foramina to supply the forehead and scalp.
- **Anastomosis between right and left supraorbital veins:** The supraorbital veins drain the rostral superficial scalp through the supraorbital and supratrochlear veins, which unite at the medial angle of the eye to form the angular vein. The angular vein becomes the facial vein at the inferior orbital margin.
- **Anastomosis between right and left supratrochlear arteries:** The supratrochlear arteries originate from the ophthalmic arteries and pass from the supraorbital margin to the scalp and the forehead.
- **Anastomosis between the right and left supratrochlear veins:** These veins begin on the forehead and scalp as a venous plexus and communicate with the superficial temporal veins and the supraorbital veins.
- **Emissary veins:** Emissary veins connect the dural venous sinuses to extracranial veins. Emissary veins lack valves, and blood may flow in either direction, though usually its flow is from the brain outward. Emissary veins vary in size and number.

Children have a frontal emissary vein that may persist in some adults. The frontal emissary vein connects the superior sagittal sinus with the frontal sinus and nasal cavities. Parietal emissary veins may occur in pairs, passing through the parietal foramina in the calvaria and allowing flow between the superior sagittal sinus and the veins of the scalp. Occipital or posterior auricular veins connect with the sigmoid sinus via the mastoid emissary veins, which course through the mastoid foramina.

Clinical Relevance: The superior sagittal sinus closely follows the course of the GV line as indicated in Figure 14-65. The connection between GV 24 and the superior sagittal sinus, as well as a lateral lacuna, shows well in Figure 14-70.

Embryologically, the superior sagittal sinus begins as two parallel structures that merge. The lateral lacunae that lie on either side of the sinus may represent remnants of the early double plexus. Their locations vary.

The lateral lakes in the adult brain receive blood from the cerebral veins. They also exhibit a carpet of arachnoid granulations that project into their floors and walls, allowing CSF to drain into them and thereby regulate intracranial pressure. Some lacunae receive so many granulations that they are practically filled with them.[13] While the largest and most consistently present lateral lacunae occur in the parietal and posterior frontal regions, lacunae such as the one appearing in Figure 14-70 can occur at more rostral areas.

Lacunae function as autoregulators of blood flow as they control

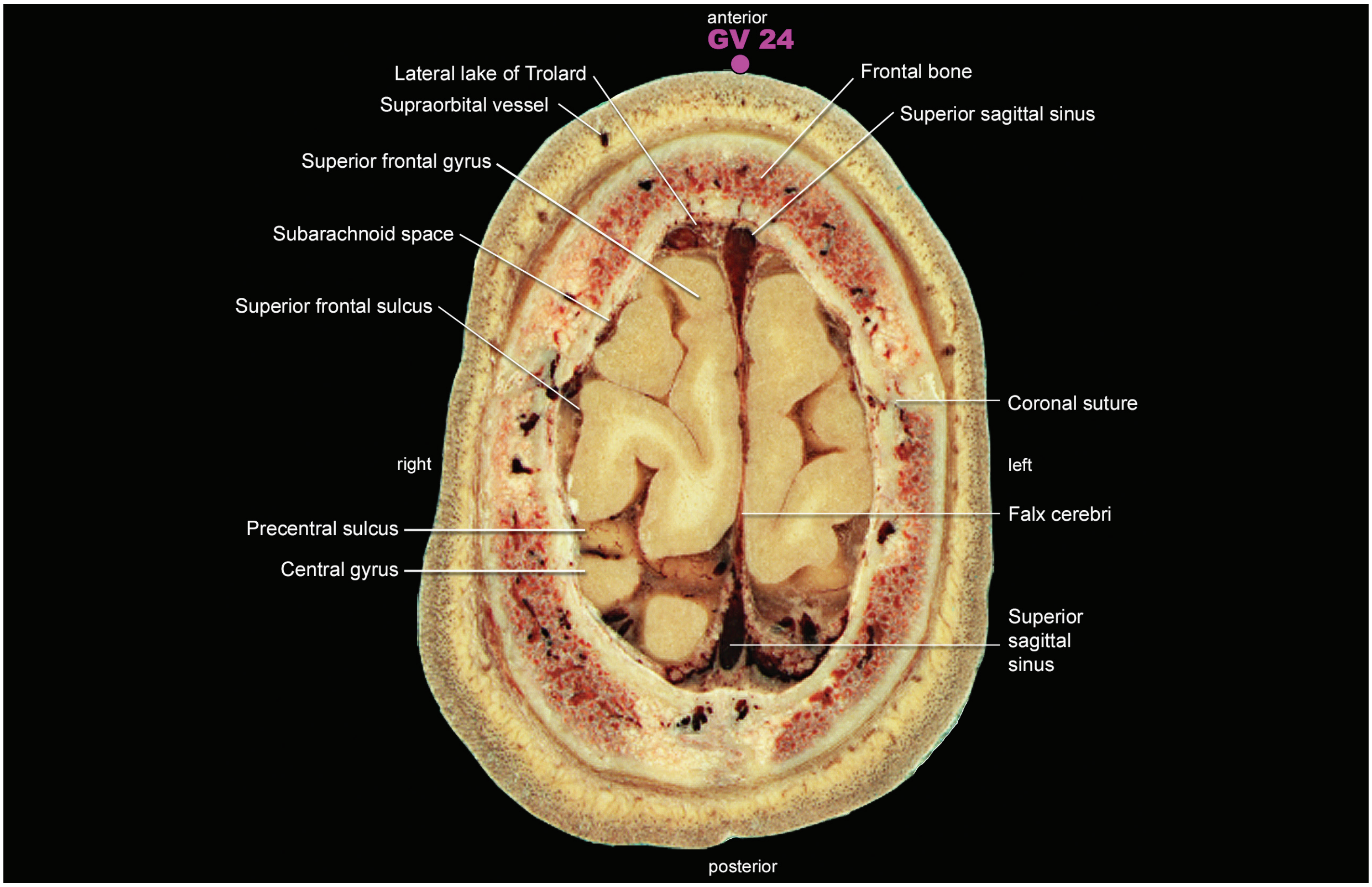


Figure 14-70. This cross-section shows the connection between a lateral lake of Trolard (a.k.a., lateral lacuna) and the superior sagittal sinus. In addition, it reveals the proximity of GV 24 to the superior frontal gyrus, a brain site involved in the conscious control over socially inappropriate impulses during activation and allowing creativity to manifest during de-activation (i.e., while meditating or exercising).

venous outflow resistance. Pathology within the lateral lacunae of the sagittal sinus compromises this draining activity. This may lead to brain swelling by reducing venous outflow. Lateral lacunae stenosis, which occurs in young women with endocrine disorders, can lead to benign intracranial hypertension.[14]

Arachnoid villi (or arachnoid granulations) are protrusions of the arachnoid layer of the meninges, through the dura mater, and into the venous sinuses of the brain. The arachnoid villi provide an exit route for cerebrospinal fluid (CSF) from the brain and into the venous system. The largest arachnoid villi occur along the superior sagittal venous sinus. Under normal circumstances, CSF draining from arachnoid villi keeps intracranial pressure from building.

Pain-sensitive fibers from the ophthalmic division of the trigeminal nerve supply sensation to the venous sinuses. These sinuses include the superior sagittal sinus, the meningeal arteries, and much of the supratentorial dura. Trigeminal fibers also supply the circle of Willis and other cerebral arteries as they join fibers from the sympathetic plexus. Trigeminal nerve irritation is central in the pathophysiology of head and facial pain.[15] Neuromodulation of trigeminal nerve function by dint of acupuncture and related techniques to rostral GV points over the calvarium may improve blood flow to and from the brain.

Supraorbital vessels anastomose with superficial temporal vasculature. Note in Figure 14-65 the proximity of a frontal branch of the superficial temporal artery to the supraorbital and supratrochlear nerves. Conceivably, myofascial restriction in the occipitofrontalis and fascial planes could compress the vessel and nearby nerves, leading to reduced tissue oxygenation and neural irritation. Given that pulsations in the occipital artery incite neuropathic pain in overlapping occipital nerves, perhaps, pulsations in the superficial temporal artery could aggravate supraorbital or supratrochlear neuralgia where the two intersect.

Indications and Potential Point Combinations

- **Frontal sinusitis:** GV 24, GV 24.5, GB 14, BL 2, Taiyang, LI 4.
- **Epistaxis:** GV 24, GV 21, LI 20, LI 4.
- **Rhinitis:** GV 24, LI 20, LI 4.
- **Frontal headache:** GV 24, GV 24.5, BL 2, GB 14, GB 20, local tender trigger points, LI 4 or LU 7.
- **Eye pain:** GV 24, BL 2, TH 23, GB 1, GB 20, ST 36.
- **Anosmia:** GV 24, GV 22, GV 24.5, LI 20, ST 3.
- **Anxiety:** GV 24, ST 36, HT 7, PC 6, CV 17, CV 14.

Evidence-Based Applications

- Acupressure at GV 24 and GV 24.5 produced **sedation** with similar electroencephalographic effects to general anesthesia.[1]

- Acupuncture at points such as GV 24, GV 20, GV 24.5, LI 4, LR 3, HT 7, and PC 6 benefited patients with **post-stroke anxiety** in a Chinese report.[2]
- Electroacupuncture between GV 24 and Yintang (GV 24.5) significantly **reduced the dose of sedation** requires for **critically ill patients on mechanical ventilation.**[16]
- Electroacupuncture applied to GV 24, GB 20, Sishencong, and GV 20 reduced signs and symptoms of earthquake-caused **posttraumatic stress disorder.**
- Electroacupuncture at GV 24, GV 20, Sish encong, and GB 20 improved the cognitive function of patients with **mild cognitive impairment** and outperformed nimodipine.[17]

References

1. Litscher G. Shenting and Yintang: Quantification of cerebral effects of acupressure, manual acupuncture, and laserneedle acupuncture using high-tech neuromonitoring methods. *Medical Acupuncture*. 16(3). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_3/article4.html on 01-10-06.
2. Ping W and Songhai L. Clinical observation on post-stroke anxiety neurosis treated by acupuncture. *J Trad Chin Med*. 2008;28(3):186-188.
3. Pareja JA and Cuadrado ML. Lacrimal neuralgia: So far, a missing cranial neuralgia. *Cephalalgia*. 2013;33(14):1198-1202.
4. Delion AL. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg*. 2013;131(5):844e-847e.
5. Janis JE, Hatef DA, Hagan R, et al. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg*. 2013; 131(4):743-750.
6. De Ru JA, Schellekens PP, and Lohuis PJ. Corrugator supercilii transection for headache emanating from the frontal region: a clinical evaluation of ten patients. *J Neural Transm*. 2011;118(11):1571-1574.
7. Kim CC, Bogart MM, Wee SA, et al. Predicting migraine responsiveness to botulinum toxin type A injections. *Arch Dermatol*. 2010;146(2):159-163.
8. Vaisman J, Markley H, Ordia J, et al. The treatment of medically intractable trigeminal autonomic cephalalgias with supraorbital/supratrochlear stimulation: a retrospective case series. *Neuromodulation*. 2012;15(4):374-380.
9. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia*. 2012. DOI: 10.1177/0333102412459575
10. Du Boisgueheneuc F, Levy R, Volle E, et al. Functions of the left superior frontal gyrus in humans: a lesion study. *Brain*. 2006;129:3315-3328.
11. Dietrich A. Functional anatomy of altered states of consciousness: the transient hypofrontality hypothesis. *Conscious Cogn*. 2003;12(2):231-256.
12. Dietrich A. Neurocognitive mechanisms underlying the experience of flow. *Conscious Cogn*. 2004;13(4):746-761.
13. Tubbs RS, Loukas M, Shoja MM, et al. Lateral lakes of Trolard: anatomy, quantitation, and surgical landmarks. *J Neurosurg*. 2008;108:1005-1008.
14. Shakhnovich AT et al. Venous and cerebrospinal fluid outflow in patients with brain swelling and oedema. *Acta Neurochirurgica*. 1990;Suppl 51:357-361.
15. Larrier D and Lee A. Anatomy of headache and facial pain. *Otolaryngol Clin N Am*. 2003;36:1041-1053.
16. Zheng X, Meng JB, and Fang Q. Electroacupuncture reduces the dose of midazolam monitored by the bispectral index in critically ill patients with mechanical ventilation: an exploratory study. *Acupunct Med*. 2012;30(2):78-84.
17. Zhang H, Zhao L, Yang S, et al. Clinical observation on effect of scalp electroacupuncture for mild cognitive impairment. *J Tradit Chin Med*. 2013;33(1):46-50.

GV 24.5

Yintang “Hall of Impression”

On the glabella, midway between the eyebrows.

Yin Tang is also known as “Ex-1” or “EX-HN3”. “EX-”refers to its designation as an “extra” point on the head and neck, or “HN”.

The location for GV 24.5 between GV 24 and GV 25 justifies its name but more acupuncturists recognize the term “Yintang”.

Muscles

- **Frontalis muscle (frontal belly of the occipitofrontalis, or epicranius, muscle):** The frontalis muscle originates on the epicranial aponeurosis and inserts onto the skin of the forehead and eyebrows. It elevates the eyebrow and wrinkles the forehead. Prolonged contraction of the frontalis muscle causes upper facial rhytides, i.e., forehead wrinkles.
- **Procerus muscle:** The procerus muscle is continuous with the frontalis muscle, extending from the forehead to the bridge of the nose. Allows squinting or frowning. Causes transverse furrows, or wrinkles, associated with “frown lines”. Note its position in Figure 14-71B.
- **Corrugator supercilii muscle:** Furrows the brow and contributes to the development of vertical “frown lines”. This small, narrow muscle sits at the medial end of the eyebrow, interposed between the frontalis and orbicularis muscles. Its fibers travel between the palpebral and orbital parts of the orbicularis oculi muscle. It protects the eyes from the glare of high sunlight by drawing the eyebrows mediad; this forms a roof over the medial canthi. The corrugator supercilii muscle has two heads – one transverse and one oblique. The oblique head works in conjunction with the depressor supercilii muscle and the medial head of the orbital portion of the orbicularis oculi muscle to depress the medial eyebrow; chronic contraction produces an oblique glabellar skin line. The zygomatic branch of the facial nerve supplies all three medial eyebrow depressor muscles.[8]
- **Depressor supercilii muscle:** Previously considered a part of the orbicularis oculi muscle, the depressor supercilii may be a distinct muscle that has a unique effect on movement of the eyebrow and skin over the glabella.[9] It originates on the medial orbital rim near the lacrimal bone and inserts on the medial orbit, inferior to the corrugator supercilii muscle. Some individuals have two heads and others only one.

Clinical Relevance: Myofascial pathology in the frontalis, procerus, and/or corrugator supercilii muscles can irritate the supratrochlear and supraorbital nerves. Dry needling of GV 24.5 may thereby reduce neuropathic pain and trigger point

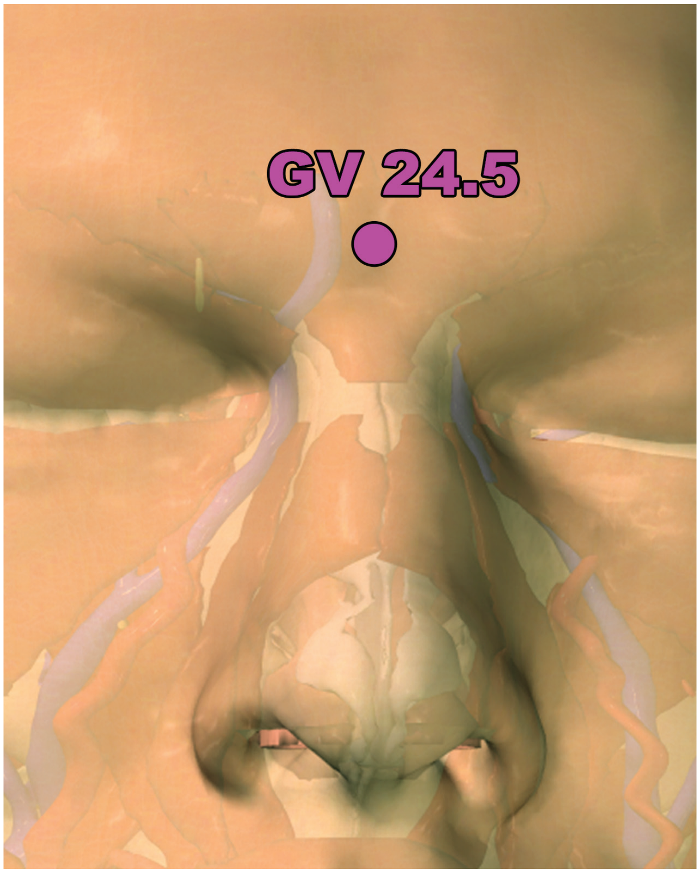


Figure 14-71A. GV 24.5, or Yintang, resides where Buddhists paint a red dot, symbolizing wisdom and illumination. Some cultures regard the “third eye” point as one that supports insight and intuition; hence the name “Hall of Impression”. Still others view Yintang as a doorway through which to influence the pituitary gland. Meditators turn their focus and their eyes toward this point and find this method of “inner gaze” relaxing.

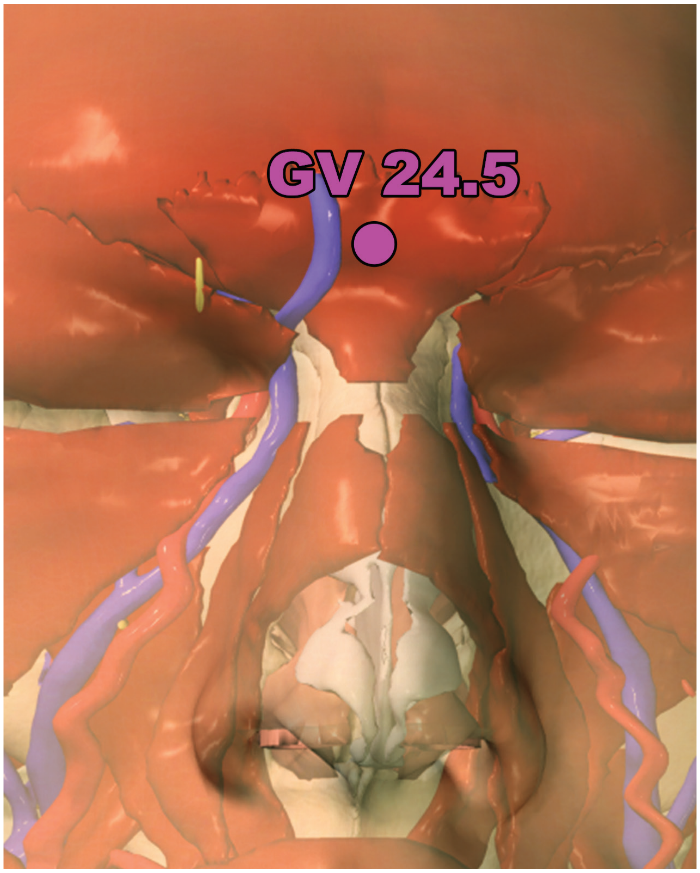


Figure 14-71B. This image reveals the presence of the procerus muscle at GV 24.5. Its prolonged contraction, in conjunction with the corrugator and depressor supercilii muscles, causes wrinkles at the glabella. Trigger points in these structures may entrap nerves, compress local vessels, and produce headache. Note the supratrochlear nerve and large ascending vein emerging from the medial end of this individual’s right orbicularis oculi muscle.

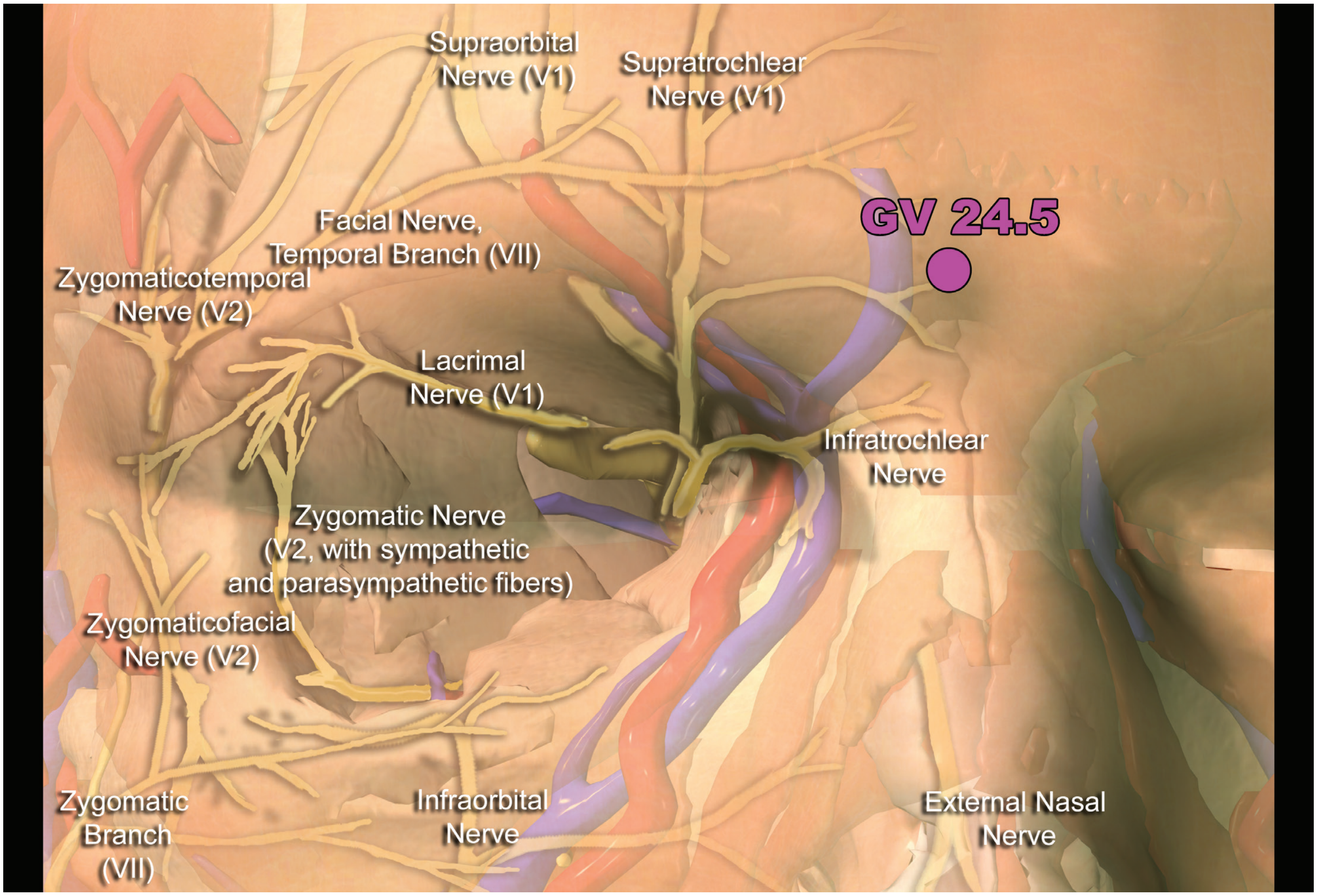

Supraorbital Nerve (V1)
Supratrochlear Nerve (V1)
GV 24.5
Facial Nerve, Temporal Branch (VII)
Zygomaticotemporal Nerve (V2)
Lacrimal Nerve (V1)
Infratrochlear Nerve
Zygomatic Nerve (V2, with sympathetic and parasympathetic fibers)
Zygomaticofacial Nerve (V2)
Zygomatic Branch (VII)
Infraorbital Nerve
External Nasal Nerve

Figure 14-71C. Numerous nerves directly supply the GV 24.5, as indicated here.

dysfunction. Massage and other forms of manual therapy reduce pressure on the nerve along its course and empirically yield better outcomes than medication.

GV 24.5 represents one of the few points along the GV channel that interfaces with muscle tissue. With the ability to deactivate trigger points and stimulate mechanoreceptors for endogenous analgesia, acupuncture at GV 24.5 may deliver a bigger bolus of somatic afferent stimulation than other points that lack muscle tissue.

Both men and women may seek treatment for glabellar frown lines that cause a persistently angry appearance resulting from chronic contraction of the procerus and corrugator supercilii muscles. Botulinum injection of frown lines at the glabella causes reduction in procerus muscle volume lasting up to a year.[10] However, the depth of glabellar frown lines may returns to pre-treatment status well before that time, suggesting compensatory recovery of procerus function by agonist muscles and/or neuroplasticity. Furthermore, the dual innervation of the corrugator supercilii muscle by the buccal and zygomatic branches also complicates neurectomy.

Botulinum toxin type A injection into the glabella results in partial inactivation of the medial frontalis fibers. This leads to relatively increased muscle tone in the lateral and superior frontalis fibers, constituting a "brow lift"[11]

Nerves

- **Supratrochlear nerve (CN V_1):** The supratrochlear nerve is a branch of the frontal nerve that ascends medial to the supraorbital nerve and subsequently divides into two or more branches.

It provides skin sensation in the region extending from the mid-forehead to the area near the hairline.

- **Supraorbital nerve (CN V_1):** The supraorbital nerve is a continuation of the frontal nerve; it innervates the mucous membrane of the frontal sinus and the upper eyelid conjunctiva and provides sensation to the forehead skin and vertex.
- **Temporal branch of facial nerve (CN VII):** Innervates the frontalis muscle.
- **Angular nerve, formed by the buccal and zygomatic branches of facial nerve (CN VII):** Innervates the procerus muscle. The buccal branch receives fibers from the zygomatic branch and then forms the angular nerve.[12] It supplies the corrugator supercilii muscle.
- **Frontal, buccal, and zygomatic branches of the facial nerve (CN VII):** Innervate the corrugator supercilii muscle.

Clinical Relevance: Supraorbital/supratrochlear neuralgia, along with infraorbital neuralgia and ophthalmic division trigeminal neuralgia, comprise neuralgic etiologies of pain in the periorbital tissues and forehead.[13]

Dysfunction in the supratrochlear nerve may lead to migraine headache.[14] Peripheral nerve block of the supratrochlear, supraorbital, auriculotemporal, and the occipital nerves has been used to treat a variety of headache disorders, suggesting a role for acupuncture and related techniques in neuromodulating these

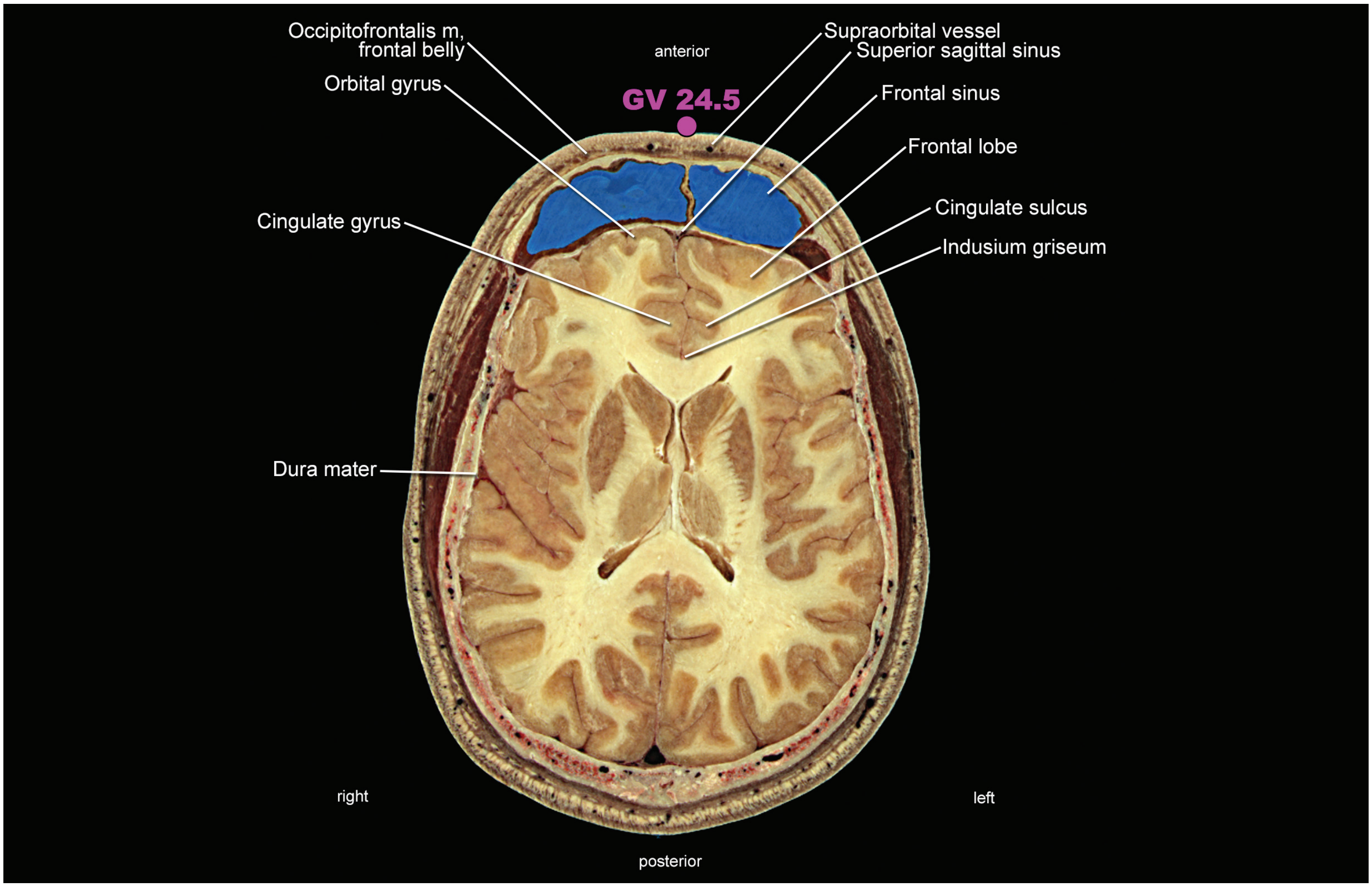


Figure 14-71D. A common indication for GV 24.5 is frontal sinus pain. The frontal sinuses appear here in blue, identifying air chambers within the skull. The proximity of the frontal lobe of the brain may help explain its benefits for mental agitation, emotional problems, and frontal lobe function.

pathways noninvasively for similar headache relief and clinical benefit.

Compression of the supratrochlear nerve by a tense corrugator muscle, frontalis, or procerus muscle may also precipitate migraine, arguing for alleviation of this pressure through acupuncture, manual therapy, and/or laser therapy well before attempting surgical decompression with corrugator supercilii transection, botulinum toxin injection, or other invasive maneuvers.[15,16,17]

Stimulation through implanted devices of the supraorbital and supratrochlear nerves can aid patients with otherwise intractable trigeminal autonomic cephalalgias (TAC).[18] It seems clear that one might try for relief with noninvasive neuromodulation first with acupuncture, laser therapy (including mandatory eyewear and cautious application of laser to GV 24.5), and myofascial release or massage.

Supraorbital neuralgia (SON) produces headaches characterized by paroxysmal or constant pain in the medial region of the forehead. Patients complain of tenderness to palpation over the supraorbital notch/foramen and along the course of the nerve (which follows the BL channel and includes the midline GV channel) to the vertex.[19] Sensory dysfunctions associated with SON include hypoesthesia, paresthesia, and/or allodynia. Autonomic manifestations accompanying SON or concomitant trigger point pathology include conjunctival injection, lacrimation, or rhinorrhea, as well as migrainous features in some patients, depending on the extent of vascular involvement through trigeminosympathetic reflexes.

Syndromes similar to SON include trigeminal neuralgia in the ophthalmic division of the trigeminal nerve, hemicrania continua, and other trigeminal autonomic cephalalgias. SON differs from primary stabbing headache, nummular headache, and supratrochlear neuralgia by exhibiting tenderness to palpation over BL 2 (i.e., at the supraorbital notch).

The prefrontal cortex, appearing at the rostral region of the frontal lobe in Figure 14-71D, contributes to higher cognitive function and working memory. It also participates in executive function and spatially oriented processing.[20] Executive function allows an individual to control conflicting thoughts and desires that, if left unchecked, might lead to socially unacceptable outcomes. The lateral aspect of the superior frontal gyrus may be more important for the working memory network. This becomes relevant when neurosurgeons remove low-grade gliomas near the superior frontal gyrus. It also informs approaches involving laser therapy neuromodulation for brain injury.

Meditation and exercise deregulate or down-regulate activity in the prefrontal cortex. In so doing, these processes invite altered states of consciousness known as “transient hypofrontality”, considered a possible prerequisite for creativity.[21,22] Thus, neuromodulation at GV 24.5 may benefit the prefrontal cortex by increasing cognitive flexibility rather than by merely affecting its behavior in a unidirectional fashion (i.e., up or down).

In contrast to “meditating on the third eye” at GV 24.5 (see Figure 14-71A), tapping on this site causes a “glabellar reflex”.

The ophthalmic division of the trigeminal nerve mediates the afferent limb. Three electrophysiologically distinct responses reflect activation of the cortex and basal ganglia.[23] As such, some consider its presence as an indicator of Parkinson's disease, although it has also been called a "primitive reflex". The trigeminal nerve afferent signal reflexes with the orbicularis oculi muscle to cause a blink reflex. When the blinking persists, this suggests neurologic dysfunction, possibly signaling "frontal release", i.e., the appearance of primitive reflexes in cases of frontal lobe lesion(s).

Research shows that acupressure at this site calms parents whose children are about to undergo elective surgery,[24] implicating that neuromodulation follows via trigeminovagal connections or frontal lobe effects.

Prolonged contraction of the procerus muscle follows excessive stimulation of the buccal branch of the facial nerve. This contributes to frown lines near the nasal bridge.[25] Plastic or cosmetic surgeons seeking to block or eliminate[26] nerve function sometimes find that their attempts alleviate glabellar frown lines fail. Partly, the emotional state (i.e., anger, worry, or stress) that incites the facial nerve often remains. In addition, several muscles contribute to the onset and maintenance of frown lines, including the corrugator supercilii, depressor supercilii, and procerus muscles. The corrugator supercilii receives nerve supply not only from the buccal branch but also the frontal and zygomatic facial nerve branches.[27] Resolution of frown lines may defy attempts at denervation until all neural participation has been reduced. That said, neuromodulation and trigger point deactivation with acupuncture and related techniques at GV 24.5 may reduce frown lines while leaving anatomy intact.

In a way resembling the putative effects of botulinum toxin type A,[28] acupuncture and related techniques may facilitate motor repatterning and interrupt the sustained muscle contraction that leads to wrinkles.

Vessels

- **Anastomosis between right and left supratrochlear arteries:** The supratrochlear arteries originate from the ophthalmic arteries and pass from the supraorbital margin to the scalp and the forehead. They supply the glabella at GV 24.5. After leaving the ophthalmic artery inside the orbit, each supratrochlear artery emerges by piercing the orbital septum above the medial canthus (BL 1). On its way to the forehead, each supratrochlear artery then courses along the procerus and corrugator supercilii muscles at the root of the nose. They then pass to the forehead subcutaneously.[29] The supratrochlear and supraorbital arteries anastomose ipsilaterally. The right and left supratrochlear arteries also anastomose across the midline. The supratrochlear arteries do not follow the supratrochlear veins, unlike most arteries that parallel companion veins. The supratrochlear arteries exhibit a minute reticular venous network attending to their adventitia. These vasa vasorum connect to the polygonal venous network of the forehead along with a few small ascending veins that drain the dermis.
- **Anastomosis between the right and left supratrochlear veins:** The supratrochlear veins begin on the forehead and scalp as a venous plexus (the polygonal venous network"); they communicate with the superficial temporal veins as well as the supraorbital veins.
- **Large ascending veins:** Large ascending veins (usually one on each side of the midline) arise in the vicinity of the medial canthus, either from the angular vein or the transverse nasal vein. They pierce the procerus muscle and pass beneath the dermis of the forehead. They may meet at GV 24.5 or ascend as parallel structures toward the vertex.
- **Deep glabellar venous network:** The deep venous drainage system in the glabellar region comprises a network that includes the superior transverse orbital vein, angular vein, facial vein, and root of the transverse nasal vein, all deep to the orbicularis oculi muscle.
- **Emissary vein at the foramen cecum:** The foramen cecum in the frontal bone transmits the emissary vein from the nose to the superior sagittal sinus. This creates a conduit by which bacteria from the nose and face can course into the cranium and infect the meninges and brain. The frontal diploic vein, draining the frontal sinus and frontal diploe in some species, connects to the rostral extent of the superior sagittal sinus.
- **Cavernous sinus connections:** The cavernous sinuses are part of the dural sinus system and reside on either side of the sella turcica (which houses the pituitary gland), lateral and superior to the sphenoid sinus and immediately posterior, or dorsal, to the optic chiasm.[30] A largely valveless venous web drains blood into the cavernous sinuses from the facial vein (by way of the superior and inferior ophthalmic veins) as well as the middle cerebral and sphenoid veins. Other venous structures linked to the network include the inferior petrosal sinuses, the internal jugular veins, the sigmoid sinuses and superior petrosal sinuses.

Clinical Relevance: While an acupuncture needle stimulating the surface at GV 24.5 would not directly impact cerebrospinal venous flow, reflexes mediated through the ophthalmic division of the trigeminal nerve and the autonomic nervous system may indirectly influence venous outflow from the brain.

Glabellar skin receives arterial supply mainly from the supratrochlear arteries, as noted above. Venous blood exodus from the glabella and forehead does not parallel arterial networks and is less well characterized. Surgical complications from plastic surgery or nasal reconstruction may occur if surgeons lack understanding of the unique nature of venous drainage from the glabella and forehead. These complications include venous congestion, partial flap necrosis, and contour irregularities. Because veins of the forehead may lie at some distance from major arteries, island flaps may undergo engorgement due to good inflow but insufficient outflow, should the narrow arterial pedicle exclude venous access.

The "danger triangle" of the face refers to sites on the face from which infection may spread to the cavernous sinuses, i.e., deep internal sections of the dural venous sinus network. The complexity of the intracranial venous channels and its bidirectional flow facilitate the spread of infection from the nose, tonsils, and eyes into the cavernous sinuses, deep inside the cranium.

Cavernous sinus thrombosis typically occurs as a late complication of infection affecting the central portion of the face (in the danger triangle) or paranasal sinuses. Maxillary tooth or otic infection, bacteremia, and trauma can also cause cavernous sinus thrombosis. Without appropriate antimicrobial agents, intracranial septic thrombosis of the cavernous sinus may produce devastating complications due to the myriad neurovascular connections made in the sinuses. The internal carotid artery courses within the cavernous sinuses along with the sympathetic plexus that surrounds it. Cranial nerves supplying extraocular muscles, i.e., CN III, IV, and VI, follow its lateral walls. Trigeminal nerves from the ophthalmic and maxillary divisions travel within the walls.

Consequences of cavernous sinus thrombosis thus include cranial nerve deficits and visual impairment (due to increased intraocular pressure and traction on both the optic nerve and central retinal artery). Delaying the diagnosis of cavernous sinus thrombosis and its treatment by surgical drainage and antibiotics may prove fatal.

While early signs may be nonspecific, any patient that presents with 1) a sharp, progressive headache in the ophthalmic and/or maxillary trigeminal regions and 2) abnormal cranial nerve findings (affecting CN III, IV, V_1, V_2, and/or VI) should receive evaluation for cavernous sinus thrombosis. Headache typically precedes cranial nerve dysfunction and the periorbital edema that reflects venous obstruction. Dural irritation can cause nuchal rigidity and Kernig or Brudzinski signs. Increased retrobulbar pressure can lead to exophthalmos and ophthalmoplegia. Eye swelling that begins as a unilateral event and becomes bilateral within one to two days has been considered "pathognomonic" of cavernous sinus thrombosis.[31] Fever may follow or occur at any point in the process. Patients ordinarily report history of sinusitis or manipulation of a mid-face furuncle over the past five to ten days. Some have had recent surgery of the "danger zone" or maxillary teeth. Once mental status changes manifest, as in confusion, drowsiness, or coma, death may soon follow, as this sign indicates that the infection is impairing brain function. It may then spread systemically and cause sepsis. As many as 30% of patients with cavernous sinus thrombosis die; survivors suffer permanent neurologic sequelae.

Indications and Potential Point Combinations

- **Frontal headaches:** GV 24.5, GB 14, BL 3, BL 4, BL 9, BL 10, GB 21, pertinent trigger points.
- **Insomnia:** GV 24.5, HT 7, GV 20, LR 3.
- **Nasal pain:** GV 24.5, GV 25, ST 3.
- **Anosmia:** GV 24.5, LI 20, BL 2.
- **Frontal sinusitis:** GV 24.5, GV 23, LI 4, ST 43, ST 44.
- **Rhinitis:** GV 24.5, LI 20, LI 4.
- **"Frown lines" due to chronic contraction of the procerus and corrugator/depressor supercilii muscles:** GV 24.5, BL 2, BL 1, GB 14, TH 23, HT 7.

Evidence-Based Applications

- Electroacupuncture at GV 20, GV 24.5, and either (GB 34 + SP 6), (PC 6 + SP 6), or (KI 3 + SP 6) – depending on the type of **depression** – treated depression as effectively as tricyclic antidepressant medication.[1]
- A Chinese trial looking at the effect of LI 4, LR 3, GV 20, and GV 24.5 showed improved **"depressive neurosis"** comparable to Prozac.[2]
- Treatment of Yintang, GV 20, GV 16, GV 14, GB 20, PC 6, and SP 6 accelerated the clinical response to the selective serotonin reuptake inhibitor paroxetine, prevented the worsening of **depression**, and provided, through electroacupuncture of these sites, long-lasting enhancement of the drug's antidepressant effects.[32]
- Acupressure applied to Yintang by parents whose children were scheduled to undergo elective surgery yielded statistically significant reductions in **anxiety** experienced by these parents compared to a "sham" point near TH 23.[3]
- Electroacupuncture between GV 24 and Yintang (GV 24.5) significantly **reduced the dose of sedation** required for **critically ill patients on mechanical ventilation,** thereby decreasing **anxiety.**[33]
- Acupuncture at Yintang significantly reduced **preoperative anxiety** in adult surgical patients. *J Altern Complement Med.* 2013;19(5):420-424.
- Acupuncture at GV 24.5, KI 3, LR 3, SP 9, LI 4, HT 7, ST 36, and SP 9 reduced systolic and diastolic pressure in persons with **essential hypertension.** Nitric oxide concentration increased significantly as well.[34]
- Electroacupuncture at Yintang and GV 20 produced a series of changes in activation of the frontal lobe, cingulate gyrus, and cerebellum, reinforcing its value for inducing changes in **brain function.**[35]
- Acupuncture at Yintang, PC 6, and CV 4 led to a **reduction in heart rate** and "state of health".[36]
- EA at GV 2, GV 14, GV 20, GV 24.5, prevented tissue shrinkage of the dorsal hippocampus, basolateral nucleus of the amygdala, substantia nigra, and perirhinal cortex. EA at ST 36 and SP 6 prevented tissue shrinkage in all of the aforementioned regions except for the dorsal hippocampus. EA to GV 2 + GV 14 + GV 20 + GV 24.5 or ST 36 +SP 6 reduced the cognitive deficits in pilocarpine-epileptic rats. Administration of p-chlorophenylalanine, a compound that depletes serotonin, negated the behavioral and some of the histologic changes due to EA. This suggests that the functional recovery exhibited by the rats may have been influenced through serotonergic pathways affected by acupuncture and subsequent **neuroprotective benefits.**[4]
- Acupressure at GV 24 and GV 24.5 produced **sedation** with similar electroencephalographic effects to general anesthesia.[5]
- Electroacupuncture applied to Yintang (GV 24.5), GV 20, Sishencong (GV 20 plus four points 1 cun away in four directions), and Anmian ("Peaceful Sleep", located midway between TH 17 and GB 20) produced better results over placebo acupuncture for the short-term treatment of primary **insomnia** in a Chinese report.[6]
- Acupuncture at LI 4, LI 20, and Yintang demonstrated measurable improvement in nasal airflow compared to control points in patients suffering from **chronic nasal congestion.**[7]

References

1. Han C, Li X, Luo H, Zhao X, and Li X. Clinical study on electro-acupuncture treatment for 30 cases of mental depression. *Journal of Traditional Chinese Medicine.* 2004;24(3):172-176.
2. Fu W-B, Fan L, Zhu X-P et al. Depressive neurosis treated by acupuncture for regulating the liver – a report of 176 cases. *J Trad Chin Med.* 2009;29(2):83-86.
3. Wang S-M, Gaal D, Maranets I, et al. Acupressure and preoperative parental anxiety: a pilot study. *Anesth Analg.* 2005;101:666-669.

4. Guilherme dos Santos Jr. J. Tabosa A, Hoffman Martins do Monte F, Blanco MM, de Oliveira Freire A, and Mello LE. Electroacupuncture prevents cognitive deficits in pilocarpine-epileptic rats. *Neuroscience Letters*. 2005;384:234-238.

5. Litscher G. Shenting and Yintang: Quantification of cerebral effects of acupressure, manual acupuncture, and laserneedle acupuncture using high-tech neuromonitoring methods. *Medical Acupuncture*. 16(3). Obtained at http://www.medicalacupuncture.org/aama_marf/journal/vol16_3/article4.html on 01-10-06.

6. Yeung W-F, Chung K-F, Zhang S-P, et al. Electroacupuncture for primary insomnia: a randomized controlled trial. *Sleep*. 2009;32(8):1038-1047.

7. Sertel S, Bergmann Z, Ratzlaff K, et al. Acupuncture for nasal congestion: a prospective randomized, double-blind, placebo-controlled clinical pilot study. *Am J Rhinol Allergy*. 2009;23:1-6.

8. Knize DM. Muscles that act on glabellar skin: a closer look. *Plast Reconstr Surg*. 2000;105(1):350-361.

9. Knize DM. Muscles that act on glabellar skin: a closer look. *Plast Reconstr Surg*. 2000;105(1):350-361.

10. Koerte IK, Schroeder AS, Fietzek UM, et al. Muscle atrophy beyond the clinical effect after a single dose of onabotulinumtoxinA injected in the procerus muscle: a study with magnetic resonance imaging. *Dermatologic Surgery*. 2013;39:761-765.

11. Carruthers A and Carruthers J. Eyebrow height after botulinum toxin type A to the glabella. *Dermatol Surg*.

12. Caminer DM, Newman MI, and Boyd JB. Angular nerve: new insights on innervation of the corrugator supercilii and procerus muscles. J*ournal of Plastic, Reconstructive & Aesthetic Surgery*. 2006;59:366-372.

13. Pareja JA and Cuadrado ML. Lacrimal neuralgia: So far, a missing cranial neuralgia. *Cephalalgia*. 2013;33(14):1198-1202.

14. Delion AL. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg*. 2013;131(5):844e-847e.

15. Janis JE, Hatef DA, Hagan R, et al. Anatomy of the supratrochlear nerve: implications for the surgical treatment of migraine headaches. *Plast Reconstr Surg*. 2013; 131(4):743-750.

16. De Ru JA, Schellekens PP, and Lohuis PJ. Corrugator supercilii transection for headache emanating from the frontal region: a clinical evaluation of ten patients. *J Neural Transm*. 2011;118(11):1571-1574.

17. Kim CC, Bogart MM, Wee SA, et al. Predicting migraine responsiveness to botulinum toxin type A injections. *Arch Dermatol*. 2010;146(2):159-163.

18. Vaisman J, Markley H, Ordia J, et al. The treatment of medically intractable trigeminal autonomic cephalalgias with supraorbital/supratrochlear stimulation: a retrospective case series. *Neuromodulation*. 2012;15(4):374-380.

19. Mulero P, Guerrero AL, Pedraza M, et al. Non-traumatic supraorbital neuralgia: A clinical study of 13 cases. *Cephalalgia*. 2012. DOI: 10.1177/0333102412459575

20. Du Boisgueheneuc F, Levy R, Volle E, et al. Functions of the left superior frontal gyrus in humans: a lesion study. *Brain*. 2006;129:3315-3328.

21. Dietrich A. Functional anatomy of altered states of consciousness: the transient hypofrontality hypothesis. *Conscious Cogn*. 2003;12(2):231-256.

22. Dietrich A. Neurocognitive mechanisms underlying the experience of flow. *Conscious Cogn*. 2004;13(4):746-761.

23. Friedman JH and Abrantes AM. The glabellar reflex is a poor measure of Parkinson motor severity. *International Journal of Neuroscience*. 2013;123(6):417-419.

24. Wang SM, Gaal D, Maranets I, et al. Acupressure and preoperative parental anxiety: a pilot study. *Anesth Analg*. 2005;101(3):666-669.

25. Hwang K, Jin S, Park JH, et al. Innervation of the procerus muscle. *J Craniofac Surg*. 2006;17(3):484-486.

26. Kim JH, Jeong JW, Son D, et al. Percutaneous selective radiofrequency nerve ablation for glabellar frown lines. *Aesthet Surg J.i* 2011;31(7):747-755.

27. Caminer DM, Newman MI, and Boyd JB. Angular nerve: new insights on innervation of the corrugator supercilii and procerus muscles. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2006;59:366-372.

28. Ben Simon GJ, Blaydon SM, Schwarcz RM, et al. Paradoxical use of frontalis muscle and the possible role of botulinum a toxin in permanent motor relearning. *Ophthalmology*. 2005;112(5):918-922.

29. Shimizu Y, Imanishi N, Nakajima T, et al. Venous architecture of the glabellar to the forehead region. *Clinical Anatomy*. 2013;26(2):183-195.

30. Sharma R. Cavernous sinus thrombosis. *Medscape*. March 7, 2013. Accessed at http://emedicine.medscape.com/article/791704-overview#a0104 on 06-05-13.

31. Sharma R. Cavernous sinus thrombosis. *Medscape*. March 7, 2013. Accessed at http://emedicine.medscape.com/article/791704-overview#a0104 on 06-05-13.

32. Qu S-S, Huang Y, Zhang Z-J, et al. A 6-week randomized controlled trial with 4-week follow-up of acupuncture combined with paroxetine in patients with major depressive disorder. *Journal of Psychiatric Research*. 2013;47(6):726-732.

33. Zheng X, Meng JB, and Fang Q. Electroacupuncture reduces the dose of midazolam monitored by the bispectral index in critically ill patients with mechanical ventilation: an exploratory study. *Acupunct Med*. 2012;30(2):78-84.

34. Severcan C, Cevik C, Acar HV, et al. The effects of acupuncture on the levels of blood pressure and nitric oxide in hypertensive patients. *Acupunct Electrother Res*. 2012;37(4):263-275.

35. Zheng Y, Qu S, Wang N, et al. Post-stimulation effect of electroacupuncture at Yintang (EX-HN3) and GV 20 on cerebral functional regions in healthy volunteers: a resting functional MRI study. *Acupunct Med*. 2012;30(4):307-315.

36. Litscher G, Asian-Austrian High-tech Acupuncture Research Network. Transcontinental and translational high-tech acupuncture research using computer-based heart rate and "Fire of Life" heart rate variability analysis. *J Acupunct Meridian Stud*. 2010;3(3):156-164.

GV 25

Su Liao “White Crevice”
“White Bone-Hole”

At the tip of the nose on the midline.

Cartilage

- **Alar cartilage, medial crus (lower part of the cartilaginous wall of the nasal septum):** Forms part of the cartilaginous portion of the nose.

Clinical Relevance: The tip of the nose is often a site of focus for plastic surgeons. For example, revision rhinoplasty for cleft nasal deformity presents numerous challenges given the extent of tissue abnormalities affected.[1] “Smiling deformity” or rhinogingivolabial syndrome is a condition in which the tip of the nose appears to lengthen during smiling or talking as a result of excessive depressor septi nasi muscle contraction.[2,3] An overactive the depressor muscle can make the upper lip seem shortened and reveal an unattractive amount of maxillary gingival tissue.[4,5] A surgical treatment for this problem involves septoplasty (to correct the septum if deviated), dynamic rhinoplasty (i.e., muscular treatment of the nasal tip and upper lip), rhinosculpture (addressing aesthetics of the nasal root, dorsum, and tip), and turbinectomy (involving partial bone-mucous resection in cases of hypertrophied turbinates). Botulinum toxin obviates the need for surgery when injected into the depressor septi nasi muscle.[6] Conceivably, release of tension in the depressor muscle through acupuncture and related techniques could also improve appearance.

A firm to hard lump at the tip of the nose may represent a chondroma of the nasal tip.[7]

Nerves

- **External nasal branch of the anterior ethmoidal nerve (CN V$_1$):** Supplies the tip of the nose.

Clinical Relevance: Rhinoplasty may impair sensation at the tip of the nose, a frequent focus for cosmetic improvement.[8] The external nasal nerve supplies the nasal tip and adjacent upper columella; subcutaneous dissection during rhinoplasty may injure the nerve where it passes between the nasal bone and upper lateral cartilage. The external nasal nerve may also suffer injury during intercartilaginous and cartilaginous splitting incisions that occur during endonasal rhinoplasty.

Neuromodulation by means of acupuncture and related techniques applied to GV 25 may accelerate return of sensation to the tip of the nose.

“Nasal migraine” may stem from heminasal pain mediated by trigeminal afferents from the ophthalmic, maxillary or mandibular divisions.[9] In certain individuals, sneezing heralds onset of nasal migraine. In others, pressure at the tip of the nose at GV 25 may trigger the migraine-tic syndrome. Differential diagnoses include post-traumatic nasal pain, mucosal contact point headache, rhinosinusitis, nasociliary neuralgia, persistent idiopathic facial pain, and idiopathic rhinalgia. Treatment with acupuncture, manual therapy, and/or laser therapy at GV 25 and nearby regions may reduce neuropathic irritability of trigeminal afferents.

Vessels

- **Dorsal nasal artery:** Branches off of the ophthalmic artery to supply the dorsal surface of the nose.
- **Lateral nasal artery:** Branches from the facial artery. Anastomoses with other arterial branches of the facial artery, including the septal and alar arteries. Also anastomoses with the dorsal nasal artery (from the ophthalmic artery) and the infraorbital branch of the internal maxillary artery.

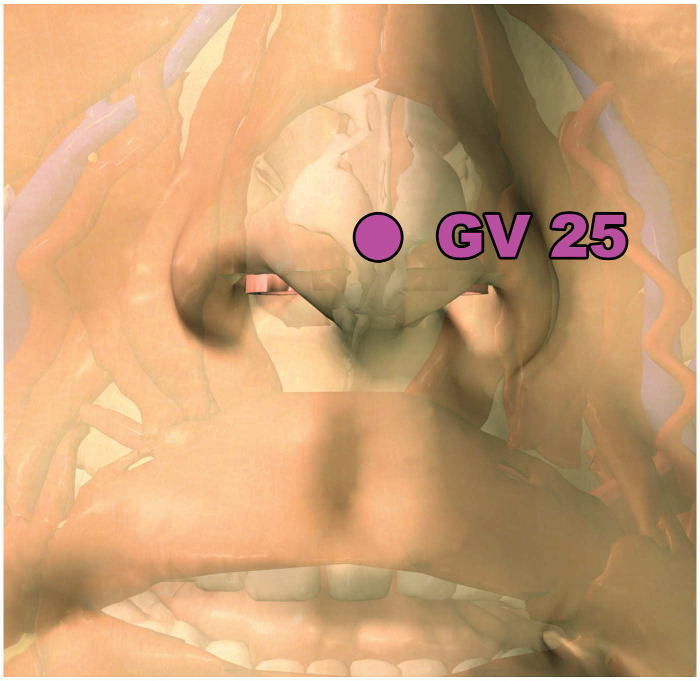


Figure 14-72. A dip at the tip of the nose designates the location of GV 25.

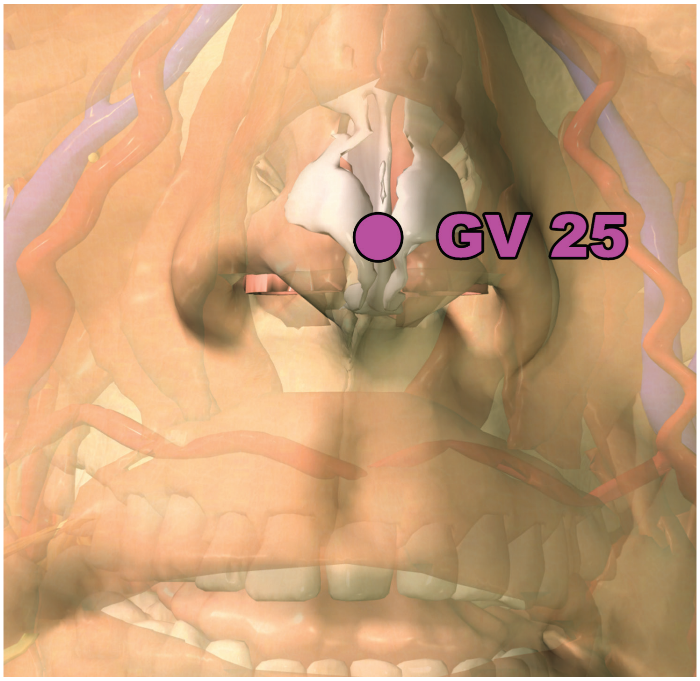


Figure 14-73. The cleft in the nasal cartilage at GV 25 reveals the reason for its descriptive names, “White Crevice” and “White Bone-Hole”.

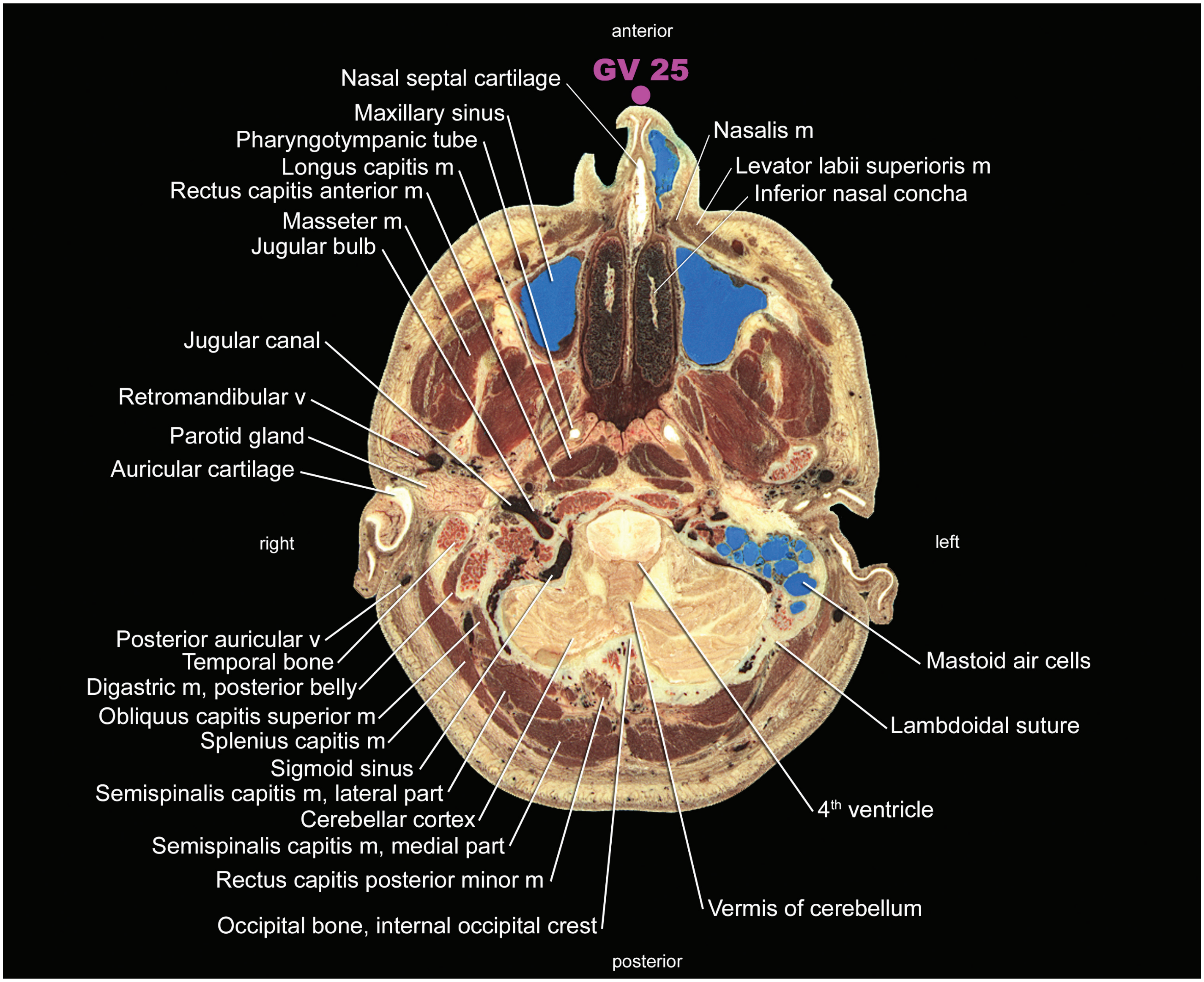

anterior
GV 25
Nasal septal cartilage
Maxillary sinus
Pharyngotympanic tube
Longus capitis m
Rectus capitis anterior m
Masseter m
Jugular bulb
Nasalis m
Levator labii superioris m
Inferior nasal concha
Jugular canal
Retromandibular v
Parotid gland
Auricular cartilage
right
left
Posterior auricular v
Temporal bone
Digastric m, posterior belly
Obliquus capitis superior m
Splenius capitis m
Sigmoid sinus
Semispinalis capitis m, lateral part
Cerebellar cortex
Semispinalis capitis m, medial part
Rectus capitis posterior minor m
Occipital bone, internal occipital crest
Mastoid air cells
Lambdoidal suture
4th ventricle
Vermis of cerebellum
posterior

Figure 14-74. This cross section shows the relationship between the nasal septal cartilage, the bright white structure, and GV 25.

Clinical Relevance: The nasal tip receives its main source of blood supply from the lateral nasal artery in over three-quarters of individuals.[10] The dorsal nasal artery serves as the main arterial supply to the nose in the remaining approximate one-quarter of the population.

Indications and Potential Point Combinations

- **Rhinitis:** GV 25, GV 24.5, LI 20.
- **Sinusitis:** GV 25, GV 24.5, GV 23, add BL 2 and GB 14 for frontal sinusitis or ST 3 and LI 20 for maxillary sinusitis.
- **Nasal migraine:** GV 25, local laser and myofascial release. Consider cranial manipulation and acupuncture as indicated and where needed.

References

1. Angelos P and Wang T. Revision of the cleft lip nose. *Facial Plast Surg.* 2012;28(4):447-483.
2. Beiraghi-Toosi A, Rezaei E, Nooghabi MJ, et al. Effect of depressor septi nasi muscle activity on nasal lengthening with time. *Aesth Plast Surg.* 2013;37(5):989-992.
3. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg.* 2012;36:819-826.
4. Rohrich RJ, Huynh B, Muzaffar AR, et al. Importance of the depressor septi nasi muscle in rhinoplasty: anatomic study and clinical application. *Plast Reconstr Surg.* 2000;105(1):376-383.
5. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg.* 2012;36:819-826.
6. Cigna E, Sorvillo V, Stefanizzi G, et al. The use of botulinum toxin in the treatment of plunging nose: cosmetic results and a functional serendipity. *Clin Ter.* 2013;164(2):e107-e113.
7. Ozturan O, Degirmenci N, and Yenigun A. Chondroma of the nasal tip. *J Craniofac Surg.* 2013;24(2):e153-e155.
8. Bakhshaeekia A and Ghiasi-hafezi S. Comparing the alteration of nasal tip sensibility and sensory recovery time following open rhinoplasty with and without soft tissue removal. *Plastic Surgery International.* 2012; Article ID 415781.
9. Alvarez M, Montojo T, de la Casa B, et al. Unilateral nasal pain with migraine features. *Cephalalgia.* 2013;33(12):1055-1058.
10. Jung DH, Kim HJ, Koh KS, et al. Arterial supply of the nasal tip in Asians. *Laryngoscope.* 2000;110 (2 Pt 1): 308-311.

GV 26

Shui Gou “Water Trough” or Ren Zhong “Man’s Middle”

On the philtrum, on the anterior midline, at the junction of the upper third and lower two-thirds of the distance from the nose to the margin of the upper lip.

Muscles

- **Orbicularis oris muscle:** Serves as the first in the series of sphincters associated with digestive structures. Orbicularis oris muscle fibers encircle the mouth and reside within the lips. Active contraction causes the lips to pucker, although over time its effects on the skin may show as wrinkles. The orbicularis oris muscle has been regarded as a simple sphincter, or circular muscle, like the orbicularis oculi. Now, some claim that it comprises four independent quadrants of muscles that together encircle the mouth. Orbicularis oris fibers intermix with those of surrounding muscles of facial expression that also insert onto the lips, such as the buccinator muscle. Additional intermingling muscles include the caninus, triangularis, quadratus labii superioris, zygomaticus, and quadratus labii inferioris, along with the nasolabilis, incisivus labii superioris, mentalis, and incisivus labii inferioris muscles.
- **Depressor septi nasi muscle:** Constricts the nasal aperture via the nares by drawing the nasal septum downward. Fibers arise from the incisive fossa of the maxilla and insert onto the nasal septum and dorsal portion of the alar part of the nasalis muscle. Sits between the mucous membrane of the lip and the orbicularis oris. As such, one can better access the depressor muscle through an intraoral approach, in the vicinity of GV 28.

Clinical Relevance: “Smiling deformity” or rhinogingivolabial syndrome is a condition in which the tip of the nose appears to lengthen during smiling or talking as a result of excessive depressor septi nasi muscle contraction.[32,33] An overactive the depressor muscle can make the upper lip seem shortened and reveal an unattractive amount of maxillary gingival tissue.[34,35] A surgical treatment for this problem involves septoplasty (to correct the septum if deviated), dynamic rhinoplasty (i.e., muscular treatment of the nasal tip and upper lip), rhinosculpture (addressing aesthetics of the nasal root, dorsum, and tip), and turbinectomy (involving partial bone-mucous resection in cases of hypertrophied turbinates). Botulinum toxin obviates the need for surgery when injected into the depressor septi nasi muscle.[36] Conceivably, release of tension in the depressor muscle through acupuncture and related techniques at GV 26 could also improve appearance and allow the upper lip to lengthen.

In contrast to the short lip syndrome just described, the aging perioral region is associated with upper lip lengthening.[37] The orbicularis oris muscle thins, the subcutis thickens and elastic as well as collagen fibers degenerate. Conceivably, treatment with laser therapy or other means of improving tissue health may forestall some of the consequences of advancing age on perioral appearance.

Nerves

- **Superior labial branches of infraorbital nerve (CN V_2):** Provides cutaneous sensation to the upper lip.
- **Buccal branches of facial nerve (CN VII):** The buccal branch of the facial nerve supplies the upper part of the orbicularis oris muscle and the inferior portion of the levator labii superioris muscle.
- **Sympathetic input:** Tissues associated with GV 26 receive sympathetic fibers from the cervical sympathetic ganglia (T1-T5). Trigeminal nerve branches provide sensation to the skin and underlying structures. Somatosensory-sympathetic and somatosensory-parasympathetic fiber combinations occur in blood vessels of the face.[1]

Clinical Relevance: Close connections between somatosensory and autonomic fibers help regulate regional microcirculation. These communications may also mediate autonomic responses to afferent stimulation. Acupuncture at GV 26 strongly activates the sympathetic nervous system, manifested as elevated catecholamine levels that increase cardiac output and boost stroke volume.

Stimulation of extracranial trigeminal nerve fibers can also increase cortical cerebral blood flow.[2] Electrical stimulation at 2 Hz delivered to sympathetic fibers of the nose cause strong sympathetic activation and vasoconstriction of nasal mucosa.[3] Two Hz electroacupuncture stimulation approximates the frequency of pecking during resuscitation maneuvers. These neurophysiologic responses explain how acupuncture at GV 26 reverses cardiopulmonary collapse and loss of consciousness.

GV 26 also assists in the recovery of orbicularis oris muscle function in the event of facial nerve paralysis affecting its buccal branch. However, tenderness to needling here may warrant selection of other points such as ST 4 and TH 17.

Chronic pursing of the lips may worsen wrinkles on the upper lip. For this condition, plastic surgeons seek to interrupt, rather than improve, facial nerve function in order to reduce muscle contraction and foster skin relaxation.[38]

Vessels

- **Anastomosis of the superior labial arteries:** The superior labial arteries branch from the facial artery and course mediad along the upper lip, anastomosing at GV 26. They supply the upper lip, nasal septum, and nasal alae. See Figure 14-75 B to view the relationship between the facial artery and the superior labial arteries.

Clinical Relevance: Knowledge of the arterial anatomy of the oronasal region is imperative for cosmetic and lip repair surgery.[39] It also aids in revealing the clinical significance of GV 26 for cardiopulmonary resuscitation by dint of its local and abundant sympathetic supply associated with the perioral vascular network.

Indications and Potential Point Combinations

- **Vasovagal syncope, loss of consciousness, cardiopulmonary arrest:** Vigorous pecking applied to GV 26 until resistance is felt at the bone or cartilage.

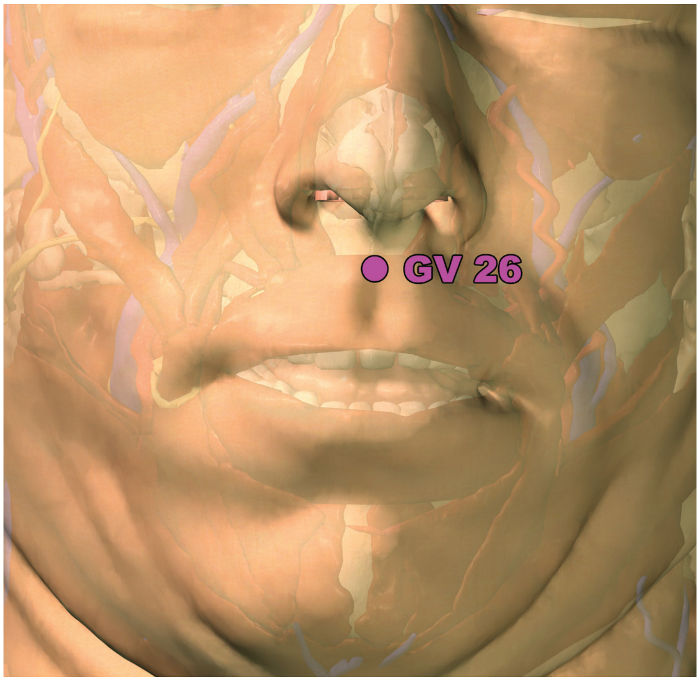


Figure 14-75A. The canal between the nasal planum and upper lip, i.e., the philtrum, looked like a "Water Trough" to the ancient Chinese, along which discharge from the nose might gather.

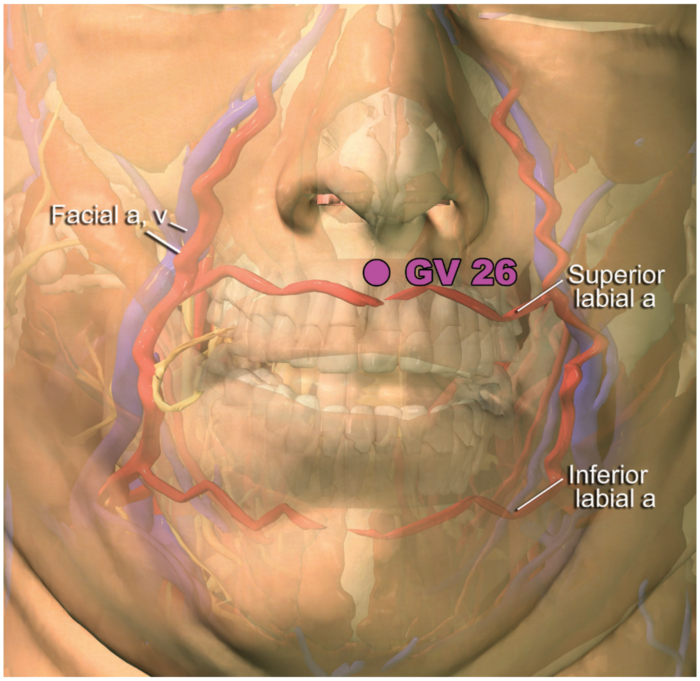


Figure 14-75B. Sympathetic innervation of oronasal vasculature accounts for the strong effects GV 26 has on the cardiopulmonary system and the brain. This image reveals the branching of the superior and inferior labial arteries from the facial artery.

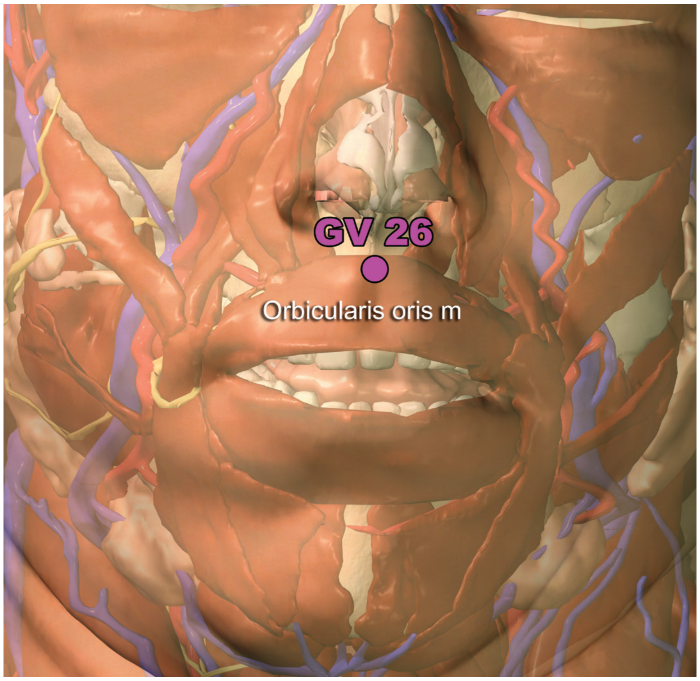


Figure 14-75C. Hypofunction of the orbicularis oris muscle, as in cases of facial nerve injury, may allow food to fall out of the mouth during mastication. Treatment of GV 26, ST 4, and CV 24 by acupuncture and related techniques may help restore function of the orbicularis oris by activating facial nerve branches that supply motor innervation to the muscle.

- **Acute lumbar or cervical spasm or pain:** GV 26 needling while the patient moves about and tries to increase range of motion of the spine.
- **Shock, coma:** GV 26, PC 6, KI 1, ST 36.
- **Sunstroke:** GV 26, KI 1, GV 20.
- **Facial edema:** GV 26, ST 9, LI 17.
- **Facial nerve paralysis affecting the buccal branch:** GV 26, TH 17, ST 4, LI 19.

Evidence-Based Applications

- **Cardiopulmonary resuscitation:**[1,2] Tissues associated with GV 26 receive sympathetic fibers from the cervical sympathetic ganglia. Trigeminal nerve branches provide sensation to the skin and underlying structures. Sensory-sympathetic and sensory-parasympathetic fiber combinations inhabit the blood vessels of the face.[4] Intimate interconnections between sensory and autonomic fibers regulate microcirculation; they may also mediate the autonomic responses to afferent stimulation provided by acupuncture. Acupuncture at GV 26 activates the sympathetic nervous system. This elevates catecholamine levels, increases cardiac output and stroke volume. Stimulation of extracranial trigeminal nerve fibers can increase cortical cerebral blood flow.[5]

Electrical stimulation at 2 Hz delivered to sympathetic fibers of the nose can cause vigorous sympathetic activation, exhibited as strong vasoconstriction of nasal musosal blood vessels.[6] Two cycles of stimulation per second (i.e., 2 Hz) approximates the frequency of pecking GV 26 during resuscitation maneuvers. Combined, these neurophysiologic responses help explain GV 26's role in reversing cardiorespiratory collapse and loss of consciousness.

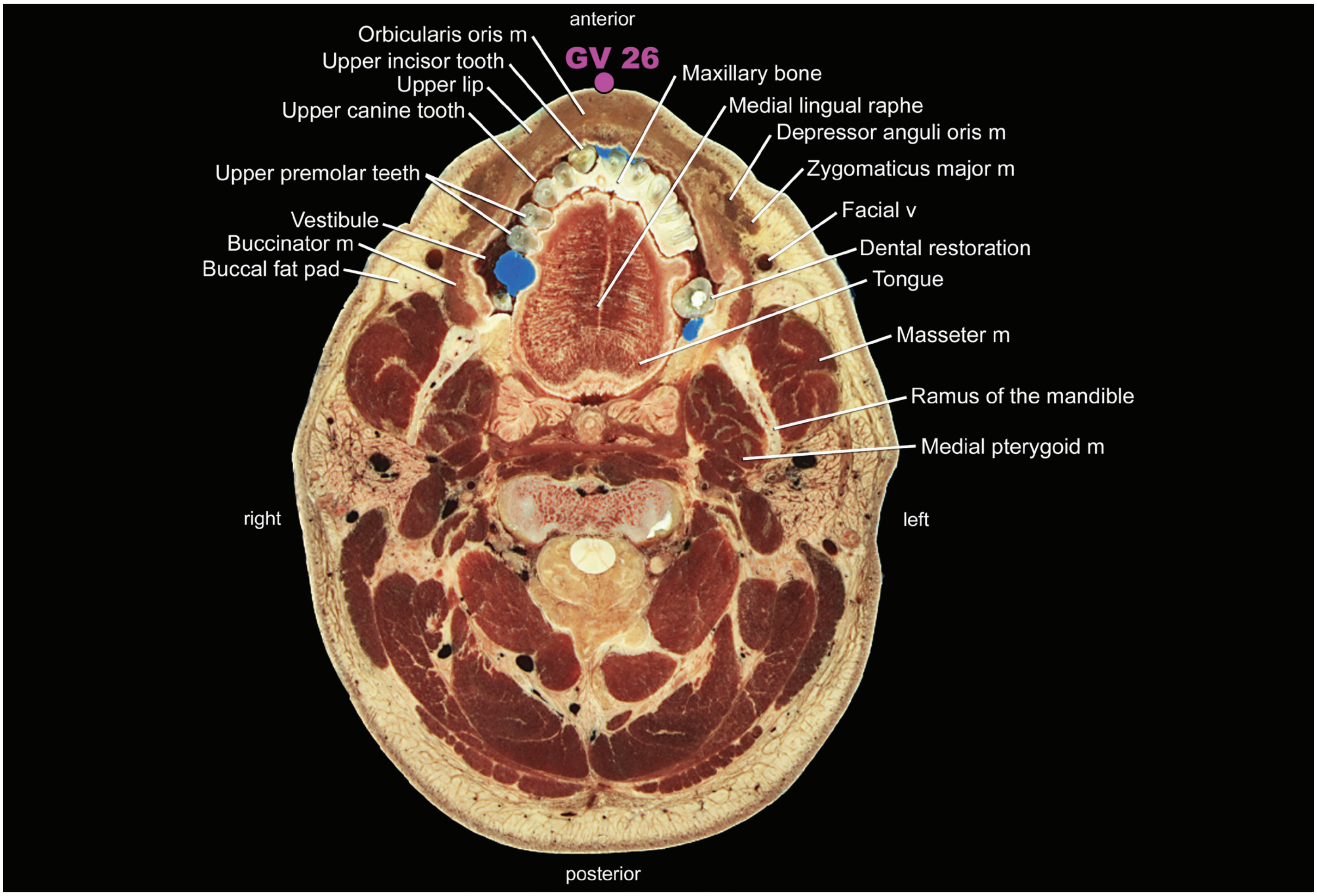


Figure 14-76. Perioral tissue at and around GV 26 contains a high density of somatosensory and sympathetic fibers. This accounts for the point's profound effects on autonomic function, brain activity, and the heart.

Sometimes, stimulation of the same acupuncture point under different clinical conditions can produce opposite responses.

The reason for this is that acupuncture works by neuromodulation, which may raise or flatten physiologic reactions, based on the direction needed for homeostasis. The latest functional brain imaging studies on acupuncture illustrate such modulatory neural and autonomic responses in various parts of the brain, including the limbic, paralimbic, and subcortical gray areas, as well as the cerebellum.[7]

Research literature attesting to the effectiveness of GV 26 in treating cardiovascular depression began appearing in the English language veterinary literature in the 1970's. Over the two decades, numerous papers documented the sympathomimetic effects of GV 26 in various species.[8,9,10,11,12,13] Further studies showed that pretreatment with either alpha or beta blockers inhibited the sympathomimetic effect.[14,15,16] Needling adjacent regions as "sham acupuncture" points failed to result in significant changes in cardiovascular function.[17] A report on GV 26 for resuscitation of neonatal kittens delivered by cesarean section demonstrated success following unproductive cardiopulmonary resuscitation attempts.[18]

Sympathomimetic effects of GV 26 in various species;[19,20,21,22,23,24,25,26] pre-treatment with either alpha or beta blockers inhibited the sympathomimetic effect.[27,28,29]

- Electroacupuncture on GV 26 in the early postoperative period may promote **hemodynamic stability** by attenuating plasma catecholamine fluctuations.[30]
- Needling GV 26 may be able to help ascertain whether **unconsciousness** is due to a psychogenic or organic origin.[31]
- Treatment of **traumatic brain injury** by means of strong stimulation at GV 26 and the twelve ting or jing-well points three times weekly may have helped a patient regain consciousness following craniotomy for right-side subdural hemorrhage.[40]
- Needling GV 26 in addition to conventional acupuncture points may preferentially activate the prefrontal cortex and improve cognitive executive capacity in patients with **vascular dementia.**[41]

References

1. Ruocco I, Cuello AC, Parent A, and Ribeiro-Da-Silva A. Skin blood vessels are simultaneously innervated by sensory, sympathetic, and parasympathetic fibers. *The Journal of Comparative Neurology.* 2002;448:323-336.
2. Gurelik M, Karadag O, Polat S, Ozum U, Aslan A, Gurelik B, Goksel HM. The effects of the electrical stimulation of the nasal mucosa on cortical cerebral blood flow in rabbits. *Neuroscience Letters.* 2004;365:210-213.
3. Franke FE. Sympathetic control of the dog's nasal blood vessels. *Proceedings of the Society for Experimental Biology and Medicine.* 1966;123(2):544-547.
4. Ruocco I, Cuello AC, Parent A, and Ribeiro-Da-Silva A. Skin blood vessels are simultaneously innervated by sensory, sympathetic, and parasympathetic fibers. *The Journal of Comparative Neurology.* 2002;448:323-336.
5. Gurelik M, Karadag O, Polat S, Ozum U, Aslan A, Gurelik B, Goksel HM. The effects of the electrical stimulation of the nasal mucosa on cortical cerebral blood flow in rabbits.

Neuroscience Letters. 2004;365:210-213.
6. Franke FE. Sympathetic control of the dog's nasal blood vessels. *Proceedings of the Society for Experimental Biology and Medicine*. 1966;123(2):544-547.
7. Hui KKS, Liu J, Marina O, Napadow V, Haselgrove C, Kwong KK, Kennedy DN, and Makris N. The integrated response of the human cerebro-cerebellar and limbic systems to acupuncture stimulation at ST 36 as evidenced by fMRI. *Neuroimage*. 2005;27:479-496.
8. Lee DC, Lee MO, and Clifford DH. Cardiovascular effects of acupuncture in anesthetized dogs. *Am J Chin Med*. 1974;2:271.
9. Lee DC, Lee MO, and Clifford DH. Cardiovascular effects of moxibustion at Jen Chung (Go-26) during halothane anesthesia in dogs. *Am J Chin Med*. 1975;3:245-261.
10. Lee DC, Yoon DS, Lee MO, and Clifford DH. Some effects of acupuncture at Jen Chung (Go-26) on cardiovascular dynamics in dogs. *Can J Comp Med*. 1977; 41:446.
11. Lee DC, Lee MO, Clifford DH, and Morris LE. The autonomic effects of acupuncture and analgesic drugs on the cardiovascular system. *Am J Acupuncture*. 1982;10(1):5-30.
12. Davies A, Janse J, and Reynolds GW. Acupuncture in the relief of respiratory arrest. *New Zealand Veterinary Journal*. 1984;32:109-110.
13. Chang C-L, Lee JC, Tseng C-C, Chang Y-H, and Cheng J-T. Decrease of anesthetics activity by electroacupuncture on Jen-Chung point in rabbits. *Neuroscience Letters*. 1995;202:93-96.
14. Lee DC, Lee MO, Clifford DH, and Morris LE. Inhibition of the cardiovascular effects of acupuncture (moxibustion) by propanolol in dogs under halothane anesthesia. *Canad Anaesth Soc J*. 1976;23:307-318.
15. Lee MMO, Lee DC, and Clifford DH. Inhibition of the cardiovascular effects of acupuncture (moxibustion) by phentolamine in dogs during halothane anesthesia. *Am J Chin Med*. 1976;4:153.
16. Lee DC, Lee MO, and Clifford DH. Modification of cardiovascular function in dogs by acupuncture: a review. *Am J Chin Med*. 1976;4(4):333-346.
17. Lee DC, Yoon DS, Lee MO, and Clifford DH. Some effects of acupuncture at Jen Chung (Go-26) on cardiovascular dynamics in dogs. *Can J Comp Med*. 1977; 41:446-454.
18. Skarda RT. Anesthesia case of the month. *JAVMA*. 1999;214(1):37-39.
19.Skarda RT. Anesthesia case of the month. *JAVMA*. 1999;214(1):37-39.
20. Janssens L, Altman S, and Rogers PAM. Respiratory and cardiac arrest under general anaesthesia: treatment by acupuncture of the nasal philtrum. *The Veterinary Record*. 1979;105:273-276.
21. Lee DC, Lee MO, and Clifford DH. Cardiovascular effects of acupuncture in anesthetized dogs. *Am J Chin Med*. 1974;2:271.
22. Lee DC, Lee MO, and Clifford DH. Cardiovascular effects of moxibustion at Jen Chung (Go-26) during halothane anesthesia in dogs. *Am J Chin Med*. 1975;3:245-261 .
23. Lee DC, Yoon DS, Lee MO, and Clifford DH. Some effects of acupuncture at Jen Chung (Go-26) on cardiovascular dynamics in dogs. *Can J Comp Med*. 1977; 41:446.
24. Lee DC, Lee MO, Clifford DH, and Morris LE. The autonomic effects of acupuncture and analgesic drugs on the cardiovascular system. *Am J Acupuncture*. 1982;10(1):5-30.
25. Davies A, Janse J, and Reynolds GW. Acupuncture in the relief of respiratory arrest. *New Zealand Veterinary Journal*. 1984;32:109-110.
26. Chang C-L, Lee JC, Tseng C-C, Chang Y-H, and Cheng J-T. Decrease of anesthetics activity by electroacupuncture on Jen-Chung point in rabbits. *Neuroscience Letters*. 1995;202:93-96.
27. Lee DC, Lee MO, Clifford DH, and Morris LE. Inhibition of the cardiovascular effects of acupuncture (moxibustion) by propanolol in dogs under halothane anesthesia. *Canad Anaesth Soc J*. 1976;23:307-318.
28. Lee MMO, Lee DC, and Clifford DH. Inhibition of the cardiovascular effects of acupuncture (moxibustion) by phentolamine in dogs during halothane anesthesia. *Am J Chin Med*. 1976;4:153.
29. Lee DC, Lee MO, and Clifford DH. Modification of cardiovascular function in dogs by acupuncture: a review. *Am J Chin Med*. 1976;4(4):333-346.
30. Tseng C-C, Chang C-L, Lee J-C, Chen T-Y, and Cheng J-T. Attenuation of the catecholamine responses by electroacupuncture on Jen-Chung point during postoperative recovery period in humans. *Neuroscience Letters*. 1997;228:187-190.
31. Streitberger K and Gries A. Acupuncture in diagnosing prehospital unconsciousness. *American Journal of Emergency Medicine*. 2005;23:90-91.
32. Beiraghi-Toosi A, Rezaei E, Nooghabi MJ, et al. Effect of depressor septi nasi muscle activity on nasal lengthening with time. *Aesth Plast Surg*. 2013;37(5):989-992.
33. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg*. 2012;36:819-826.
34. Rohrich RJ, Huynh B, Muzaffar AR, et al. Importance of the depressor septi nasi muscle in rhinoplasty: anatomic study and clinical application. *Plast Reconstr Surg*. 2000;105(1):376-383.
35. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg*. 2012;36:819-826.
36. Cigna E, Sorvillo V, Stefanizzi G, et al. The use of botulinum toxin in the treatment of plunging nose: cosmetic results and a functional serendipity. *Clin Ter*. 2013;164(2):e107-e113.
37. Iblher N, Stark GB, and Penna V. The aging perioral region – do we really know what is happening? *J Nutr Health Aging*. 2012;16(6):581-585.
38. Hwang K, Jin S, Hwang SH, et al. Innervation of upper orbicularis oris muscle. *J Craniofac Surg*. 2006;17(6):1116-1117.
39. Al-Hoqail R and Meguid EMA. Anatomic dissection of the arterial supply of the lips: an anatomical and analytical approach. *Journal of Craniofacial Surgery*. 2008;19(3):785-794.
40. Tseng YJ, Hung YC, and Hu WL. Acupuncture helps regain postoperative consciousness in patients with traumatic brain injury: a case study. *J Altern Complement Med*. 2013; 19(5):474-477.
41. Huang Y, Lai XS, and Tang AW. Comparative study of the specificities of needling acupoints DU20, DU 26 and HT 7 in intervening vascular dementia in different areas in the brain on the basis of scale assessment and cerebral functional imaging. *Chin J Integr Med*. 2007;13(2):103-108.

GV 27

Dui Duan "Extremity of the Mouth"

On the midpoint of the upper lip where it meets the philtrum.

Muscles

- **Orbicularis oris muscle:** Serves as the first in the series of sphincters associated with digestive structures. Orbicularis oris muscle fibers encircle the mouth and reside within the lips. Active contraction causes the lips to pucker, although over time its effects on the skin may also cause wrinkles. The orbicularis oris muscle has been regarded as a simple sphincter, or circular muscle, like the orbicularis oculi. Now, some claim that it comprises four independent quadrants of muscles that together encircle the mouth. Orbicularis oris fibers intermix with those of surrounding muscles of facial expression that also insert onto the lips, such as the buccinator muscle. Additional intermingling muscles include the caninus, triangularis, quadratus labii superioris, zygomaticus, and quadratus labii inferioris, along with the nasolabilis, incisivus labii superioris, mentalis, and incisivus labii inferioris muscles.

Clinical Relevance: The aging perioral region is associated with upper lip lengthening and wrinkling.[1] As the orbicularis oris muscle thins, the subcutis thickens, and elastic as well as collagen fibers degenerate. Conceivably, treatment with laser therapy or other means of improving tissue health may forestall some of the consequences of advancing age on perioral appearance.

Facial nerve injury may impair the ability of an individual to close the mouth with the action of the orbicularis oris muscle. Neuromodulation applied to GV 27 may aid in restoring its function.

Cleft lip affects orbicularis oris muscle anatomy.[2] That is, with incomplete clefts, the intrinsic portion within the vermilion is interrupted without distortion while the extrinsic part, i.e., the portion outside of the vermilion, distorts vertically in relation to the degree of nasal deformity. Complete clefts cause the extrinsic part to deviate more significantly. These differences influence surgical repair (cheiloplasty) which requires reorienting orbicularis oris muscle fibers.

Nerves

- **Superior labial branches of infraorbital nerve (CN V$_2$):** Provides cutaneous sensation to the upper lip.
- **Buccal branches of facial nerve (CN VII):** The buccal branch of the facial nerve supplies the upper part of the orbicularis oris muscle and the inferior portion of the levator labii superioris muscle.

Clinical Relevance: GV 27 sends afferent stimulation through infraorbital nerve branches; it affects motor innervation of the orbicularis oris muscle through the buccal branch of the facial nerve. Injury to the buccal branches of the facial nerve warrants consideration of additional points such as ST 4 and CV 24.

Smoking and a countenance that includes chronic pursing of the lips may accentuate the appearance of wrinkles on the upper lip. For this condition, plastic surgeons seek to interrupt, rather than improve, facial nerve function in order to reduce muscle contraction and foster skin relaxation.[3]

"Beauty" Tip: The yoga posture known as "Lion Pose", or Simhasana, counters the chronic contraction of the orbicularis oris fibers associated with the formation of vertical wrinkles around the mouth and lips. It does so by stretching the skin and re-lengthening muscle as the mouth opens widely, like a lion issuing a loud and long roar.

Vessels

- **Anastomosis of the superior labial arteries:** The superior labial arteries branch from the facial artery and course mediad along the upper lip, anastomosing at GV 27. They supply the upper lip, nasal septum, and nasal alae. See Figure 14-75 B to view the relationship between the facial artery and the superior labial arteries.

Clinical Relevance: Knowledge of the arterial anatomy of the oronasal region is imperative for cosmetic and lip repair surgery.[4] Should mishaps occur, restoration of circulation by means of laser therapy, massage, and acupuncture at GV 27 and surrounding sites may hasten return of vascular supply.

Indications and Potential Point Combinations

- **Labial pain or swelling:** GV 27, ST 4.
- **Nasal obstruction:** GV 27, LI 20.
- **Facial nerve injury affecting the buccal branch:** GV 27, ST 4, CV 24.

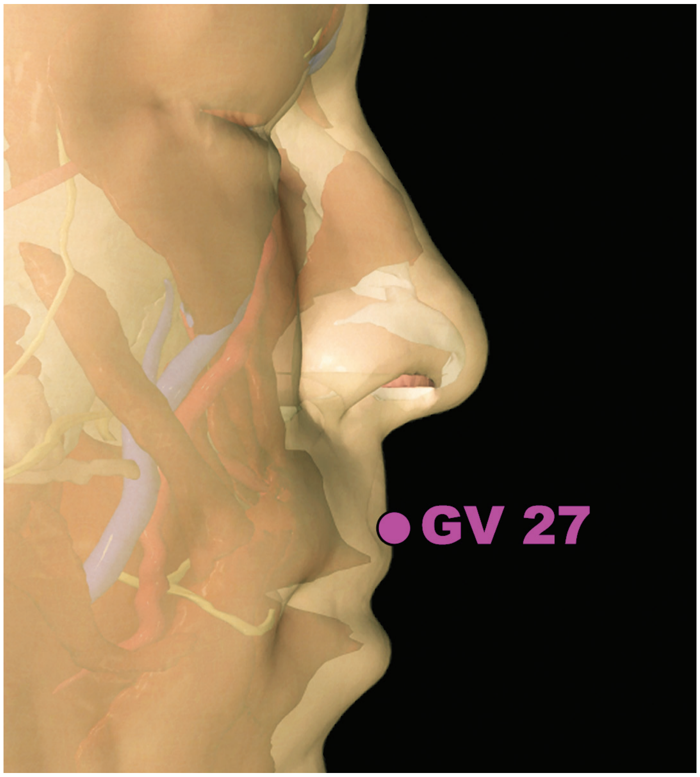


Figure 14-77A. GV 27, "Extremity of the Mouth", identifies the location where the philtrum meets the upper lip. When the mouth opens, GV 27 indicates highest point, or extremity, of the mouth.

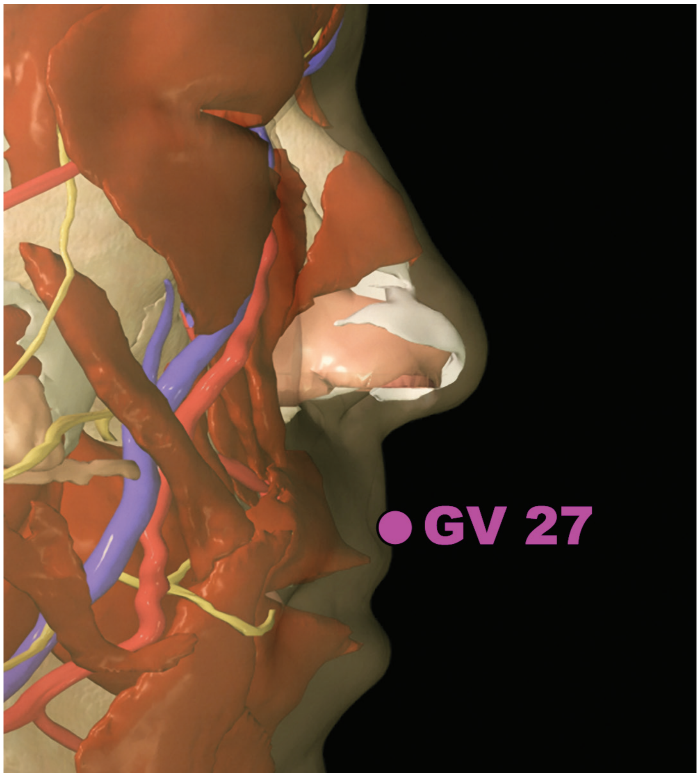


Figure 14-77B. Note how GV 27 points to the junction of the intrinsic and extrinsic parts of the orbicularis oris muscle deep to the lip and surrounding the mouth, respectively. Their different orientations, with the intrinsic part jutting out, suggest different functions. That is, the intrinsic part identifies more with pursing the lips for a kiss or pout, while the extrinsic part can close the mouth on its own, even if the lips relax.

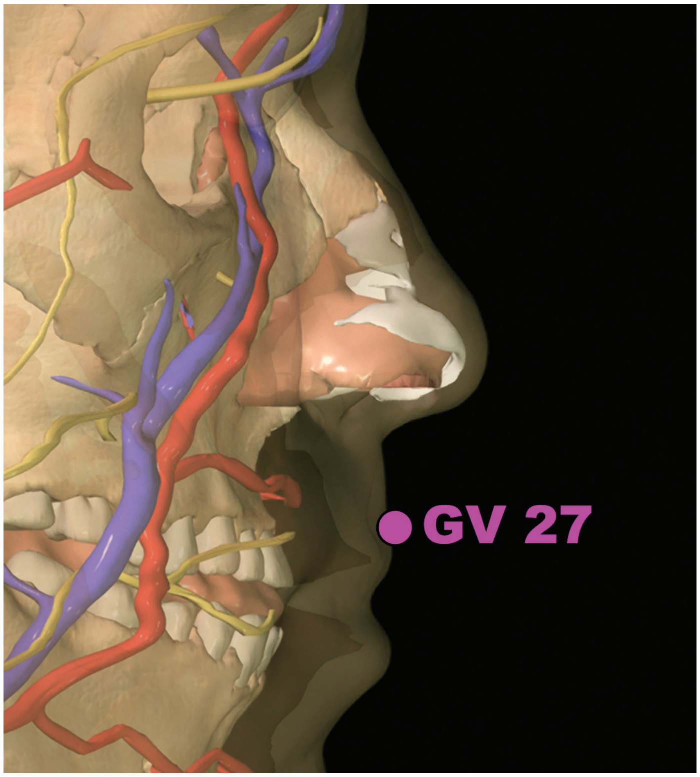


Figure 14-77C. This image highlights the relationship between the buccal branches of the facial nerve (overlying the teeth) and GV 27.

References

1. Iblher N, Stark GB, and Penna V. The aging perioral region – do we really know what is happening? *J Nutr Health Aging.* 2012;16(6):581-585.
2. De Mey A, Van Hoof I, De Roy G, et al. Anatomy of the orbicularis oris muscle in cleft lip. *British Journal of Plastic Surgery.* 1989; 42(6):710-714.
3. Hwang K, Jin S, Hwang SH, et al. Innervation of upper orbicularis oris muscle. *J Craniofac Surg.* 2006;17(6):1116-1117.
4. Al-Hoqail R and Meguid EMA. Anatomic dissection of the arterial supply of the lips: an anatomical and analytical approach. *Journal of Craniofacial Surgery.* 2008;19(3):785-794.

GV 28

Yin Jiao “Gum Intersection”

In the mouth, on the midsagittal plane, at the junction of the frenulum of the upper lip with the maxillary gingiva.

Connective Tissues

- **Labial frenulum:** During development, the frenulum, a free-edged fold of mucous membrane along the midline, guides development of structures of the oral cavity. Although they later recede and diminish in size, frenula help guide the positions of the baby teeth during childhood.

Clinical Relevance: Several frenula exist in the body; the term “frenulum” means “little bridle” in Latin. It refers to a small tissue fold that tethers more mobile structures to fixed locations. The mouth has three frenula: the frenulum linguae under the tongue, the frenulum labii inferioris inside the lower lip, and the frenulum labii superioris within the upper lip at GV 28. Trauma to the face and mouth may tear one or more frenula. Finding a torn frenulum in a patient may indicate physical abuse from violent assaults to the head.

Muscles

- **Orbicularis oris muscle:** Serves as the first in the series of sphincters associated with digestive structures. Orbicularis oris muscle fibers encircle the mouth and reside within as well as around the lips. Active contraction causes the lips to pucker, although over time its effects on the skin may also cause wrinkles. The orbicularis oris muscle has been regarded as a simple sphincter, or circular muscle, like the orbicularis oculi. Now, some claim that it comprises four independent quadrants of muscles that together encircle the mouth. Orbicularis oris fibers intermix with those of surrounding muscles of facial expression that also insert onto the lips, such as the buccinator muscle. Additional intermingling muscles include the caninus, triangularis, quadratus labii superioris, zygomaticus, and quadratus labii inferioris, along with the nasolabialis, incisivus labii superioris, mentalis, and incisivus labii inferioris muscles.
- **Depressor septi nasi muscle:** Constricts the nasal aperture by drawing the nasal septum downward and narrowing the nostril openings. Depressor fibers originate from the incisive fossa of the maxilla and insert onto the nasal septum and dorsal portion of the alar part of the nasalis muscle. This muscle sits between the mucous membrane of the lip and the orbicularis oris, as shown in Figure 14-82. Not all individuals have a depressor septi nasi muscle, and it is not clear if this individual had one or not. That said, if one is present, it is more directly accessible by means of an intraoral approach, starting at GV 28.

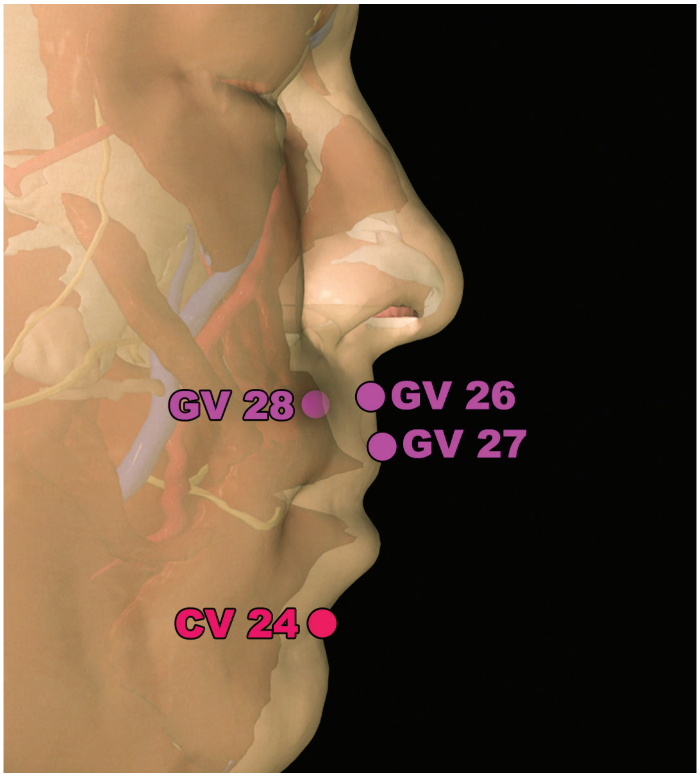
Clinical Relevance: The aging perioral region is associated with upper lip lengthening and wrinkling.[1] As the orbicularis oris muscle thins, the subcutis thickens, and elastic as well as collagen fibers degenerate. Conceivably, treatment with laser therapy or other means of improving tissue health may forestall some of the consequences of advancing age on perioral appearance.

“Beauty” Tip: For upper and lower lip wrinkles, one can push the lips forward with the tongue, thereby stretching a chronically contracted orbicularis oris muscle. The Lion Pose in yoga, described previously, also stretches orbicularis oris fibers.

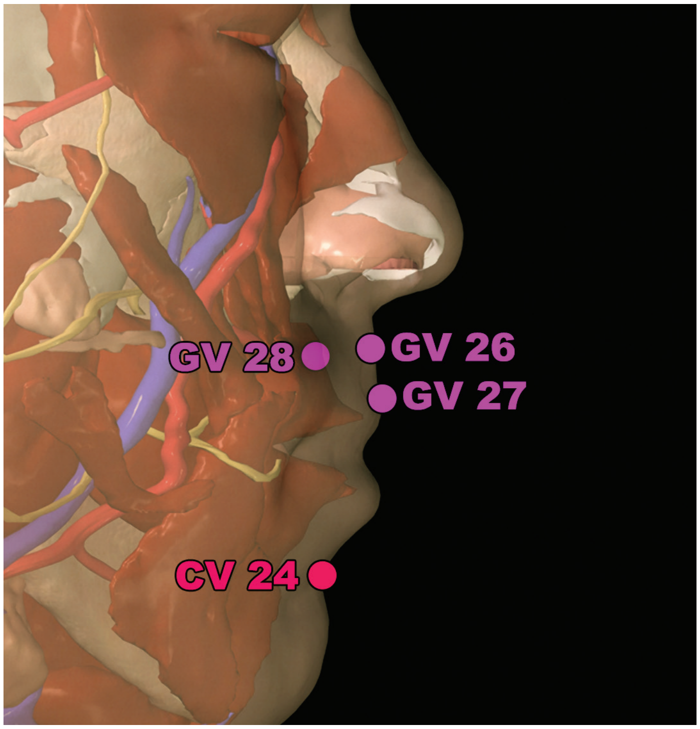
Facial nerve injury may impair the ability of an individual to close the mouth. Neuromodulation applied to GV 28 may aid in restoring function of the dorsal and ventral branches of the buccal branch of the facial nerve (see Figure 14-81).

Cleft lip directly upsets orbicularis oris muscle anatomy.[2] That is, with incomplete clefts, the intrinsic portion within the vermilion is interrupted without distortion while the extrinsic part, i.e., the portion outside of the vermilion, distorts vertically in relation to the degree of nasal deformity. Complete clefts cause the extrinsic part to deviate even more. These differences influence surgical repair of cleft lip (cheiloplasty), which requires, in part, reorienting orbicularis oris muscle fibers to allow oral closure.

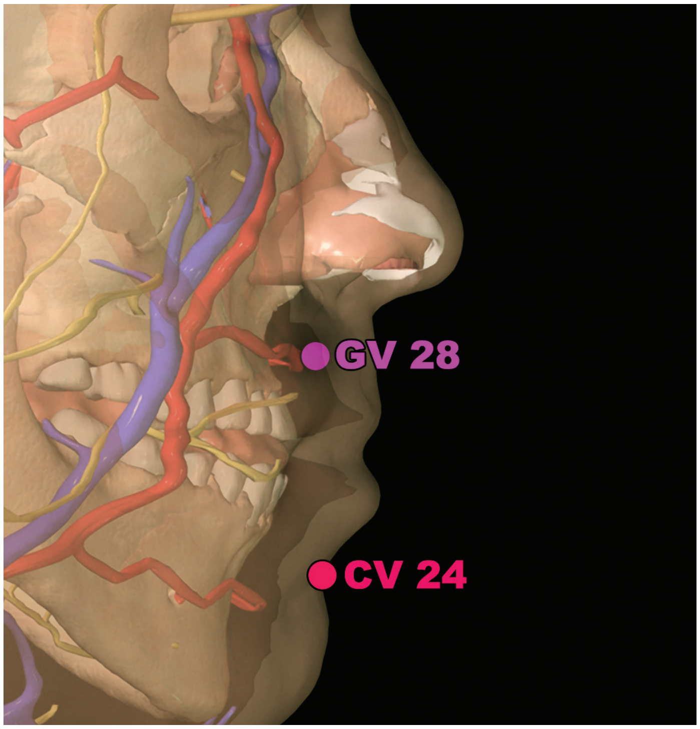
“Smiling deformity” or rhinogingivolabial syndrome is a condition in which the tip of the nose appears to lengthen during smiling or talking as a result of excessive depressor septi nasi muscle contraction.[3,4] An overactive the depressor muscle can make the upper lip seem shortened and reveal an unattractive amount of maxillary gingival tissue.[5,6] A surgical treatment for this problem involves septoplasty (to correct the septum if deviated), dynamic rhinoplasty (i.e., muscular treatment of the nasal tip and upper lip), rhinosculpture (addressing aesthetics of the nasal root, dorsum, and tip), and turbinectomy (involving partial bone-mucous resection in cases of hypertrophied turbinates). Botulinum toxin may obviate the need for surgery when injected into the depressor septi nasi muscle.[7] Conceivably, release of tension in the depressor septi nasi muscle with acupuncture and related techniques at GV 28 and GV 26 could also improve upper lip appearance by relaxing the depressor muscle and thereby allowing the upper lip to lengthen.



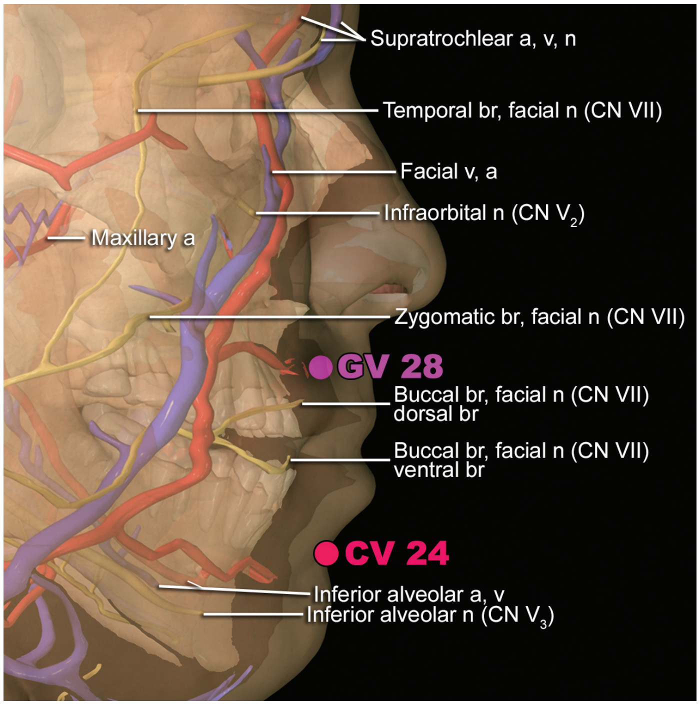
Figures 14-78. The GV channel ends at the top of the mouth; the CV channel ends below the mouth. This image shows how GV 28 resides inside the lip, at about the same level as GV 26.



Figures 14-79. GV 28 affords ready access to the depressor septi nasi muscle as it sits between the orbicularis oris muscle and mucosal lining of the upper lip.



Figures 14-80. GV 28 relates to the superior labial artery, a branch of the facial artery, in an analogous way that CV 24 relates to the inferior labial artery, another branch of the facial artery.


Supratrochlear a, v, n
Temporal br, facial n (CN VII)
Facial v, a
Infraorbital n (CN V2)
Maxillary a
Zygomatic br, facial n (CN VII)
GV 28
Buccal br, facial n (CN VII) dorsal br
Buccal br, facial n (CN VII) ventral br
CV 24
Inferior alveolar a, v
Inferior alveolar n (CN V3)

Figures 14-81. This image reveals the proximity of GV 28 and CV 24 to the maxillary and mandibular teeth, respectively. The semi-transparent bones reveal the inferior alveolar artery, vein, and nerve within the mandibular canal. While the buccal branches of the facial nerve appear to relate to the teeth, they mainly do so geographically, not functionally. That is, these nerve branches supply motor innervation to the orbicularis oris and related muscles of facial expression. It is the trigeminal nerve, with branches from its maxillary and mandibular divisions that supplies sensation to the upper and lower dental arcades, respectively. Specifically, GV 28 relates to the infraorbital nerve (CN V_2), which innervates the upper teeth while the inferior alveolar nerve (CN V_3) supplies sensation to the lower teeth.

Nerves

- **Superior labial branches of infraorbital nerve (CN V_2):** Provides cutaneous sensation to the upper lip.
- **Buccal branches of facial nerve (CN VII):** The buccal branch of the facial nerve supplies the upper part of the orbicularis oris muscle and the inferior portion of the levator labii superioris muscle.

Clinical Relevance: Stimulation of GV 28 sends afferent stimulation through infraorbital nerve branches; it affects motor innervation of the orbicularis oris muscle by neuromodulating the buccal branch of the facial nerve. Injury to the buccal branches of the facial nerve warrants consideration of additional points such as ST 4, CV 24, and GV 27.

Smoking and adopting a pursed-lip countenance over time may accentuate the appearance of wrinkles on the upper lip. For this condition, plastic surgeons seek to diminish local facial nerve function in order to reduce muscle contraction and foster skin relaxation.[8]

Vessels

- **Anastomosis of the superior labial arteries:** Arising from the facial artery near the corner of the mouth, the superior labial arteries run along the upper lip in a medial direction, to supply the upper lip, the nasal septum, and the nasal alae. Their anastomoses with each other and with the inferior labial arteries form an arterial ring around the oral cavity.

Clinical Relevance: Knowledge of the arterial anatomy of the oronasal region is imperative for successful cosmetic and lip repair surgery.[9] Should mishaps occur, restoration of circulation by means of laser therapy, massage, and acupuncture at GV 28

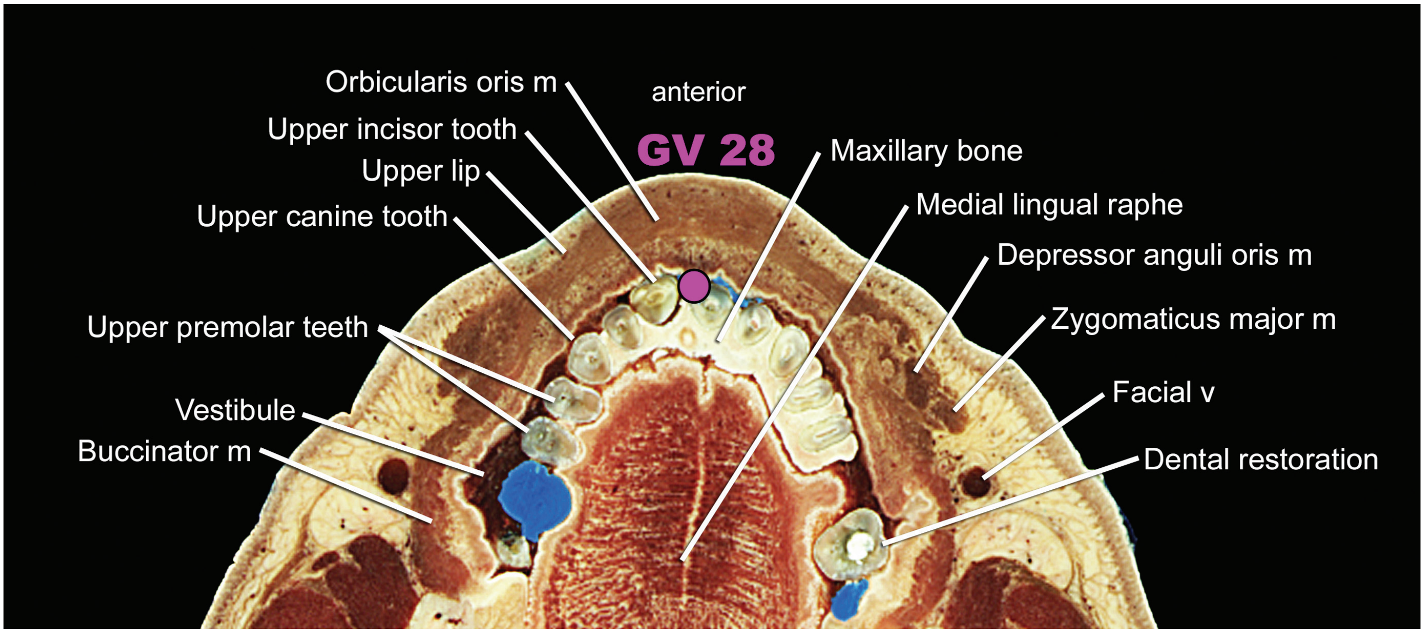

Orbicularis oris m
anterior
Upper incisor tooth
GV 28
Maxillary bone
Upper lip
Medial lingual raphe
Upper canine tooth
Depressor anguli oris m
Zygomaticus major m
Upper premolar teeth
Facial v
Vestibule
Dental restoration
Buccinator m

Figure 14-82. The name "Gum Intersection" for GV 28 refers to its location at the intersection of the frenulum of the upper lip and the maxillary gingiva.

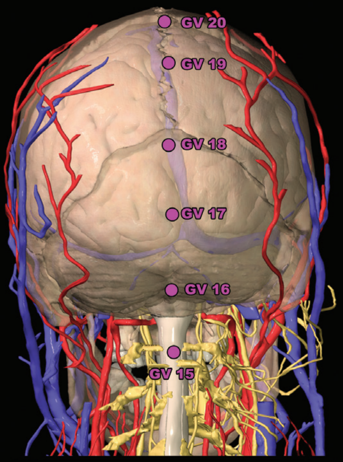
and surrounding sites may foster circulatory recovery.

Indications and Potential Point Combinations

- **Gingivitis:** GV 28, ST 24.
- **Tooth pain:** GV 28, LI 4.
- **"Smiling deformity" with shortened upper lip due to depressor septi nasi muscle hypercontraction:** Massage, laser therapy to GV 28 and GV 26 down to GV 27.

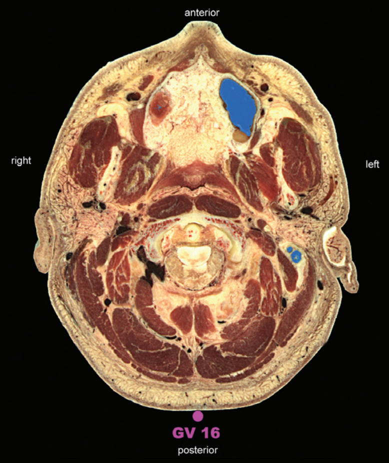
References

1. Iblher N, Stark GB, and Penna V. The aging perioral region – do we really know what is happening? *J Nutr Health Aging.* 2012;16(6):581-585.
2. De Mey A, Van Hoof I, De Roy G, et al. Anatomy of the orbicularis oris muscle in cleft lip. *British Journal of Plastic Surgery.* 1989; 42(6):710-714.
3. Beiraghi-Toosi A, Rezaei E, Nooghabi MJ, et al. Effect of depressor septi nasi muscle activity on nasal lengthening with time. *Aesth Plast Surg.* 2013;37(5):989-992.
4. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg.* 2012;36:819-826.
5. Rohrich RJ, Huynh B, Muzaffar AR, et al. Importance of the depressor septi nasi muscle in rhinoplasty: anatomic study and clinical application. *Plast Reconstr Surg.* 2000;105(1):376-383.
6. Tellioglu AT, Inozu E, Ozakpinar R, et al. Treatment of hyperdynamic nasal tip ptosis in open rhinoplasty: using the anatomic relationship between the depressor septi nasi muscle and the dermocartilaginous ligament. *Aesth Plast Surg.* 2012;36:819-826.
7. Cigna E, Sorvillo V, Stefanizzi G, et al. The use of botulinum toxin in the treatment of plunging nose: cosmetic results and a functional serendipity. *Clin Ter.* 2013;164(2):e107-e113.
8. Hwang K, Jin S, Hwang SH, et al. Innervation of upper orbicularis oris muscle. *J Craniofac Surg.* 2006;17(6):1116-1117.
9. Al-Hoqail R and Meguid EMA. Anatomic dissection of the arterial supply of the lips: an anatomical and analytical approach. *Journal of Craniofacial Surgery.* 2008;19(3):785-794.



Interactive Medical Acupuncture Anataomy is a clear and practical guide to the practice of medical acupuncture focused on the interrelationship of structure and function.

The 1,051 images in this text delineate the relationships of acupuncture points with nearby anatomy that help to explain the physiological effects of point activation. This highly detailed investigation of the neuroanatomical basis and evidential support of acupuncture deeply informs its clinical application, making this work a "must have" for your medical practice library.



- An anatomically precise presentation of acupuncture points and channels
- Complete, 3-dimensional, computer generated images of the human body
- Permits visualization of the underlying anatomical structures that acupuncture needles stimulate
- Provides the critical information needed for safer and more productive acupuncture practice
- Thousands of references supply much-needed evidential support of acupuncture science and practice
- Provides scientific validation for the effects of acupuncture on visceral, immune, circulatory and other bodily functions
- National Library of Medicine Visible Human Project images provided on the DVD provide 3-dimensional, rotatable, dissectible, Quick Time Virtual Reality images for identification of acupuncture points and their neural and vascular relationships.

TETON NEWMEDIA
INNOVATIVE PUBLISHING OF VETERINARY & HUMAN MEDICINE

ISBN 159161020-6
9 781591 610205
1-59161-020-6